TT_1

Tricky Topics

About this free course

This free course is an adapted extract from the Open University course .

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Introduction Guidance

Contents

Welcome to this free course, *Teaching and learning tricky topics*.

The course lasts 8 weeks with approximately 3 hours of study time each week. You can work through the course at your own pace, so if you have more time one week there is no problem with pushing on to complete another week. The eight weeks consist of the following:

1 Tricky topics and threshold concepts
2 Identifying tricky topics
3 The tricky topics process
4 Introduction to learning design
5 Developing your learning design
6 Innovating pedagogies and targeted interventions
7 Assessment and tricky topics
8 Reflection, sharing and becoming a champion

Through the first three weeks you will be focusing on the background to tricky topics and how to apply the process to your practice. In Week 3 you will be asked to look at IRIS Connect, the sharing platform, to develop your understanding of the tricky topics process. This will require you to sign up and login to the platform. While this would be beneficial to you, it is not compulsory for gaining your badge. You can sign up for a free IRIS Connect account here. The next two weeks will focus on the role of learning design and how to use this approach with tricky topics. The final three weeks will help you to look at the wider picture of using tricky topics and learning design to help innovate, assess and embed your understanding with others. At the successful completion of this course you will be able to receive a statement of participation certificate.

There are lots of opportunities to check your learning. This includes interactive quizzes; Weeks 4 and 8 will provide you with an opportunity to earn a badge to demonstrate your new skills. You can read more on how to study the course and about badges in the next sections.

After completing this course, you will be able to:

- understand the background to tricky topics and how they relate to the subject area
- apply the tricky topic process to support identifying student learning barriers and why they occur
- understand how learning design activities can help to identify the 'student voice'
- apply student and activity profiles and discover how they can inform a tricky topics intervention
- understand why and how to develop a targeted tricky topic intervention, as well as how to assess student learning of a tricky topic.

Moving around the course

In the 'Summary' at the end of each week, you can find a link to the next one. If at any time you want to return to the start of the course, click on 'Course content'. From here you can navigate to any part of the course. Alternatively, use the week links at the top of every page of the course.

It's also good practice, if you access a link from within a course page (including links to the quizzes), to open it in a new window or tab. That way you can easily return to where you've come from without having to use the back button on your browser.

What is a badged course?

While studying *Teaching and learning tricky topics* you have the option to work towards gaining a digital badge.

Badged courses are a key part of The Open University's mission *to promote the educational well-being of the community.* The courses also provide another way of helping you to progress from informal to formal learning.

To complete a course you need to be able to find about 24 hours of study time, over a period of about 8 weeks. However, it is possible to study them at any time, and at a pace to suit you.

Badged courses are all available on The Open University's OpenLearn website and do not cost anything to study. They differ from Open University courses because you do not receive support from a tutor. But you do get useful feedback from the interactive quizzes.

What is a badge?

Digital badges are a new way of demonstrating online that you have gained a skill. Schools, colleges and universities are working with employers and other organisations to develop open badges that help learners gain recognition for their skills, and support employers to identify the right candidate for a job.

Badges demonstrate your work and achievement on the course. You can share your achievement with friends, family and employers, and on social media. Badges are a great motivation, helping you to reach the end of the course. Gaining a badge often boosts confidence in the skills and abilities that underpin successful study. So, completing this course should encourage you to think about taking other courses.

How to get a badge

Getting a badge is straightforward! Here's what you have to do:

- read each week of the course
- score 50% or more in the two badge quizzes in Week 4 and Week 8.

For all the quizzes, you can have three attempts at most of the questions (for true or false type questions you usually only get one attempt). If you get the answer right first time you will get more marks than for a correct answer the second or third time. If one of your answers is incorrect you will often receive helpful feedback and suggestions about how to work out the correct answer.

For the badge quizzes, if you're not successful in getting 50% the first time, after 24 hours you can attempt the whole quiz, and come back as many times as you like.

We hope that as many people as possible will gain an Open University badge – so you should see getting a badge as an opportunity to reflect on what you have learned rather than as a test.

If you need more guidance on getting a badge and what you can do with it, take a look at the OpenLearn FAQs. When you gain your badge you will receive an email to notify you and you will be able to view and manage all your badges in My OpenLearn within 24 hours of completing the criteria to gain a badge.

Get started with Week 1.

Week 1 Tricky topics and threshold concepts

Introduction

Welcome to Week 1 of this badged open course. Each week builds on the understanding you have developed during the previous week's study, and you should expect to spend 3 hours per week studying.

