

“I’m a busy distance learner” – Engage me

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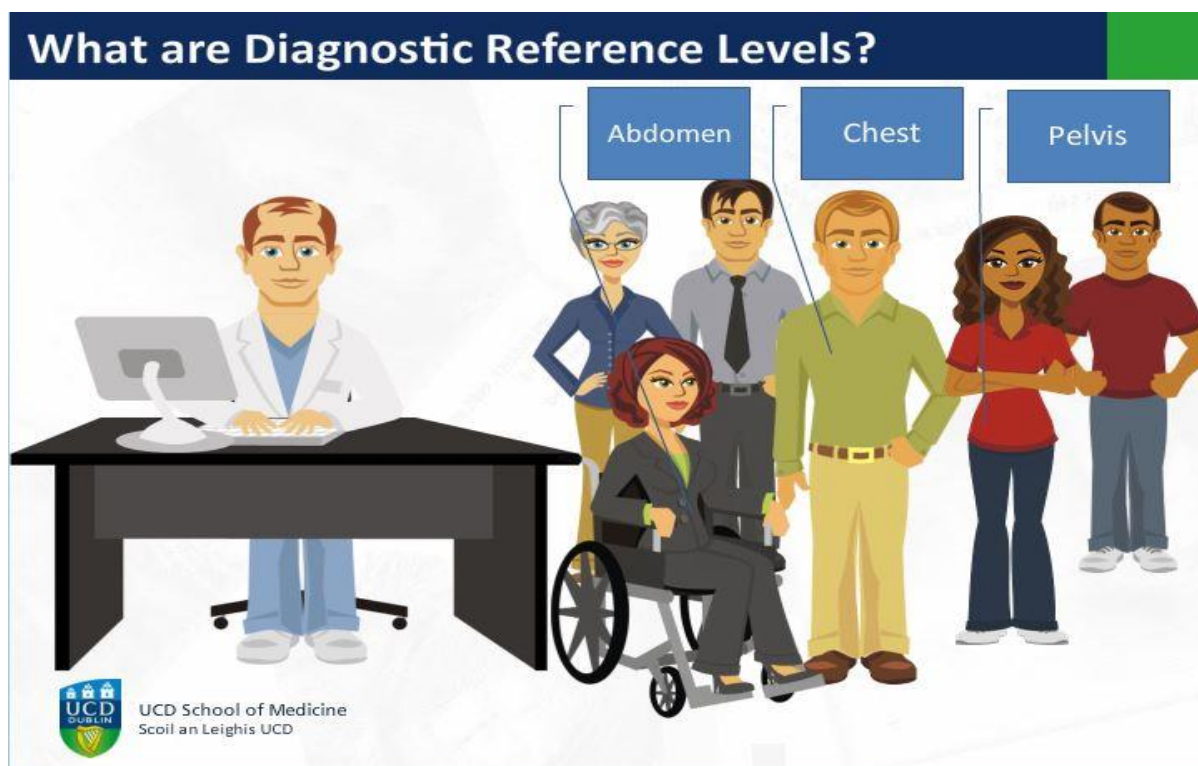
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Table 1. Programme and Module overview

Module Name	Patient Care & Interventional Radiology [RDGY 41250] Technology of Interventional Radiology [RDGY 41260]
Universal Design Principles	Simple & Intuitive, Flexibility in Use, Tolerance for Error, Community of Learners
Discipline	Radiology
Level	UCD Level 4
College	UCD College of Health and Agricultural Sciences
Student Numbers	RDGY41250 – 8 RDGY 41260 – 9
Learning Outcomes	Patient Care & Interventional Radiology [RDGY 41250] On successful completion of this module, the student should be able to: • Competently discuss a wide range of procedural aspects of interventional procedures within the context of service provision and patient outcomes. • Demonstrate an awareness of the need to adapt all aspects of procedural technique in individual procedures based on patient presentation, case history and procedural environment. • Critically reflect on the advantages of using interventional radiology to develop and improve the quality of service provision in the Imaging Department Technology of Interventional Radiology [RDGY 41260] • On successful completion of this module, the student should be able to: • Challenge and optimise the application of IR technology across a range of clinical contexts • Appraise IR safety and facility design issues from diverse perspectives from angiography suites to hybrid operating theatres

Table 1. Programme and Module overview

	Isolate and focus on the challenges associated with the evolving nature of IR technologies and suggest appropriate solutions
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Our distance learners, like many others, are very busy people. We decided to engage our diverse group of students through implementing Universal Design principles in our modules. These modules are designed for radiographers working in the area of interventional radiology. They aim to provide students with an in depth knowledge of the procedures provided by interventional radiology. There is systematic approach to discussing the interventional procedures currently performed in Irish hospitals focussing on promoting both professional knowledge and quality of service in the interventional radiology environment. These module aims to develop each student's knowledge and understanding of the aetiology of the disease processes that present in the IR department, their compatibility with radiological intervention, the possible procedural risks and complications and the expected outcomes for each patient.

