

Learning

Introduction

By reading this book, you may have already made a decision to reflect on how you teach and learn. You may be thinking about experiences you have had, positive and negative, and want the opportunity to understand why sometimes education is great, and sometimes it really is not. Or perhaps you have been told that you have to read this text and feel just a bit resentful about that. Whatever your motivations this is a chance to explore some of the issues that underpin our responses to education, whether we are teaching, learning or engaged in a bit of both.

Theories of learning have historically been based on observations of the way people learn, and for academics they help to bring some understanding to learning behaviours. The educators who write the curriculums and course materials for life support courses have applied some of these theories to ensure that learning is optimised for our target learners.

In this chapter, we will give a broad overview of relevant learning theories. We will then look in the rest of the book at how we can apply these principles when we are facilitating others.

First, however, we will consider a number of evidence-based strategies that can be used to make us better learners, so that we can consciously and mindfully use this knowledge when we are teaching.

Learning outcomes

This chapter will enable you to:

- Identify how our brains hold and retrieve information
- Employ effective learning strategies
- Compare and contrast teacher-centred and learner-centred approaches to education
- Consider some of the educational theories that underpin life support courses

How we learn

Working memory

It is generally agreed that we have a long-term memory and a working memory (short-term memory). Long-term memory has a limitless storage system. You might, for example, have stored your childhood car registration in your long-term memory and be able to recall it years later. In contrast, working memory is thought to only last around 30 seconds. An example is remembering a phone number for long enough to type it into your phone. Unless this specific piece of information is attended to multiple times it will not pass into long-term memory and will be forgotten.

The role of our working memory is not only to hold pieces of information for a short period but also to *process* that information (i.e. do something with it).

All new memories have to pass through working memory in order to make it into long-term memory. Working memory has a limit and is easily overloaded. Most of us, without any specific brain training, are able to hold in our working memory a surprisingly small number of discrete pieces of information. This has implications for our

capacities as learners. If we are presented with too much new information, we cannot process it all. Imagine needing to check the oil level in a car. For somebody who already knows where the dipstick is located and what it looks like, the new information is just the process of checking how far up the oil level reaches. However, for the person who does not know where the dipstick is located, what it looks like, how to open the bonnet of their car, etc., there is a lot more new information to take on and this second person has significantly less working space available to use for processing. It seems inevitable that in this instance they are less likely to retain all of the steps, and therefore to successfully check the oil level, without considerable guidance and input.

Schema

Fortunately, we have ways of managing the limits of our working memory. Our brains are good at finding and forming patterns or structures that help us group pieces of information and understand how complex processes work. This is described as 'chunking'; creating groups or sets of familiar concepts to help retrieve more information, more quickly. We instinctively organise our knowledge, and, as we engage in new learning and take in new information, we connect it to pre-existing knowledge, beliefs or experiences.

Example

If asked to remember a random number such as 48792361 you might struggle. If asked to remember 24681357 it is likely that your brain will 'chunk' this information into 2468 and 1357 so that you are only having to remember two discrete pieces rather than eight separate ones. In order to chunk this information, you will probably have drawn on pre-existing knowledge about number sequencing, odd and even numbers or your 2 times table.



Experts typically have a host of these short cuts which save them expending valuable working memory on too many discrete 'pieces' of information. A professional tennis player does not have to think through all the details of each return shot that they make, they make rapid decisions based on a number of previously experienced episodes. The novice watching them might be overawed by their processing capacity, as they seem able to assess more information with greater speed than a beginner. Essentially, we use existing experience to make sense of new information, and the more experiences we have, the more short cuts we have to draw on. This is a particularly useful concept when trying to make ourselves increasingly adept as learners. It helps if we take as many opportunities as possible to link new learning with knowledge we already have. Equally it helps if teachers or facilitators provide spaces for the learners to make connections that are personal to them.