By the end of this week you should be able to:

- understand what constitutes a threshold concept, and why this is a problem for both students and teachers
- see how the term 'tricky topics' relates to threshold concepts
- begin to consider tricky topics in your subject area.

You'll start by thinking about threshold concepts.

1 Why don't they understand?

How often have teachers uttered these words, frustrated by their students' failure to grasp what they are teaching them? Why do some students appear to just 'get it' whereas other students encounter real barriers to learning? Often students will give the appearance of having understood. The students will believe they have understood. Their teacher will believe they have understood only for some students to fail spectacularly when confronted by tricky exam questions.

Figure 1 I don't understand

At the end of many lessons, students complete short tests to review their learning during the class. These tests contain questions that map onto each topic covered during the lesson. A typical example from a GCSE physics class might be:

Work done is measured in:

(a) Joules

(b) Watts

(c) Coulombs

(d) Newtons

Having just finished the class, most students will be able to select the correct response, a). However, this does not necessarily mean that they have a deep understanding of what 'work done' represents, nor how to calculate it.

They may have memorised terms or equations well enough to be able to select the correct multiple choice answer, but without the deep understanding that would enable them to answer more probing exam questions.

Some concepts regularly cause problems of understanding and can inhibit student progression in a subject, sometimes causing students to give up the subject altogether. Such concepts have been referred to in the literature as threshold concepts.

Threshold concepts were first identified by Meyer and Land:

> 'A threshold concept can be considered as akin to a portal, opening up a new and previously inaccessible way of thinking about something. It

represents a transformed way of understanding, or interpreting, or viewing something without which the learner cannot progress'

(Meyer and Land, 2006)

Figure 2 Threshold concepts

Threshold concepts are more than just 'key' or 'core' concepts (Harlow et al., 2011, Lucas and Mladenovic, 2007). Threshold concepts focus on the cognitive (thinking) domain of learning rather than the affective (feelings, moods and emotions) or behavioural (physical/kinaesthetic) domains of learning (see Bloom's (1956) characterisation of learning).

1.1 Why do misunderstandings occur in threshold concepts?

Why do some topics present a threshold concept for many students, yet other seemingly equally complex topics do not? Much research on threshold concepts and the causes of student misconceptions has focused on the sciences and mathematics. For example, research has highlighted that 'intuitive beliefs' lie at the bottom of many misconceptions. Intuitive beliefs are assumptions that students make about the world around them. Sometimes these beliefs are mistaken, yet they are so engrained that students may not even realise they are making them. These intuitive beliefs may therefore persist until they clash with new knowledge. At this point, students need to identify and 'unlearn' these intuitive beliefs in order to assimilate the new knowledge.

Intuitive beliefs lie at the origin of a diverse range of misconceptions in biology (Coley and Tanner, 2012). These misconceptions lead to basic misunderstandings which impair the students' ability to understand biological concepts. For example, a common type of causal reasoning presupposes that all actions are directed toward some sort of goal, even assuming agency in non-living objects, 'the rocks were pointy so that animals wouldn't sit on them and smash them'. In Biology, this goal-driven assumption often results in students of all levels explaining biological processes with reference to a supposed purpose or goal. For example, some students believe that evolution is caused by a 'collective striving toward higher forms of life'. This belief, which is intuitively appealing, mistakes evolution for a purpose rather than a process. Students who hold this belief will have a fundamental misunderstanding of evolutionary theory (a threshold concept) and as a result, would struggle to understand the threshold concept genetic drift which relies on an understanding of the role of natural selection in evolutionary theory.

Such misconceptions are not limited to the field of Biology. Students of Physics, even at university level, reveal equally fundamental misunderstandings. For example, many are unclear on how a moving object will behave in different situations. Circular impetus theory holds that if an object is moving in a curve, say a ball being swung on the end of a string, that when released the ball will continue to follow the curved path. This theory is intuitively attractive, yet factually incorrect since the ball will actually move off in a straight line at a tangent to its original circular path (see Figure 3).