Why Universal Design for these online modules?

Students on this course are graduate radiographers who work in a clinical setting. This course is studied out of hours or in very limited amounts of time that students might have available during working hours. The majority of students would not have previously studied online. We also had a small number of international students taking this module for whom English is a secondary language. With a diverse group of students, studying in challenging circumstances, a Universal Design approach helped us to work towards meeting the needs of as many students as possible.

Our intention was to be able to structure the content into small segments so that learners felt that they could complete a section even with limited time and in this way they would be given a sense of

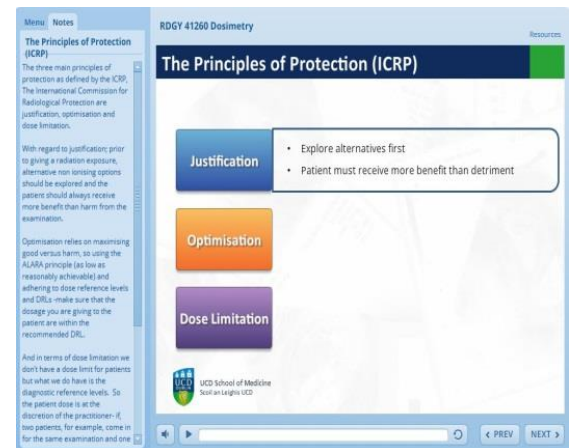
making real progress. We also wanted to help learners to put the learning into context where possible and to be able to transfer the learning to their work environment. The principles of Universal Design in the context of e-learning emphasise the need for learning to be presented in the simplest format possible, allowing for learning to be prioritised over the need to acquire additional digital skills (Elias, 2011).

Design and implementation of the module

We particularly focused on flexibility of use, ensuring that there are multiple means of representation through audio, visuals, transcript and text, as well as interactivity to promote transfer of learning. We also included multiple means of action and expression, through the inclusion of resources, notes and a variety of quiz types. We aimed to improve student engagement through combining some live online tutorials with the main content of the course.

As well as a visual explanation given through the slides and a voiceover explaining the content, we include a transcript in all of our modules to ensure that the content is accessible to all learners (ensuring the use of sans serif font throughout). The transcript can be seen on the left of the slide shown in Figure 1.

Figure 1 – transcript (on the left of the slide) and voiceover are available for all slides.



Explaining Decimal and Binary Numbers

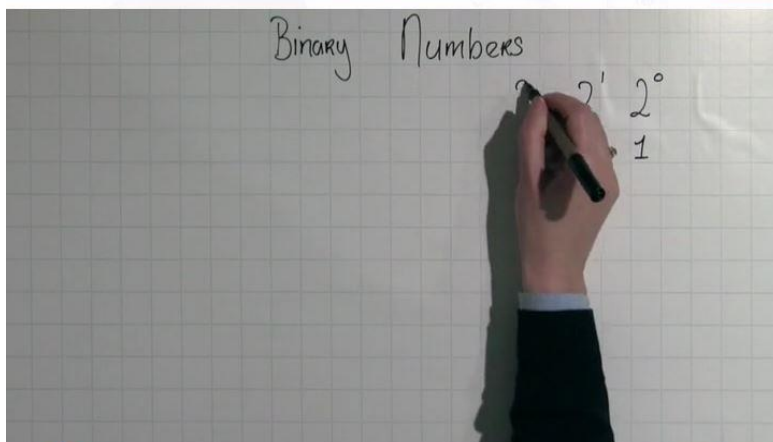
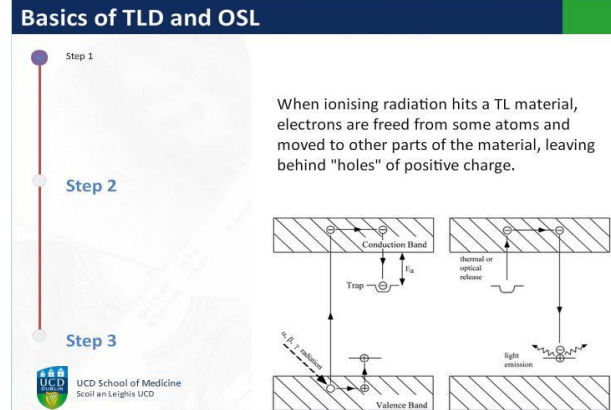
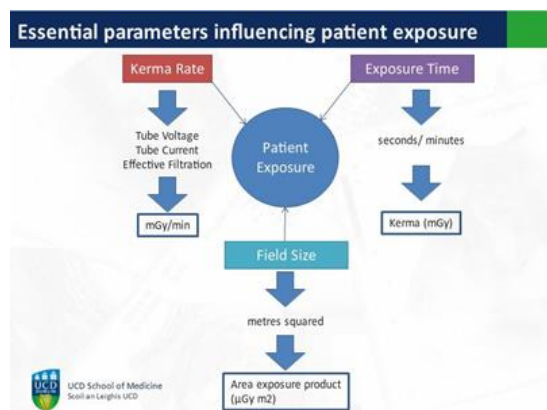


