Cambridge Assessment International Education

Transcript - Creating and using multiple-choice questions effectively

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Andrew Field: Hello.

This session is for anyone teaching, regardless of stage, age or subject. To help explore the effective use of multiple-choice questions in the classroom. There will be a particular focus on diagnosing learning loss and how multiple-choice questions can support both teacher and learner workload.

Cambridge Assessment includes several expert assessment organisations; and in this session, we are from Cambridge International, Cambridge Maths and the Cambridge Network. I'm delighted to introduce, Rachael Horsmann, Cambridge Maths lead and Simon Child who is head of assessment training and I am Andrew Field, E-Learning Manger at Cambridge International.

Now, during this presentation we will move between discussions like this and showing some examples on slides.

So, I'd like to start, what do we consider is effective questioning? What are the advantages of multiple-choice questions to support teaching and learning? Rachel?

Rachael Horsmann: So, I've been thinking about this a lot and I mean firstly I think it's worth considering why do we ask questions? There's lots of research about why we ask questions and different reasons in the classroom, down to just even occupying students and keeping them on task. It's a behavior management tool.

But I think some of the things you see in the research, in particular by people like Dylan Wiliam, they talk about, it's about making students or learners engage their brains, it's making them think. Really importantly, it's about providing information to the teacher about their next steps. Are they ready to move on? Is there something they need to recap? Is there something they need to re-tech? And if you get that wrong, things can go quite wrong in the classroom, or online, quite quickly.

If you recap the wrong bits, students can be disengaged. If you reteach when it's not needed, are you wasting time? If you move on and students aren't ready, there are some dangers there.

Really identifying the right questions to ask, at the right time, can give you so much information about the progression of your lesson. For me, that is really central to it. And multiple-choice questions offer some really excellent ways to do that, whilst also not overloading teachers, particularly at this time, when we're working online.

Andrew Field: Okay, thank you.

Multiple choice questions, there's often a lot of myths about these and beliefs about what they can be used for and what they can't be used for.

Simon, any thoughts?

Simon Child: Yes, that's actually one of the most interesting parts about MCQs. There are certain perceptions that persist with multiple-choice questions, even when people are using them in effective ways in the classroom and in assessment more generally.

Some tend to persist though and one of them is that MCQ assessments are only good for assessing a particular thing, which is the road to recall of knowledge. With some examples, we can possibly bust that myth in the next slide or two.

This is something you may be familiar with, Bloom's taxonomy. You can see that lower order learning, so remembering and understanding, are towards the bottom end of the taxonomy, are things that we most naturally associate perhaps with MCQs. What I wanted to get across here, was the idea that higher order learning, so applying, analyzing and evaluating, can actually be accessed with skilled MCQ examples.

Just to give an example here related to the idea of analysis, an example here is you could show someone a poem in class and then you ask the question related to a particular stanza. So, this is a multiple-choice question with an objective, correct answer, which has all the benefits for students, in terms of knowing what it is that they need to do as part of the response to the question. But also as an assessor, as someone looking to understand what the students know, you can see that if students answer correctly in this sense, they have been able to analyse the actual ambitions and aims of that particular stanza. In this case stanza 9.

So, with those in mind, there are perhaps other misconceptions that could be held as well. One of the other misconceptions that tends to persist, is the idea that somehow MCQs are easier and I think that links with this idea of MCQs being associated with lower level knowledge recall. So, as we've shown on the previous slide, analysis and evaluation can be assessed using MCQs. But they are also interesting, in that the difficulty of MCQs is actually somewhat determined not just by the correct answer option, but also by the plausibility of the distractors that you include.

We'll see some examples later on of ones related to common misconceptions.

So, whilst they're not easy in the sense of being easy to respond correctly to, they also, they have the advantage of students are aware of what is expected of them when they are given a question. You know they have to mark a piece of paper or click on a computer. So, in that sense its easier in the way that students have a realistic expectation of what is expected of them. Whereas, compared to say essay based questions, the strategy for responding appropriately may not be as fully set.

Another misconception is perhaps that they cause ‘teaching to the test’. This again seems to be related to the idea that MCQs encourage knowledge base to be learned in a rotary call fashion.