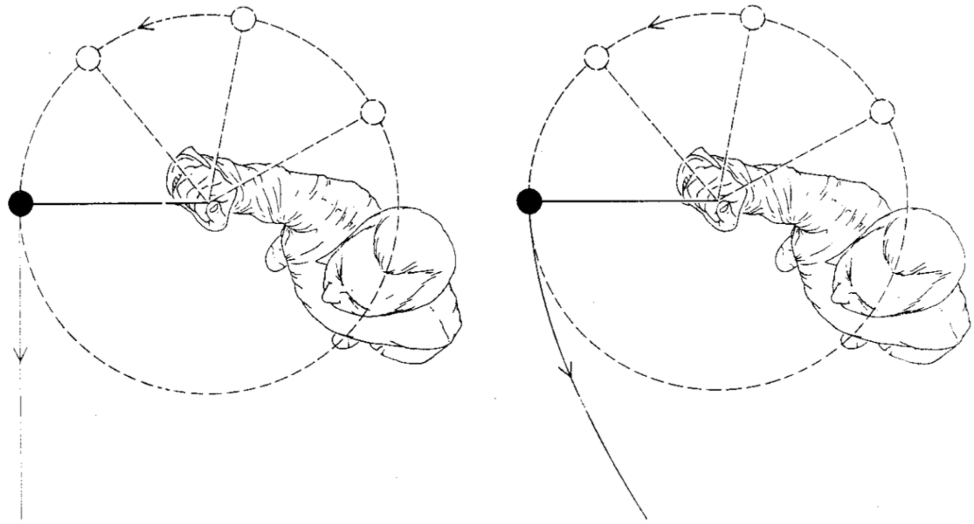

Figure 3 A demonstration of circular ímpetus theory

McCloskey (1983) reported that only 51% of college level students were able to correctly predict the path of a ball released in such a fashion, the remainder preferring some variant of the intuitive explanation, showing a lack of understanding of Newtonian theories.

In order to master a threshold concept, the theory suggests that students may travel through a tunnel or 'liminal space' (see Figure 4) where they 'get stuck' and may be in a state of uncertainty. Flanagan et al. (2010) define the liminal state as an ever-changing process, where students live with this uncertainty as they search for an understanding and begin to focus in on the concept.

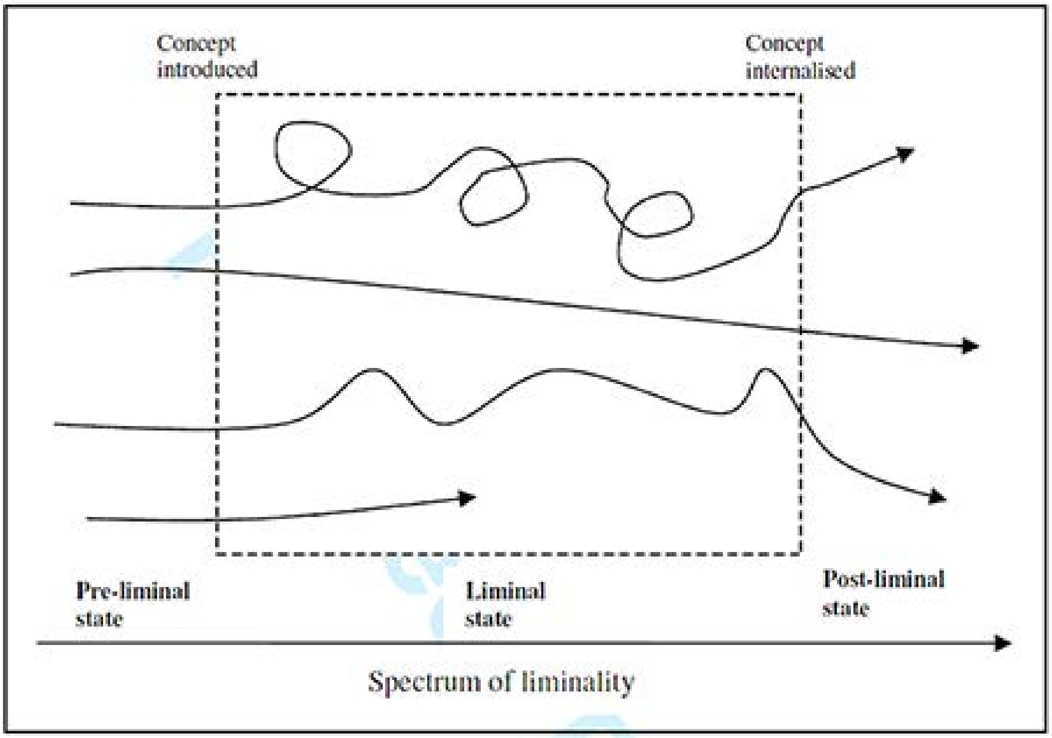

Figure 4 Liminal Space, Harlow et al (2011, p2)

Students adopt a range of strategies to cope with threshold concepts. Mimicry (Harlow et al., 2011) is often used by students and results in a situation where the students may appear to have understood because they can repeat the information verbatim, but then this apparent understanding breaks down when the student is required to use the knowledge in practice.