Figure 2 – Video explaining Decimal and Binary Numbers

We also use video, where appropriate, to provide further illustration to complex topics. This provides another media format to meet the principle of multiple means of representation as shown in the video still in Figure 2. Video is particularly effective for maths as voiceover and text alone can be difficult to follow in maths education.

Figure 3 – Big ideas and relationships are clearly shown in illustrations allowing for visual learning.



'Big Ideas' are highlighted through text or illustrations to reinforce the key points being described on each slide. Figure 3 shows how relationships between key areas or ideas can be clearly shown in an illustration improving the learning process. Relationships can be explained more clearly by requiring learners to move through the steps of a process as shown in Figure 4. Learners can click on each step to view content and listen to the audio explanation of that part of the process. In order to highlight patterns, where there are a number of comparative concepts or procedures in a topic, each will be broken into separate learning objects and chapters. The same structure and similar slide layouts are used in each section to ensure the approach is simple and intuitive and to highlight to students the similarities and differences between each concept.

Branching or layered slides are used to emphasise the critical features and connections between two subtopics. For example, in Figure 5, the learner clicks the buttons to learn about employer and employee responsibilities - connected but different information.



Figure 4 - students can move through the steps of a process to view the content and listen to audio material.

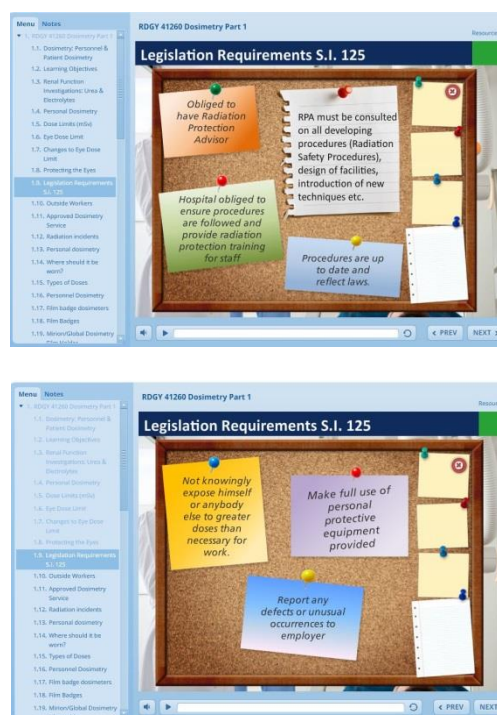


Figure 5 – Branching slides allow students to click through to see connected information.

Figure 6 – Information is chunked in small sections.