You may have observed expert team leaders at a cardiac arrest, and noticed their capacity to make quick decisions, rapidly evaluating information through chunking. Their use of schema is essential and efficient, and, through providing structure and frameworks, allows experts to achieve far more than they would if they always had to re-remember and re-process each of the separate elements of any action or knowledge. The problem with this method of information retrieval is that it can lead us to employ stereotypes or make assumptions without always considering the bigger picture. This is referred to as 'cognitive bias' and it is because of concerns about the negative effects of cognitive biases that we need to use the rest of our team to help check our actions and prevent ourselves from making mistakes based on erroneous assumptions. We explore more about cognitive biases, team working and team leadership in the non-technical skills chapter of this book (Chapter 12).

Retrieval practice

The transition from working memory to long-term memory can be arduous but rewarding. For most of us, it is not quite as simple as attending to a piece of information once and then it being miraculously stored in our long-term memory. The information has to be actively retrieved and attended to multiple times in order for it to be fully

embedded in long-term memory. This process is referred to as retrieval practice. If you have ever used flashcards to help study for an exam with a question on one side and the answer on the back, you have done retrieval practice. The more this is done the stronger the neural pathways become, and the easier that piece of information is to retrieve.

Sadly, for good learning to occur, anything that feels efficient is likely to be the opposite. Take as an example a habit you may or may not have of reading through a text book in preparation for an exam and highlighting the important bits of information. You might even find that you are highlighting the same bits you identified last time you read it. The act of highlighting is such a low-level activity that very little is required of you in terms of active investment. The chances are that this, like taking photographs of a lecturer's slides, might make you feel good, but will not guarantee that you have learned much. What is far more beneficial in terms of long-term learning is to do any of the following:

- Challenge yourself to write the concepts in your own words, or to draw a concept map
- Make a list of the key facts
- Explain them to a friend or teach a less experienced colleague

These strategies will all take much longer than using a highlighter pen but will avoid what Brown et al. (2014) call 'the illusion of knowing'. Reading something that we have read before feels familiar, we recognise some of it and therefore *feel* like we know it.

Retrieval practice is such a useful tool for us to use because it shifts information into our long-term memory: the more often we retrieve it, the better we learn it; the more connections we make with other pieces of information, the stronger the connections become.

Retrieval practice is also useful as it highlights gaps in our knowledge. If we test ourselves, and do not come up with the right answers, we have clear evidence that we do not know the answer. Unfortunately, as Kruger and Dunning (1999) explain, we are rather bad at judging our own abilities, particularly non-technical skills, and we tend to

overinflate our abilities. This is also discussed in more detail in Chapter 12.

Retrieval practice can be done at four different levels of increasing difficulty (Figure 1.1).

Yes or no questions	These can also be phrased as true/false and right/wrong. They are very simple and quick, but do not demand a lot of us.
Multiple choice questions	Here the one correct answer is hidden amongst several distractors, or several correct answers need to be chosen from a list containing distractors.
Short answer questions	These require the learner to use their own words in response to a specific question. They are much more open-ended and can either be written down individually or paired learners can discuss them with each other.
Free recall	An example of this might be asking learners to recall everything they can remember about the lecture they've just been given. Brown et al (2014) cite the example of a teacher who asks her learners to follow this up by looking at their notes and focusing on the parts they had forgotten, rather than the parts they had remembered.

Figure 1.1 Retrieval practice

Spaced practice

Research has repeatedly shown that for retrieval practice to reap maximum benefits, it is best when it is spaced out over time (see, for example, Bahrck and Hall, 2005). This is the opposite of cramming for an exam, which can be a reasonable strategy if the learner's only goal is to pass the exam the following day. If, however, they need to actually use the knowledge in a variety of contexts, spacing out the practice will ensure they have learnt it more thoroughly. As we will explore throughout this book, contextualising new knowledge and skills in a variety of settings is important for us, both as learners and facilitators.

Spaced practice is a challenge in the design of short courses as, in order for the learning to be most effective,

it needs to be revisited on a number of occasions. However, there are still benefits from asking learners to retrieve information that they processed a few hours before, on the previous day or when they were reading the manual. The online resources attached to provider courses deliberately incorporate retrieval practice at the four levels described and spaced practice to maximise learning.