1.2 Identify threshold concepts in your subject

The following table lists a few of the threshold concepts that have been identified alongside examples of the types of misunderstandings students demonstrate:

Table 1 Threshold concepts

Subject	Threshold concept	Student misunderstandings
Biology	Photosynthesis	Photosynthesis as consumption A product's reaction to sunlight

Biology	Evolutionary theory	Macro evolution Timeframes in evolution Transfer of genetic characters Understanding nature of science	
Chemistry	Acids, bases and neutralisation	Describing neutralisation Strength of acids	
Chemistry	Atoms and atomic structure	Atomicity Chemical equilibrium Chemical bonding Intermolecular forces Energy quantisation in atomic structure	Animism of atoms Probability in atomic structure Size of atoms Structure/shape of atoms Weight of atoms
Chemistry	Ideal gas equations	Gas volume calculations Pressure volume Temperature relationship Unfamiliarity with thermodynamics	
Computing/ Technology	Java programming	Boolean conditions Iteration: loops or repeat, how often to iterate; starting value; what goes into a loop; while versus for loops Selection Understanding a problem Writing a trace table	
Computing/ Technology	Polymorphism: Object oriented programming	Inheritance, loose coupling and dynamic binding, abstraction, relationships	
Physics	Heat transfer	Mathematical formalisation, equations, functions	
Physics	Magnetism	Charge distribution Coulomb's third law Induction Charge and electric field Magnetic field Magnetic force	
Physics	Potential difference	Electrons carry positive charge Current is related to potential energy Voltage and current are the same	

Pure Maths	Complex numbers	Real numbers Imaginary numbers Square root Abstraction
Maths	Limit	The limit of ratio sin ×/× is 1, as × tend to 0, suggesting 0/0 = 1 Limit as infinity

You may already know some threshold concepts in your subject area. In Activity 1 you will conduct a search which will help you to confirm the threshold concepts you know about or help you find some new ones.

Activity 1 Identify threshold concepts in your area

Allow approximately 10 minutes

Use a search engine such as Google Scholar to search for literature on threshold concepts in your subject area. Find four examples of threshold concepts then make a note of the threshold concepts and related student misunderstandings in the table below.

Table 2 Examples of threshold concepts

Your subject area:	
Threshold concept	**Student misunderstandings**
1	
2	
3	
4	

1.3 Reflect on your personal experience of threshold concepts

Apart from the actual threshold concepts you found in Activity 1, think about other concepts that you have encountered in either your teaching practice (things that have been difficult to get across to your students) or your personal learning (the things that you have found difficult to understand).

Do any of these concepts match the criteria for being a threshold concept?

Activity 2 Map characteristics onto your threshold concepts

Allow approximately 20 minutes

List the concepts you have identified alongside whichever defining characteristic(s) you think applies to them. Use the five criteria used to identify a threshold concept identified in the ‘Innovating Pedagogy report’ (see further reading at the end of the week). The criteria are:

- **Transformative** – once understood, a threshold concept may *potentially* cause a significant shift in the perception of a subject (or part thereof); sometimes it *may* even transform one’s personal identity.
- **Irreversible** – it is unlikely that a threshold concept is forgotten or unlearned once acquired due to transformation.
- **Integrative** – a threshold concept is able to expose ‘the previously hidden interrelatedness of something’.
- **Bounded** – a threshold concept can have borders with other threshold concepts which help to define disciplinary areas.
- **Troublesome** – threshold concepts may be counter-intuitive (moving against and beyond a common-sense understanding towards an expert understanding)

Please note that if you save your responses here, they will be available later in Activity 4.

Table 3 Difficult concepts

Your subject:		
	Concepts you have identified as difficult	**Threshold concept criteria**
1		
2		
3		
4		

2 Tricky topics as a practice-based application of threshold concepts

Tricky topics are a practice-based application of threshold concepts. The term ‘tricky topic’ emerged from a European project called JuxtaLearn which was investigating the use of creative video-making by students as an intervention to help them overcome the barriers presented by threshold concepts. Initial workshops were held with science teachers to explain the aims of the project and how to identify threshold concepts, very much as you have been presented with information at the start of this week’s work. The teachers were encouraged to focus on the examples of student misunderstandings they encountered in their practice, either in direct face-to-face teaching or in homework. The initial reaction of teachers was to say that everything was a threshold concept, because all topics presented challenges, though clearly this was not the case. Using the threshold concept criteria, the teachers then identified three initial threshold concepts in secondary school science which were:

- Chemistry – moles
- Physics – potential difference
- Biology – Alleles or cells (for students who hadn’t yet studied Alleles)

The teachers then focused on and identified discrete elements within each threshold concept that caused problems for the students. They mapped out these elements using paper and pen. One of the Chemistry concept maps for moles is shown below.