As I think we will explore in later parts of this session, MCQs actually have a lot of rich potential in the classroom for classroom practice, for encouraging good teaching and can actually build a dialogic interaction in the classroom. So, using MCQs and analyzing student responses can be a powerful teaching and learning moment.

And the final one that we will look at, is the idea that they are simple to write. They’re simple to write, but they are hard to write well.

So, at Cambridge Assessment we have to invest a lot of money actually and time and so on, in the development of high quality MCQs. So, question accessibility, content appropriateness and review, are all parts of what we look at. So, choosing good distractors is in particular an important element of MCQ questions. So that’s why we have to recommend that several people are part of the process of writing MCQs, at different stages of development.

So that’s that myth is busted as well hopefully.

Andrew Field: Okay, thank you so much.

It’s really good to explore those things, because this is how we can empower all our teachers to have confidence with multiple-choice questions.

So, in that regard, could we explore some examples of how multiple-choice questions can work in practice? Maybe focusing on maths to start with.

Rachael Horsmann: That would be wonderful. I think one of the things that particularly in mathematics and other subjects, is the idea of misconceptions.

If we think about why a student gets a question wrong, is it that they don’t know the content, is it a careless error, is it misuse of existing knowledge, or is it something based in the misconceptions?

So, a kind of a typically held belief where something has been misinterpreted. In maths its often that things have been over generalized. The simplest case was, I’ve witnessed primary students, younger learners, who think decimal places only ever go to two places because they’ve dealt with money and they take that on into their later learning.

Now what kind of carefully grated multiple-choice questions can do is really pull out those misconceptions.

So, mathematicians or people who have recently done some work on circles might recognise this, it’s a typical question of what is the area of this circle in square centimeters? You’ve been given a measurement and you’ve been given four answers. Now, each one of those answers has been carefully chosen, because it picks out a particular problem that you might have. It might be that students are not using the radius or the diameter in the correct way. One of those picks at that, I’m going to leave you to tell you which. I’m not going to tell you the answers as that would do your job for you. Another one looks at, have they just used the wrong formulae? So, have they used the formula for the circumference instead of the area? And another one again looks at,

have they used the radius and the diameter and the wrong formula. So, you're able to kind of pick at things.

What's really interesting afterwards, particularly with these ones, is you could have a series of these that hone down the errors but also this is a great discussion point. You know, I say, right I think it's A and everyone says, no you're wrong, you're wrong and I say well no but I think it's A, and you can really investigate why do I think it's A, well what is the misconception. It's not just the teacher thinking about the misconception, it's the students talking about those misconceptions which can offer really quality discussions about what has that student done wrong.

Andrew Field: That's such a great point.

In terms of a teacher feeling confident to use these, these are not replacing teaching or anything like that, these are enhancing the teacher aren't they.

So, you start with those formative questions and its really powerful as you've just said.

Rachael Horsmann: Yeah and I think it's really interesting when you look at these and say, I've just noticed my lettering there is terrible, but if I pick that 36π, why would a student pick 36π? And having that discussion about, well why is that the wrong answer and what do you think they got wrong, really deepens the conversation about the mathematics, rather than just, the answer is, it's right, its wrong.

And the other type that I've been looking at a lot is something called hinge questions, now these are multiple-choice questions, and you can read a lot about these by Dylan Wiliam and they're beginning to appear on the web now.

Now a hinge question is a carefully designed, multiple-choice question. It is something that's not done lots and lots of them, you have one question that really digs deeply into a particular topic, into a particular kind of crux of 'I need to move on, if students have got this I can move on, if they haven't got this, I am going to have to work out why have they not got it, what are the misconceptions?'

So, this is a very simple one of 'which of those lines has a gradient of 2?' and the answers are carefully designed, each of them, if you pick them, one of them is correct, one of them is really picking at recognizing the importance of scale. Another is looking at whether students are calculating the gradient or the reciprocal. So, the answers have been carefully designed, given previous work, so these answers were designed due to the answers that students have done in previous lessons. So, the teacher had really thought about what is the question I want to ask, what's that kind of gate keeper concept to move on and what are the mistakes students have made previously? I'm going to suggest those and see which students have overcome them and that gives that teacher great confidence then. By either saying, I can move on everybody's got it, or just saying hang on a second, there are still a few misconceptions that are worth me recapping, either with individuals or with the class as a whole. So, huge potential of really understanding where your students are.