Interleaving

Interleaving, or mixing up what you are learning, is more effective than studying the same subject or topic repeatedly. Kornell and Bjork (2008) illustrated this by asking students to learn to recognise two different artists. Half the group were exposed to paintings by artist A and then paintings by artist B. The other half were shown paintings from both artists in a random pattern. As you would imagine, the latter group were initially more confused and had to work harder to remember which artist had painted which picture. The test came when they were given paintings they had not seen and were asked to identify which artist had done them. Those in the second group were better at identifying the artist correctly, because they had been forced to discriminate between the two throughout the learning phase.

Perhaps the most interesting element of this research is the fact that the students thought that they learnt better when the artists were *not* mixed up... even when they were given the results of the test. This is because 'massed practice' (doing the same thing over and over) is *easier* than interleaving and the 'illusion of knowing' creeps in. Moving onto something new before you have fully grasped the first subject feels frustrating and difficult, but that is precisely when the learning is happening.

Both interleaving and spaced practice work because when we learn something we start to forget it shortly afterwards. Returning to it halts the forgetting, we have to re-learn, but not from quite such a low point as when we started. Each time we re-visit the skill or knowledge we have a small advantage from having already studied or practised it.

Deliberate practice

Deliberate practice has been widely written about, especially in the fields of elite sports, music and chess (Ericsson et al. 1993). In order to become truly accomplished, many hours of practice are required. This is not mindless repetition, or rote learning of the skill, it is a purposeful and thoughtful process of repeating with attention to detail at all phases. Take defibrillation as an example. Here there is a standard 'safe' procedure – check rhythm, restart chest compressions, charge defibrillator, shout 'stand clear', press the shock button. We could easily create assessment criteria that allow candidates to 'pass' or 'fail' based on the process above. What happens, then, when the candidate goes to their first cardiac arrest and the buttons on the defibrillator are in different positions and nobody stands clear when they command it? Deliberate practice would break each component down and allow us to ask ourselves 'what if?' so that our learned behaviour is not just an automatic repetition of a skill that was learned by rote, but builds in contingencies and problem-solving.

Deliberate practice can be incorporated into life support courses in a variety of ways. This might be in the manner that we run sessions or how we manage candidates' practice of certain key skills.

Deliberate practice has a number of elements that need to be present in order for it to be effective (Figure 1.2):

- **Motivation:** You have to be motivated to improve or try something new. You must want to stretch yourself.
- **Focus:** The practice must be focused and thoughtful. This requires working hard.
- **Feedback:** Immediate feedback, whether from internal or external sources, allows you to refine and adapt. If you are open to feedback, you will probably find it much more effective.
- **Repetition:** The more times you do something in different contexts, the better you will become. Spacing out the practice and doing it in different contexts can make you a more mindful practitioner.



Figure 1.2 Deliberate practice

On life support courses we can offer candidates the opportunity for ‘rapid cycle deliberate practice’ (RCDP). RCDP is a technique that involves learners performing a simulation or skill, receiving targeted, personalised feedback immediately afterwards and having opportunities to practise the new approach straight away with further feedback being incorporated. In contrast to traditional post-simulation feedback, these feedback sessions are typically more frequent and can be more succinct (de Castro et al., 2022). This offers an opportunity for candidates to be shown how to build up their knowledge and skills into increasingly complex chunks (as was described earlier), builds their expertise and frees up working memory. It also offers the opportunity for candidates who already possess some skills to be coached to a higher level. This is the advantage that deliberate practice offers – feedback can be targeted rather than generic. The feedback should be entirely dependent on the specific needs and current level of expertise of the individual learner, sometimes referred to as ‘desirable difficulty’.

Spaced practice and interleaving provide specific ways of introducing desirable difficulties. They introduce impediments into the learning process which make us have to put in more effort, which, in turn, strengthens our learning.

Elaboration

If it is possible to make connections between the current learning experience and prior learning (for example from the online learning, the provider course manual or your own lived experience) then you are engaging in a process described as 'elaboration'. This means that you are really making sense of material that you have learned. The more often you make connections to, or explain a concept, the better you will both understand it and remember it.