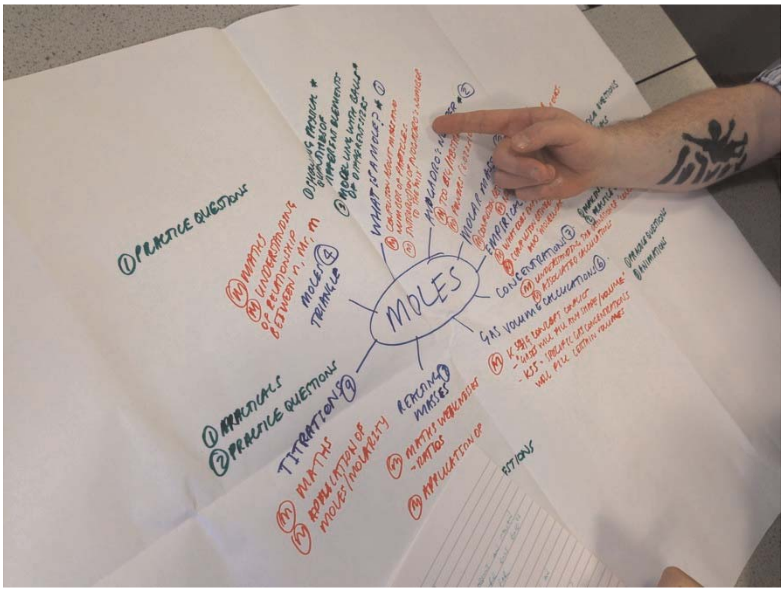

Figure 5 Teacher’s mind map of the threshold concept moles

At the suggestion of the teachers, threshold concepts were referred to as ‘tricky topics’. This fulfilled two goals. It framed the research in language that was familiar to both teachers and students, making it much easier to explain. It also removed the restriction on what difficult topics the project could engage with. The teachers pointed out that some of the tricky topics they struggled with year on year were not actually full-blown threshold concepts, however it would be of great use to them if they could help their students overcome those barriers.

Thus the term 'tricky topic' was adopted to refer to any troublesome topics as identified by teachers and practitioners. Such topics may not have been given the status of 'threshold concept' by academics but as practitioners have identified these topics, they merit attention. The students in the project were then helped to overcome the barriers to understanding these tricky topics by being encouraged to use creative video-making to explain their understanding to others, thereby revealing the gaps in their understanding. You will meet these video making interventions again in Week 6.

Below is a video on tricky topics to help your understanding. In this short video, which talks about the JuxtaLearn project, a maths teacher explains how tricky topics have successfully underpinned a process that used creative video-making as the intervention to help students understand long division in mathematics.

Activity 3 Tricky topics video

Allow approximately 5 minutes

Watch Video 1, which is about the JuxtaLearn project and its use of tricky topics.

Video 1 JuxtaLearn project

2.1 Identify your tricky topics

In the next activity, you will review the threshold concepts you have found in the literature and assess whether these concepts would be useful tricky topics.

Activity 4 Identify your tricky topics

Allow approximately 10 minutes

Refer back to your list of difficult concepts from Activity 2. If you saved your responses in Activity 2, they will appear in Table 4 below. State in the last column whether you think it is a tricky topic.

Table 4 Difficult concepts revisited

Your subject:			
	Concepts you have identified as difficult	**Threshold concept criteria**	**Tricky topic?**
1			
2			

3			
4			

3 This week's quiz

Check what you've learned this week by doing the end-of-week quiz.

Week 1 practice quiz

Open the quiz in a new window or tab then come back here when you've finished.

4 Summary of Week 1

In this week you have been introduced to threshold concepts. You should now understand what constitutes a threshold concept, and why this is a problem for both students and teachers. You have also seen that some topics present a threshold concept for many students, yet other seemingly equally complex topics do not. You have also been introduced to tricky topics which are the practical application of threshold concepts. Hopefully you now have an idea of the threshold concepts and tricky topics in your subject area. In Week 2 you will learn more about tricky topics, what they consist of and how they can be identified, laying down the foundations for the rest of the course.