Andrew Field: That's great, thank you so much.

And Simon, we're exploring sort of practical examples here so I believe you're going to mention about higher order opportunities and skills.

Simon Child: Yes, so just building on that idea of going from knowledge.

Multiple choice questions as I mentioned in the myth section before, is generally seen as about knowledge recall.

But I just wanted to show an example from Psychology, about how a question that is initially about knowledge can almost be reviewed and converted into a higher order skill. So, taking this example from Psychology, this is to do with the memory systems in the brain, so 'which sensory memory system is specific to the processing of auditory information?' and the answer is echoic memory.

If you look at the next example, this idea is essentially giving the same type of options available, so it's a multiple-choice question, 'which one of the following sensory memory systems does a piano-tuner mainly use in his occupation?' his or her occupation. So, the idea around this is that they will have an understanding of what the different memory systems do but they will also have to understand the role that a piano tuner has and apply the knowledge that they have around sensory memory to the particular application of how a piano tuner goes about their work.

You may have noticed actually as well from the two examples that if you change the distractors, you can actually make the different options more plausible. For people that know about Psychology, these examples here are all versions of sensory memory.

If you look back at the previous example, if you just go back to the previous example here, these different distractors are not actually forms of sensory memory system. So, for the student whose gone through a process of learning about these systems, this particular question here may have less plausible distractors than the application example.

So that's another way that you can increase the demand of that particular example and take it from knowledge recall and recognition to higher order skills. So that's just a couple of examples of how you can change and manipulate multiple-choice questions to get to those higher-order levels and abilities.

Andrew Field: That's great thank you.

And you mentioned distractors there, just for the uninitiated, let's pretend that's me, distractors?

Simon Child: Yes, so in MCQ terminology, the 'distractors' are the options that a student can choose but are incorrect and the 'key' is the correct option. So, that's the terminology for you there.

Andrew Field: Alright, thank you.

And as I think we're going to mention a bit later, the challenge in writing such questions is having appropriate distractors, because if you can always guess the key there are of little use.

Simon Child: Yes, that's true.

Andrew Field: Okay.

The other thing I wanted to just sort of briefly mention was how, if you use multiple choice question in a different way. So, what we can do there, is actually put the learner, the student in charge of them and have the student as the teacher.

I remember when I was teaching, if I wrote a multiple-choice question or a quiz, I was particularly enthused and energized and I would encourage the whole class to be the same. But the moment you put that challenge onto the learners themselves, that changes the dynamic quite effectively and actually in itself becomes a teaching tool and looking at the complexity of writing a question, of exploring the distractors, the key. All of those things that in themselves become a really good learning activity.

And one of the areas I would like us to keep exploring is the power of multiple choice questions, not just on their own but what then happens, what you do after the questions. You can even have a discussion with learners about how challenging it is to actually produce such questions and it's not just really learning for what might be appearing in an exam. You're actually using these to really push the boundaries of what's possible, what they can explore further. So just another interesting thing to look at, in terms of how they can be used in the classroom.

So, exploring this a little bit further, we do need to consider when we're designing multiple choice questions, what are the important considerations? So, Simon, you were going to mention a bit about that and a lot of this comes from the training that the Cambridge Network do deliver and we will be sharing details of that afterwards, but in terms of designing multiple-choice questions and the best was to do these things, we're sort of exploring what those key considerations are. So that will appear seamlessly here in a moment as well.

Simon Child: Yes.

So, I just wanted to break down the idea that multiple-choice assessment and individual item writing can mostly take three broad stages and when you're taking part in the design of MCQs, I wanted to give you a few questions to consider and to help you in that particular process.

So, the first stage, planning, the first main consideration is to think about the purpose for your particular MCQ assessment. For example, is it planning to take place at the end of the lesson as a set a hinge questions or is it to do with the idea of misconception identification or do you have more summative reasons for using an MCQ. Related to that is the idea of how you use the outcomes, do you have a particular plan in mind for how you will use the information and the data that comes out of it?