It is important, for example, that candidates have the opportunity to make sense of simulated experiences when engaged in post-simulation debrief. If you have ever been frustrated by instructors telling you what you have learnt, or giving their own examples, this is because you have been deprived of the opportunity to build your own, unique understanding. In order to be an effective learner, it is worthwhile taking every available opportunity to make these connections and often the best way of doing this is by talking. Elaboration may also involve creating your own 'story', a concept we explore in more detail below.

Peer teaching

Verbalising plays a key role in the *process* of understanding and, therefore, learning. Explaining a new concept to a fellow learner requires us to make sense of it in our own words. This also allows us to elaborate and create our own narratives and experience. Provider courses offer ample opportunities for peer teaching where instructors are secure enough, and trust the learners enough, to allow learning to happen outside their close supervision.

Stories and concrete examples

Attaching stories to concepts helps us understand them better. These real world examples are often built into books and we have put quite a few in here in the form of examples

and case studies. Abstract concepts can be difficult to process unless they are made 'real'. Attaching your own stories to your experiences further enhances your learning and understanding. If, for example, you are trying to understand some of the theoretical concepts in the next section, have a go at drawing on your own experience to come up with examples. This will take a little more time than simply reading the text, but it will help you understand and have a reason for remembering. Incidentally, this will also be a form of elaborating as you make connections between new and old learning.

It is helpful for candidates to have opportunities to bring their own stories to workshops and discussions since this enhances their learning. A simple question such as, '*Has anyone had experience of managing acute asthma?*' will turn out to be a deceptively simple way of securing the learning.

Theories of learning

The next section of this chapter briefly looks at some of the educational theories that have driven the development of life support courses. The strategies already described – retrieving, spacing, verbalising, elaborating, interleaving and story-telling – will be useful for you to employ as you engage with the theories of learning and their application in later chapters.

The scientific study of teaching and learning has been the topic of scholarly research for over 2000 years. A working knowledge of some resulting theories helps us as instructors to understand our own pedagogy. It can help explain why and when certain approaches may be more (or less) effective, thus enabling teaching to be tailored accordingly.

Our favourite teachers were often those who made learning enjoyable and who seemed to speak to us personally. They may have made this look easy, but they probably had substantial knowledge of teaching and learning theories and many years of experience. This section aims to outline some of that educational theory, exploring why and how it underpins our approach to teaching.

As we try to make sense of how we learn and look at some theories of education, it might be helpful to consider seven essentials of teaching and learning:

- Encourage contact between candidates and faculty
- Develop reciprocity and cooperation among candidates
- Encourage active learning (engaging candidates with the course material through discussions, problem-solving, case studies, role play and simulation)
- Give prompt feedback
- Emphasise time on task by keeping as many learners actively engaged as possible
- Communicate high expectations
- Respect diverse talents and ways of learning

(Adapted from Chickering and Gamson, 1987)

Traditional approaches to teaching

A traditional approach to teaching might be described as one in which learners are perceived as ‘empty vessels ready to be filled with knowledge’. This is sometimes referred to as a ‘didactic’ approach, where the teacher tells the learners what they need to know, turning them into passive rather than active participants (Lockey et al., 2021). The lecture is a modality that lends itself to a didactic approach, but as we shall explore in Chapter 10 it does not necessarily have to be.

Objectives and outcomes

The main criticism of a didactic approach is that it is teacher-centred, a ‘one size fits all’ method with little appreciation of the needs of the learner. In this setting *objectives* are established and the teacher delivers them. By contrast, a learning *outcome* implies that the learners will gain something useful. For example:

Objective: By the end of this session I will have taught you the algorithm

Outcome: By the end of this session you will be able to *remember* the algorithm to help save more lives



Bloom's taxonomy (1956), can be used to provide structure when you are designing learning outcomes as the levels of knowledge are increasingly complex the further you move up the pyramid (Figure 1.3). To illustrate the application of this taxonomy, candidates may be required to demonstrate their *comprehension* of a treatment algorithm before *applying* it and/or *evaluating* its efficacy in different clinical situations.