You should now be able to:

- understand what constitutes a threshold concept, and why this is a problem for both students and teachers
- see how the term ‘tricky topics’ relates to threshold concepts
- begin to consider tricky topics in your subject area.

In Week 2 you will learn more about tricky topics, what they consist of and how they can be identified, laying down the foundations for the rest of the course. You can now go to Week 2.

Week 2

Introduction

As you saw in Week 1, **tricky topics** are the practical application of **threshold concepts** and their theoretical underpinning. Your understanding of tricky topics will be developed over weeks 2 and 3 by identifying and breaking down tricky topics in practice and the tricky topic process. You will learn the many ways in which you can identify tricky topics and the problems that students have in understanding them. You will know many ways of finding out why students have problems with them. You will then be in a position to begin to think about how to design learning to specifically overcome them (in Week 4).

In this week, you will consider what makes tricky topics tricky. Why are these topics so difficult to learn and teach? This week you will see how tricky topics are made up of several assessable parts (which are referred to as **stumbling blocks**) and how each of the stumbling blocks can be identified and constructed from students' specific problems in the topic. The students' problems (which are referred to as **problem examples**) highlight their misunderstanding of the tricky topic in general and may identify one or two of the stumbling blocks in particular. You will learn how the students' problem examples can be grouped together to form stumbling blocks or visa-versa, and how stumbling blocks can be defined by many problem examples.

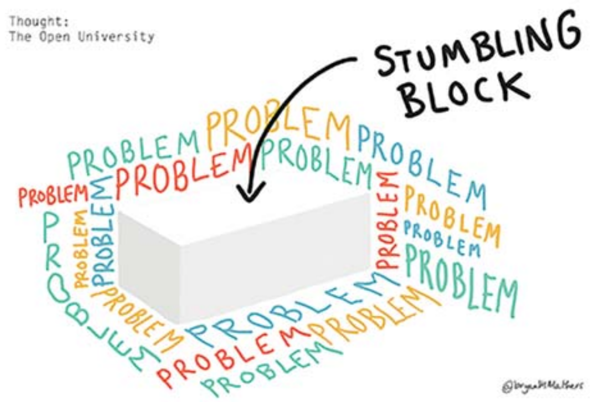

Figure 1 Stumbling block cartoon

By the end of this week you should be able to:

- identify tricky topics and their key components
- conduct a mini 'needs analysis' to identify students' problems in tricky topics
- use the 'problem distiller' to examine why students have these problems
- begin to appreciate the relationship between stumbling blocks and students' problem examples.

1 What are tricky topics again?

Tricky topics are topics which contain difficult concepts that students struggle to understand and which teachers find difficult to teach. Some of the tricky topics will be full-blown threshold concepts (identified according to the complex theories you read about in Week 1 and once learned will be transformative for the student) but others will not. You can find some of the tricky topics through existing literature in your subject area or through your own teaching experience. For some subject areas, personal experience may be all there is, because relevant literature on the topics which students find difficult, may not exist.

Here are some definitions for the terms that are used in this course:

Tricky topics: Topics which are challenging concepts that students find hard to learn and teachers find difficult to teach. They may also be threshold concepts (which once learned are transformative).

Stumbling blocks: Identifiable and assessable component parts of a tricky topic which are common to a variety of students' problems. You would expect to find at least three or four key stumbling blocks in a tricky topic but there may be as many as six.

Problem examples: Examples of the problems students have which display their misunderstanding of the tricky topic and are symptoms of one or more stumbling blocks in that tricky topic.

Problem distiller: Classification table which helps you to identify why students have specific problems in tricky topics.

Figure 2 is a structure chart of a tricky topic which shows the relationship between these terms. This chart shows that students' problem examples can be related to more than one stumbling block and stumbling blocks can have more than one problem example. What is not clear from this diagram is that each stumbling block usually has many problem examples (by definition).

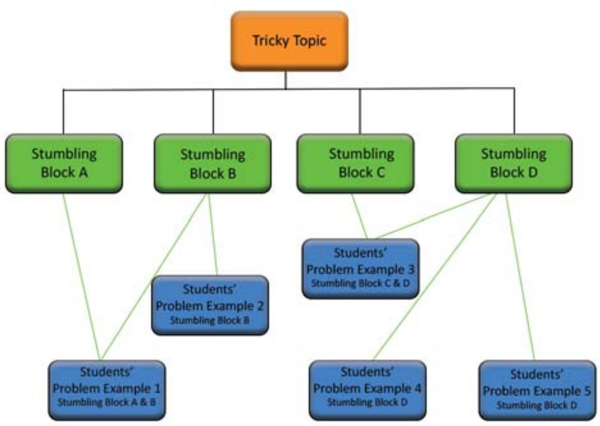

Figure 2 Template structure of a tricky topic

Figure 2 represents a template, now let's look at a real example. Figure 3 shows the tricky topic of Moles in Chemistry. Interestingly Moles is also a threshold concept which you met in week 1. You will see many more interesting tricky topics as you work through this course.