**Lecture 8 Parts 1-4 Notes**
Enabled: Statistics Tracking

**Notes**

**Lecture 8 Pt 1 (Introduction)**
Availability: Item is no longer available. It was last available on 01-Jun-2016 23:59.
Enabled: Statistics Tracking

**Presentation**

**Lecture 8 Pt 2 (TACE)**
Availability: Item is no longer available. It was last available on 01-Jun-2016 23:59.
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**Presentation**

**Lecture 8 Pt 3 (Radio Embolisation)**
Availability: Item is no longer available. It was last available on 01-Jun-2016 23:59.
Enabled: Statistics Tracking

**Presentation**

**Lecture 8 Pt 4 (Radio Frequency Ablation)**
Availability: Item is no longer available. It was last available on 01-Jun-2016 23:59.
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**Presentation**

Content is released progressively each week and, as previously mentioned, is further ‘chunked’ into smaller topics where appropriate as shown in Figure 6. Each section is clearly labelled and easy to navigate for students. In this way the content is made more accessible to learners. A full notes document is also included for each lecture in Blackboard. These consist of a screenshot of each slide and space for note taking as shown in Figure 7. Learners can take notes on each slide as they view the lecture.

Figure 7 – students can use these notes sheets to take notes on each slide.

1.2 Learning Objectives

Learning Objectives
During this session, we will look at:

- Personnel Monitoring
- Detectors
 - Film
 - FD
 - CDL
- Typical Staff Duties

Tabbed slides, as in Figure 8, can be used to further break down topics ‘chunking’ information while still demonstrating the relationship between the sub-topics.

Pharmacological Agents Used

Patient Preparation

Contra-Indications

Agents

Monitoring

Procedures

Technique

First Procedure

- Antibiotic pre-procedure
- Conscious sedation with Midazolam and Fentanyl
- Post procedure: antiemetic, analgesic and antipyrexia
- Oral sodium perchlorate
- Intra arterial Tc-99m Microaggregated albumin (MAA)
- Iodinated Contrast

Second Procedure

- Antibiotic pre-procedure
- Octreotide (somatostatin) infusion or depot injection (Symptomatic neuroendocrine tumour only)
- Conscious sedation with Midazolam and Fentanyl
- Post procedure: antiemetic, analgesic and antipyrexia (occasionally steroid and proton pump inhibitor).

Formative quiz questions also assist learners in processing information into usable knowledge and allow for Tolerance for Error. In the Drag and Drop interaction shown in Figure 9 symptoms jump back to their starting point until they are dropped into the correct folder. In order to provide scaffolds which will help to improve memory and transfer of content, we include elements of active learning where possible. With interactions such as these, it is important to check whether they are accessible for learners using a screen reader or other assistive technology. If required, provide the additional equivalent content in an alternative, accessible format.

Figure 8 – tabbed slides are used to break down information in to manageable chunks.

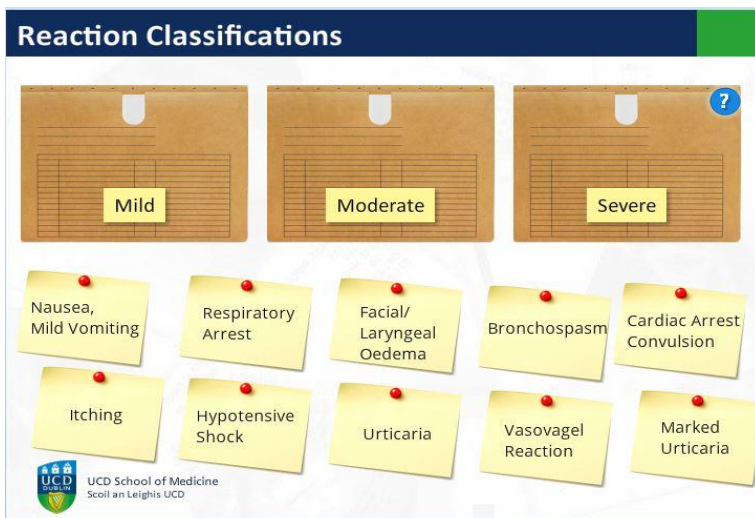


Figure 9 – a drag and drop quiz allowing for interactive learning and self-testing

In the interaction shown in Figure 10, the learner drags the radiographer to different distances from the patient, in order to see how this affects the dose of radiation received by the radiographer. This facilitates knowledge acquisition, more so than telling the learner the effects directly. Simply using appropriate images for labelling and description can help the learner to transfer the information and put it into context. Slider functionality can also be used. This illustrates the comparisons by requiring the learner to drag the slider to different options. Not all content will lend itself to this approach but even simple interactions can help to make the content more memorable and transferable by encouraging active rather than passive learning.