Bloom's taxonomy is a tool we can use to consider the different cognitive levels that determine the detail and focus of a teaching session. The outcome example above uses the word 'remember'. Consider how replacing 'remember' with 'apply' will influence the content and structure of your session.

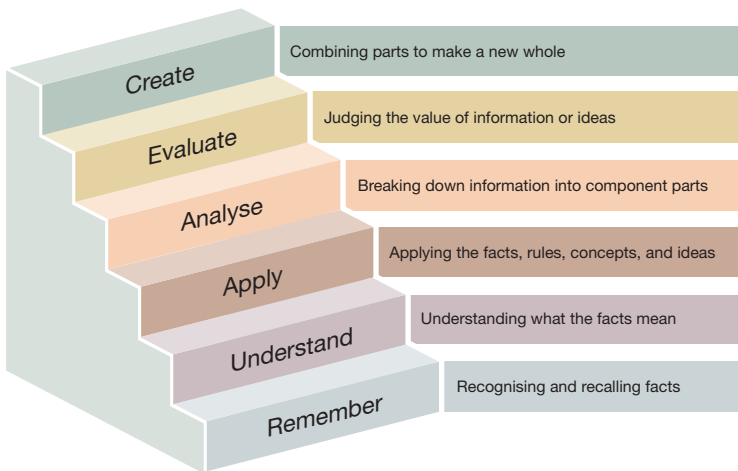


Figure 1.3 Bloom's taxonomy

Andragogy

Andragogy refers to any form of *adult* learning (Knowles, 1984), recognising that most adults have attained wider knowledge and greater experience than children. From a practical standpoint, *andragogy* encompasses a range of approaches that utilise these differences by encouraging *active engagement* in the process and content of learning.

The following is a useful summary of how adults learn:

Adults learn best when:



- They are involved in the planning and evaluation of their learning
- Their own experience (including mistakes) provides the basis for learning activities
- The subject has immediate relevance and impact on their job or personal life
- Learning is problem-centred rather than content-orientated

(Adapted from Knowles, 1984)

Kolb's (1984) experiential learning cycle (Figure 1.4) may be useful in considering how to structure and maximise learning in life support courses. Consider an episode of simulation-based learning that includes the application of Kolb's cycle, where acting as team leader provides a *concrete experience* for a candidate. When the active part ends, they will be prompted to *reflect* on both the activity and their feelings. Through self-reflection and discussion with other candidates, they can identify any necessary changes and relate them to earlier experience (*abstract conceptualisation*). The more opportunities learners are given to compare current learning with previous experience, the better (as discussed earlier). Candidates can then experiment with new or adapted behaviours in future situations.

When teaching adults, consider tailoring your approach to the needs of the particular individual or group involved. For example, during a debrief, if a group of candidates is independently exploring events and having an in-depth clinical discussion, then it may be best for the instructor to remain quiet. Conversely, if salient events have not been raised, the instructor may decide to take a more active role, using language that incorporates good judgement to review the event and encourage further reflection and exploration (Davis & Denning, 2018). This element of debriefing is considered further in Chapter 8.