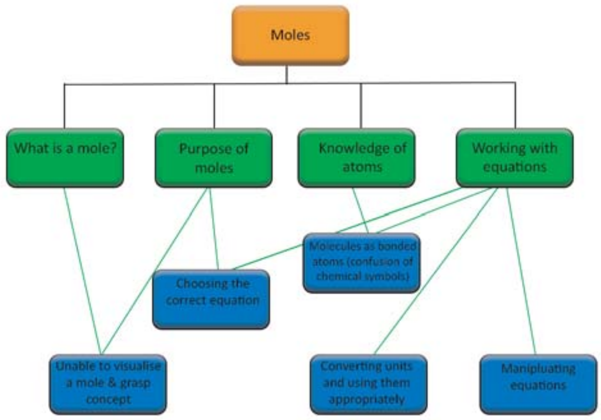

Figure 3 Example of tricky topic – moles

Figure 2 illustrates the connections between tricky topic, stumbling blocks and students' problem examples. Figure 3 provides concrete examples from the tricky topic moles to show how each problem example may be linked to more than one stumbling block. Before investigating how to define tricky topics further it is important to discuss how to find out what students understand or misunderstand about tricky topics in order to define those stumbling blocks and problem examples. Section 2 explains how you can conduct a needs analysis that is tailored to identifying and capturing details of your students' misunderstandings.

2 What is it that students don't understand?

Identifying what tricky topics exist in any particular subject area can be very difficult, even for teachers who appear to understand their students' learning needs in great detail. Teachers often feel frustrated when trying to understand their students' difficulties, saying:

> 'I just don't understand why they don't understand'

Figure 1 (repeated from Week 1) I don't understand

Through the work with teachers, the tricky topics that drills down to the causes of student misconceptions and helps teachers target their teaching interventions so that they make a difference. The first step in this process is to work out what it is that the students are struggling to understand. This can be done through a 'needs analysis'.

2.1 Using a needs analysis to identify misunderstandings

One way to overcome the frustration of not knowing why your students just do not understand a tricky topic, is to conduct a focused 'needs analysis' to identify their misunderstandings. In the context of tricky topics, the misunderstandings are specific to each student, therefore the needs analysis will take the form of discussions or semi-structured interviews with focus groups of students in order to draw out these misconceptions. It could be considered as a **diagnostic step** in developing a deeper understanding of your students' needs and is therefore a valuable first step in the tricky topics process (i.e. a series of steps to unpick the tricky topics which will be explained further in Week 3). As an experienced teaching practitioner, you may already feel that you understand your students' needs very well. However, there may be areas where students are having difficulties understanding which have not yet become obvious. Consider this section an opportunity to have a fresh focus on your students' understanding.

This step of understanding your students' needs feeds directly into the tricky topic process. The process involves understanding learning needs, then planning and designing your learning intervention according to those needs and then assessing students' progression to assess if those needs have been met and there is a deeper understanding of the difficulties (see Figure 4).

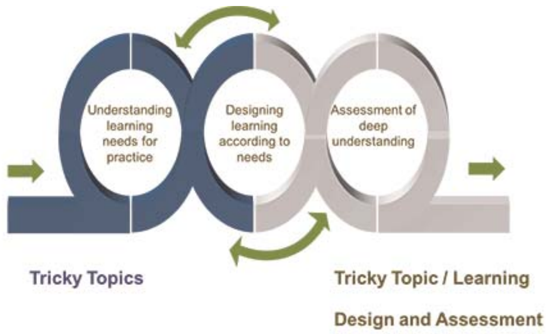

Figure 4 Tricky topic process cycle

When looking at your own practice and reflecting on it, this clearly links with wider research cycles that you find in action research and the related method of practitioner inquiry (see Figure 5).