The next stage of planning is the idea of what topics do you want to cover and also the final thing is when do you plan on using the assessment questions. So, all to do with timing, is it after a period of learning, is it before a period of learning. Or do you want to compare the before and after later on with different sets of MCQ questions. So, it's all about this idea of creating your plan and your blueprints for why your designing the particular assessment that your thinking of, or the specific items.

So, the next stage would be the actual writing of the question itself and this mostly forms into this set of stages. So, selecting the learning outcome or content to test, so that's related to the planning as a mentioned before. Setting the particular context, so this may be a particular scenario or an example that you're interested in.

A really useful thing to do as well is to write the stem and the key option, so the correct answer, as one true statement. So, if you line out a full sentence about the particular learning outcome or the knowledge that you want to get from that particular MCQ question. That's a really useful way

because that can help you at the next stage when you separate the stems, so the main sentence or the main body of the question, from the correct answer, to create your question and correct answer sections.

And then you devise the distractors, and as we say that's quite a complex and difficult process, potentially. So, the main thing to think of there is the plausibility of the distractors and making sure that they are roughly the same size and visually look the same and those kinds of things. So, there's lots of things consider there.

And then there's this idea of have someone try it out, now this could be students or it could be other teachers. So, just to give you that kind of feedback loop, so it gives you an indication of whether they're working well, whether there is anything that's not clear or accessible, and then going through the process of editing.

So, that's just a very broad overview of the key stages to help you going forward.

Andrew Field: Okay, thank you so much.

It's just really interesting to see everything behind these multiple-choice questions. They're not just computer generated and we press a button and there we go. There's so much more thinking behind these things.

In terms of actual practical application in the classroom and how a teacher can make really good use of these, I remember using multiple-choice questions as starters and plenaries. I would often build a quiz with an additional activity, sort of, if they get a question right they can score a goal in a game or something like that. And that was really good and a great way of enthusing learners and it built up a massive enthusiasm to then review when you got a question wrong, well why was that wrong. Or the whole class gets something wrong and can we explore that. At times that felt too low level but actually a good teacher can use such approaches to explore and say, 'well why did we get that wrong?'.

As Rachael was exploring earlier and as Simon's explained, it's about how the teacher uses these things and as part of a range of teaching techniques, they can be so powerful and I hope as we've seen so far here that multiple-choice questions are not just for low-level knowledge recall. An effective teacher can make really powerful use of them. I don't know whether you've got any further thoughts?

Rachael Horsmann: Certainly.

I think the fact of getting, like you said earlier, the students writing their own questions. I mean to write a question and devise some answers, you've got to really understand the subject and I think delve in deeply.

And that different uses of them you talked about as well, I've seen them being used and I used them in my own classroom, where each corner of a classroom has been given the answer and the students themselves physically move into the corner they think. And then you have a classroom debate, about 'well you're wrong' 'no you're right' and just standing back and hearing the conversations that come about, trying to convince the other people that they need to come. Because likewise, you say 'well if you all choose the right answer, you're all going to get a prize' or whatever the system is within that establishment.

There's so much richness that's available that is so unapparent when you just look at a question and I think that's really, really important.

Andrew Field: Great, thank you.

Simon, anymore thoughts or ideas about next steps for use in class?

Simon Child: Yes.

So, I think the idea of potential or richness potential of MCQs is something that its useful to emphasise because we think to ourselves that an MCQ sort of just leads to a certain outcome in terms of classroom interactions and so on.

Again, we normally associate that with quite limited things as a general rule again, a commonly held myth. Just the examples that Rachael gave there just shows that you can use the same MCQ question in a variety of different ways. So that scope and that potential is actually much broader than perhaps you would initially think.

Rachael Horsmann: There was one other thing that I think we haven't mentioned as well, and that is the professional development actually of writing these.