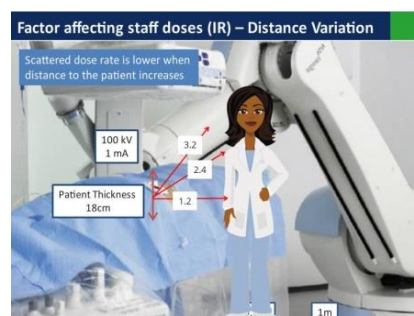
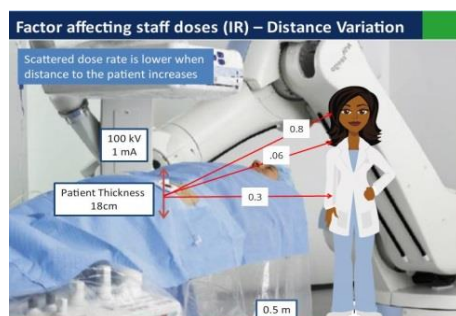
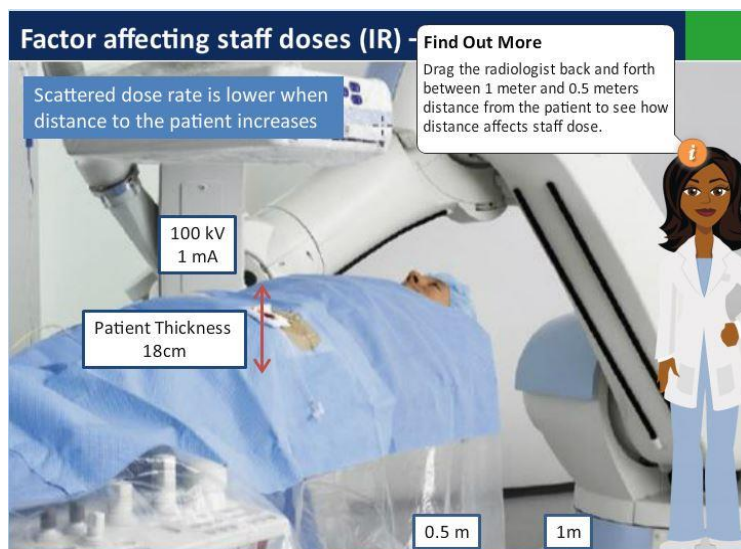


Figure 10 – Interactive slide demonstrating staff doses – the learner can drag the radiologist back and forth to see how the dose is affected by distance.

A flip card approach as shown in Figure 11 allows learners to click on each procedure to see the radiation dose. This communicates the information but can also be used by learners to test their learning. Where resources such as policy documents, regulations or hospital forms are referred to, a copy is made available in the Resources section of the Learning Object. If a journal article is relevant, a link is provided to the article in the UCD library. This can be accessed from the slide itself but is also included in the resources section.

Interaction with faculty and among students is encouraged in order to create a Community of Learners. Through Blackboard Collaborate students can raise their hand and the academic can enable their microphone or students can use the text box to speak to the lecturer or each other. The whiteboard in Collaborate is also used to demonstrate samples of exam questions as shown in Figure 12.

Different types of quiz questions are included where appropriate. These are formative and learners are given several attempts at each question. If the answer is incorrect, the correct answer is provided or learners are directed back to the relevant slide where they can review the information. A variety of quiz types are used to appeal to different learners.

CT Fluoroscopy (120 Sec Exam)	CT Fluoroscopy (18 Sec Exam, low mAs)	CT
Mammo - graphy	0.008 mSv	Mobile Chest X-ray

Figure 11 – a series of flip cards which reveal the information when clicked.

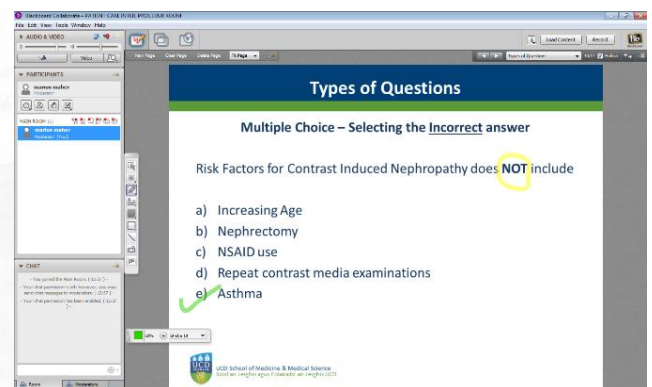


Figure 12 - Whiteboard in Blackboard Collaborate used to demonstrate exam questions and to allow for interaction with students.