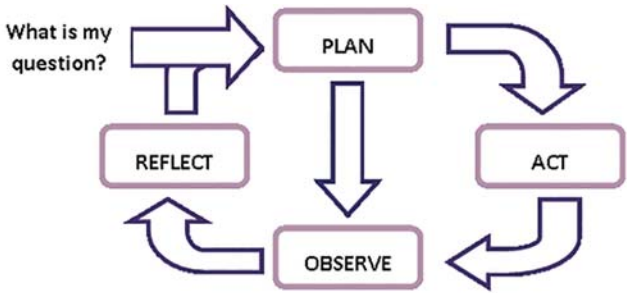

Figure 5 Practitioner inquiry cycle (adapted from Reason and Brandbury 2001)

As you can see from Figure 5, a needs analysis with your students must be planned, conducted, observed (i.e. analysed) and then reflected upon. If you already have a detailed understanding of your students' needs it could be that you can use the planning stage to record this understanding and move directly to observing/analysis which is the process of identifying tricky topics, stumbling blocks and problem examples as shown earlier, and in Week 3 activities.

2.2 Preparing a needs analysis

To conduct a needs analysis with students there are several key points that need to be considered. For a detailed description of how to collect students' needs and understanding it would be good to read Adams and Cox (2008): 'Questionnaires, in-depth interviews and focus groups'

This paper details key tips on how to capture accurate information when talking to students. They are in reference to both face to face and digital interactions which could be applied when interviewing an individual or a group. The tips below have been restructured from this paper to focus specifically on students of all ages. Tips for accurately capturing students' misunderstandings:

- Focus on the students as learners, not on you as teacher, so they should do most of the talking. You should talk at most for 5–15 per cent of the time.
- Keep students focused, not allowing them to drift off topic (more likely in a focus group than with an individual).
- Be flexible about their responses to questions. Don't restrict them to answering questions in the order they have been asked. This is more important for younger students or for those students with less confidence.
- Ensure all students speak equally in a focus group by not allowing a dominant personality to steal the limelight by giving you all the answers.

As a teacher you ask questions all the time, but asking students 'needs analysis' questions is particularly difficult. You are not assessing the students, merely finding out about their understanding or more importantly, their misunderstanding. The guidance below has been provided by experienced teachers in order to alleviate some of the issues that have been identified as problematic in conducting needs analyses:

- Ask open questions which allow students to talk in their own words. So, don't ask leading questions which contain hints or closed questions which can receive simple yes/no responses. Allowing them to talk freely in their own words frequently reveals their depth of understanding without mimicking what they think they should say. This is especially true for younger or less experienced students who can feel less confident in using their own words in a subject they feel the teacher 'owns'.
- Ask questions that probe without prompting for a response. If a student gives a vague response ask them to qualify it (e.g. 'What do you mean by that?'), but don't give them a response to agree to (e.g. 'Do you mean this…?'). Once again this is especially true for younger or less confident students who may say yes to fulfil what they think is the 'right' answer from a teacher.
- Ask students to clarify what they mean when they use jargon as they may be using it without understanding its true meaning.
- Remember that there are no right or wrong answers in a 'needs analysis' as it is only the students' understanding you want to hear (however far that is from the correct meaning).
- Be careful not to give the student *your* view on the topic as this can lead towards a teaching session and will not elicit the students' own ideas on the topic. This may be the hardest thing to remember as a teacher but the teaching must be left to a later point in time so that the students feel free to give you their 'real' understanding (or misunderstanding). However, open debate among students in a focus group who disagree on a topic can be enlightening (if managed well).

The next section provides some guidance on methods for collecting data from your needs analysis.

2.3 Planning an effective needs analysis activity

When conducting a students’ needs analysis in order to identify their (mis) understandings it is useful to consider how you are going to:

1. structure an activity to best capture students’ thoughts
2. record the students’ thoughts and understanding
3. analyse those thoughts.

Structuring to capture students’ thoughts

Students are most likely to provide their own thoughts, views and potential (mis)understandings if they are engaged in an activity which will stretch their understanding of difficult concepts. Your questions should then tease out students’ thoughts while they are busy with the activity.

For example, the following table (Table 1) of items was made into a set of cards by science teachers and given to secondary school children to establish (mis)understandings about living things. The students were asked to group the cards into living and non-living and then asked to explain why they have grouped the cards in that way.

Table 1 Alive or not cards

fire	water	tree	wood
egg	baby	monkey	worm
flower	cactus	wind	nut
meerkat	jellyfish	bee	elephant

It is important to emphasise before the task that this is not a test and that you are only interested in what they **think**. The students should be prompted where necessary with non-leading questions such as, ‘That’s interesting – can you say why?’ and ‘You said … that’s interesting, can you say more?’

Recording students’ thoughts

Table 2 looks at the different methods of recording student's views.