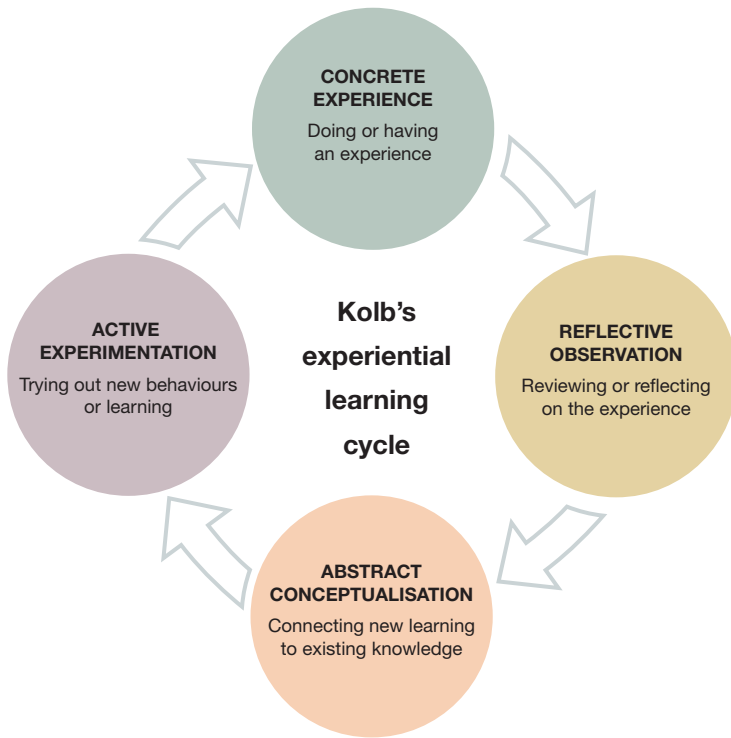


Figure 1.4 Kolb's experiential learning cycle

Heutagogy

Ultimately, today's wide access to learning materials of all kinds means that learners can easily choose their own preferred method of learning, moving beyond being self-directed to becoming self-determined. This has been labelled 'heutagogy'.

Heutagogy is about self-motivated or self-determined learning, the importance of knowing *how* to learn, and how to do it effectively. Recently another strand has arisen: thanks to growing interest in the use of technology, candidates can now choose what, when, where and how they use a variety of resources. However, some candidates appear to find this greater degree of autonomy and flexibility disorientating. They may be either unfamiliar with the new methods or accustomed to approaches used in schools (Chen et al., 2021).

A heutagogical approach has critical thinking and reflection at its heart. Learners are empowered to be analytical about their learning needs and to have a high degree of control over their own learning. This kind of ethos prepares students for the complexities of the ever-changing workplace. It need not be a solo activity, since a key element is collaborating and testing ideas with colleagues, particularly in workshops where learners are encouraged to bring their own case studies, or in simulation where non-technical skills are interpreted in highly personal ways.

Life support courses have standardised learning and assessment outcomes which make aspects of a heutagogical approach challenging. However, we *can* encourage candidates to engage in beneficial activities such as spaced practice, interleaving, retrieval practice, peer teaching and elaboration. We can provide space within workshops for case study discussions that encourage the learners to think about their own contexts so that each learner can work out what they can apply from our sessions. Our courses also direct learners to additional resources and encourage them to continue learning even after the course itself has finished.

Optimising learning

Motivation (sense of purpose)

Motivation is the 'driving force' through which people strive to achieve personal goals, uphold a value or fulfil a need (Ryan & Deci, 2020). This driving force can be *intrinsic* or *extrinsic*. *Intrinsically* motivated candidates attend a course because they actively wish to learn, while *extrinsically* motivated people have usually been told by someone else that they are obliged to attend. Various motivating factors may affect a candidate's attitude and desire/ability to learn; instructors need to consider this when getting to know their candidates. In reality, most people who attend courses probably have a mixture of extrinsic and intrinsic motivators.

Whatever motivation is driving candidates, it is up to instructors to enhance the *desire* to learn, by using interesting and interactive teaching methods and clearly

illustrating the clinical benefits of the lessons learned. Also, a genuinely enthusiastic facilitator can be ‘infectious’, which aids motivation.

Race (2020) places motivation (the ‘want’ or ‘need’ to learn) at the centre of efficient learning (Figure 1.5). He argues that candidates learn by doing, and by receiving feedback to help them make sense of what they learn. Learning is deepened by good facilitation, peer teaching (verbalising) and assessment (retrieval practice), all of which are factors in life support courses.



Figure 1.5 Race's ripples model of learning

Sense of security

In order for learning to be maximised, candidates need to feel safe; both physically and psychologically. Maslow's hierarchy of needs (1971) determines that certain fundamental needs must be met to enable candidates to progress (Figure 1.6). With that in mind, life support courses take care to cater for basic physiological needs such as warmth, food, hydration and regular breaks, and to provide them in a physically safe and secure environment.