Quick Quiz – Question 3

Convert this Decimal Number to a Binary Number

Write the binary number to 9 places

9 =

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Quick Quiz: Question 1

Convert this Binary Value to a Decimal Number

2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	Decimal No.
0	0	1	0	0	0	0	1	1	1	0	0	0	Answer Here

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Gapfill

Quiz Question 3

Prothrombin times (PT) is a better indicator for warfarin than INR.

☐ True

☐ False

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Quiz Question eGFR

Match these eGFR results with an appropriate action for patients attending for iodinated contrast examination of the arterial system in the IR suite.

eGFR Rate	Appropriate action
> 60 ml/L	Mild decrease in eGFR - consider hydration post procedure.
45 – 60 ml/L	Severe decrease in eGFR - consider IV fluids pre and post procedure.
30 - 45 ml/L	Normal range- ok to proceed with contrast examination.
< 30 ml/L	Moderate decrease in eGFR - consider IV fluids pre & post procedure.

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True & False and Matching Pairs

Quiz Question Renal Profile

John, diabetic, has lower peripheral vascular disease. He attends for a peripheral angiogram +/- angioplasty.

His current serum creatinine result is attached to his medical notes.

In your opinion which of the following would most likely explain the abnormal serum creatinine findings;

- ☐ Diabetic patients are more likely to have nephropathic changes decreasing the rate of serum creatinine excretion.
- ☐ Diabetic patients are more likely to have nephropathic changes increasing the rate of serum creatinine excretion.

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Quiz Question 2 (part A)

Which manipulation was performed on the image?



☐ Image brightness was increased

☐ Image brightness was decreased

☐ Image was smoothed

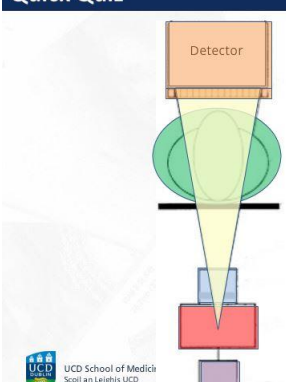
☐ Image contrast was increased

☐ Image contrast was decreased

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Multiple Choice based on scenario/based on images.

Quick Quiz



Drop the labels on to the correct parts of the fluoroscopic imaging chain.

Quiz Question 3

WASTE ITEMS

Gloves/Aprons
MSRA infected



Black/White bag Yellow bag Yellow bin Orange lid Yellow box Yellow lid Yellow box Purple lid Yellow bin Purple lid Yellow box Black lid

WASTE CONTAINERS

Drag and Drop

Evidence of Impact. How do you know it worked?

This is the second iteration of the course and it was in the most recent release that we really focused on inclusion of interaction, different quiz types and branching as well as the online tutorials. The feedback we have had is positive with all respondents stating that they were satisfied (40%) or very satisfied (60%) with the course.

Students said the following:

“I think the module was well structured.”

“Tutorials gave me confidence in the MCQ exam.”

“I really enjoyed the tasks in the lectures.”

“Shorter lectures are easier to tackle than the lengthy ones.”

Advice to others for implementation

Some interactions such as Drag and Drop will not be accessible to learners using a screen reader. It's important to check the accessibility of templates and activities, however if you feel that it is beneficial to include it, just be sure to include an equivalent, alternative task that is accessible. Implementing Universal Design does not mean having to compromise learning but rather ensuring that there are equivalent options for all learners.

It does take time to include these aspects and to add interactivity to the course so this should be considered in the development process. However, the time taken in development can transform the module from a didactic delivery method to an engaging learning experience. Universal Design also makes the content more accessible to all learners and this should be reflected in students' understanding of the content. Hopefully, because of this, the material will need less work in the future

so it is time that is well-invested. Also once templates for interactions and quizzes are created they can be reused for other learning materials. If changes are needed in the future, the fact that the content is broken down into manageable 'chunks' should mean that any changes will be manageable. We did not include alt-text with our images, mainly due to time restrictions. This is something that we will add in the future, to ensure that content is accessible for learners using a screen reader.

We would recommend in a purely online course, including online tutorials earlier in the course and possibly to do so at regular intervals as students felt that it was helpful to get to know that there are other students on the course. The social aspect of learning and peer learning are particularly beneficial for post-graduates who all bring their own experience to the course. A discussion forum would also be beneficial in this regard, although this will require some moderation which may not always be possible.

References

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