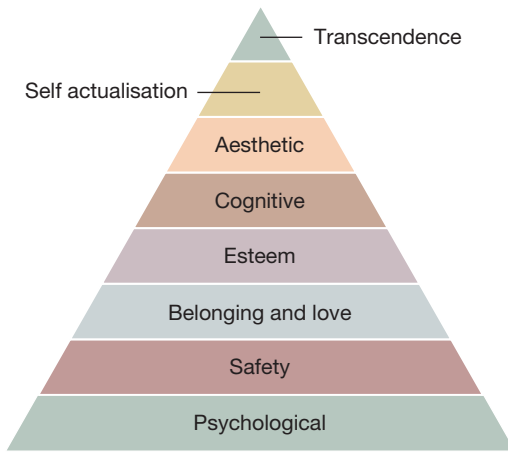


Figure 1.6 Maslow's hierarchy of needs

Psychological and emotional safety are key. Provider courses should be intellectually stimulating and challenging, but candidates also need to feel secure and free to ask questions without threat of criticism or ridicule. The notion of psychological safety is explored more deeply in Chapter 7.

Sense of belonging

In the context of life support courses, a sense of belonging means feeling part of a valued group where new relationships can be formed or existing ones maintained. Creation of this sense of belonging can be challenging, given the timeframes involved and the diverse backgrounds of candidates who may not have met before. However, life support courses are intense, shared experiences that can lead to the formation of strong bonds. To encourage this atmosphere, instructors naturally make use of their emotional intelligence (EI), which means an ability to examine feelings and emotions, to distinguish between them, and to let this information inform actions and decision making (Goleman, 1995).

Mortiboys (2012) regards EI as the third, often unrecognised, component of teaching (the first two being expertise in and knowledge of the subject), and says that its use can result in candidates becoming more motivated, confident, resilient and willing to collaborate. In striving to understand emotions, in both themselves and others, it is helpful for instructors to note how they display their own emotions, in verbal and non-verbal ways. This then also makes it easier to be perceptive to candidates' emotional cues and respond to them appropriately. An example is being able to 'read the room' during a session and then adjust to the ebb and flow of interaction accordingly.

Sense of significance

A sense of significance is achieved when everyone in the group is accorded equal value and status, along with recognition of aspects such as gender equality, diversity, inclusivity and cultural competence. Addressing people correctly conveys that they are valued. Something as apparently simple as using a person's name can be incredibly powerful, creating a sense of belonging and inclusivity. Accurate pronunciation is vital – ask the person how to pronounce their name rather than avoiding or mispronouncing it, and be accepting of correction. This courtesy shows respect and also acknowledges the individuality, identity, race and ethnicity implicit in a name (Bryan, 2021). Of equal importance is the correct use of preferred pronouns during interactions.

Reasonable adjustment

Course design, development and delivery should ensure equality of access and opportunity wherever possible, but in some cases 'reasonable adjustments' may be called for.

With candidates who have dyslexia (for example), there are standard regulations that allow them extra time for written exams. Course directors are a useful resource if you are unsure about what is meant by reasonable adjustments.

Case study



A course centre was approached by a potential candidate who was profoundly deaf. With the agreement of the course director, the candidate arranged to have BSL interpreters available in support. Further discussions were held about ways to ensure the candidate's learning was not compromised by missing peripheral aspects, and that the rest of the group were not compromised by insufficient focus on their needs.

Most governing or awarding bodies offer guidance on making reasonable adjustments, but these are not exhaustive. If the course director is unsure what reasonable adjustments can be made, guidance is usually available when it is sought.

Understanding of these factors and the theories of learning in the wider context will enhance our role as instructors.

Summary and learning

Our brains assimilate and retrieve information in a number of ways.

Having an awareness of how we learn will make us better instructors.

Active engagement in learning is essential for adult learners.

Instructors are pivotal in facilitating responsive learning which reflects the individual needs of the candidates.

In order to optimise learning, instructors are encouraged to consider environmental, social, cultural and interpersonal factors.