You know, collaborating with your colleagues in school, sitting down and looking at a topic and deciding. All the planning you talked about, and actually you know particularly the hinge questions for me, identifying what is that crux of this? What is that gatekeeper concept that I need to know that students understand, for me to be able to move on in my teaching? How do I design those distractors? Am I trying to probe misconceptions, well what are the misconceptions? Looking back at students' books to help you decide what those misconceptions are going to be. Or research as it stands, you know typical misconceptions in a particular area.

Andrew Field: And that links really nicely to a thing we were sort of covering earlier.

So, I'll put this slide back on, one we didn't see earlier, about rich data. I believe this was Project Quantum, Simon, you were involved in this. Is there a couple of things you could mention there?

Simon Child: Yes, so Project Quantum, just for people who may not have come across it, is the idea of using crowd sourced multiple-choice questions in a particular context. In this sense, its computer science related questions.

So, the idea is that any teacher around the world can submit their questions to the project and they are taken by students around the world and the data comes through about the quality of those particular questions. And then they can be reviewed and analysed. So, the idea is to create a huge item bank with really useful questions in computer science. So, the data that you can get from it is really incredibly rich. So, you can get information about the percentage of students that have chosen particular options. This is just an example here related to code, a couple of screenshots.

But another thing that is built into this particular project and maybe something for you to explore in your own context, is the idea of students giving an explanation behind why they have selected a particular response. And that can give you useful information, not just for the people who have

got the question incorrect but also for those who have got it correct, because they may be arriving at the correct answer for the wrong reasons. So, there could be misconceptions being shown there that you wouldn't necessarily have got without that qualitative information.

So, it can just be that extra source of data that can be incredibly useful for informing the next teaching steps.

Andrew Field: Okay thank you so much.

The final thing we're going to look at here, is really just focusing on sort of five top tips that we feel emerge from here.

Thank you both so much for all your ideas and suggestions, it's such a huge amount of things to explore.

For me, it's about using these as part of your teaching toolkit, your range of things that you have. So, once you've done the quiz, once you've discussed it, what then happens? What's next? Do the learners have a further quiz for them to create, does that lead onto the next activity? Do half the learners get the use a different approach? How do we make really effective use of these? So actually, start those formative questions.

I think as well Simon, it's about the strategy as well?

Simon Child: Yes, and so I mentioned the idea before of getting people to review items that have been or assessments that have been developed in the past and developing a strategy around that.

So, for example, you may want to develop a checklist based approach. A resource that you can give to people around your particular context, school context, to help people review the quality of the multiple-choice questions.

There's also a lot of useful statistical data that you could collect about how the multiple-choice questions have worked, which are quite easily calculated on spreadsheets and so on. They give you some really useful information about how difficult the MCQs were for students and how well it discriminated between the better students and the ones that didn't perform so well.

So, there's a lot of useful information around that and developing a strategy to pick up on issues and the positive elements of how they've worked is something that I would definitely recommend.

Andrew Field: Okay, and our third one there is to mention student ownership.

We've mentioned this many times during this presentation, it's just about, it's not just enthusiasm to have a quick quiz because it's fun, we're actually using these for deep learning, exploring next steps, where things can go. So that's sort of my third one there and that leads nicely onto the fourth one Rachael.

Rachael Horsmann: Yeah and that, I think it's this effective use. Why are you using a multiple-choice question?

I talked about earlier, is it at the beginning of a series of lessons just to get a snapshot of where students are? Is it to compare that to the end? Is it to really probe at these misconceptions and

what are you going to do once you've got that? Are you going to discuss those? Or is it this kind of idea of a hinge question, of a gate keeper, of right my class is ready to move onto the next concept which builds on this one.

So, it's really thinking about the purpose of you using them and I think that helps you in the design of them as well.

Andrew Field: And then Simon?

Simon Child: Yes, building on that point really.

So, in having those discussions, you'll probably have a sense across different teachers in your school or departments. You may have a sense of, okay I've got a roadmap for how I want to use particular MCQ questions at different times, for different reasons. So, this idea about utilising the wisdom of the practitioners that are around you and some cases even the students as well, when looking at how developing and critiquing multiple-choice questions and how well they've worked. We mentioned before about the idea of crowd-sourced assessments.

So, one thing you may want to consider is building an item bank across your school of questions that have really worked well. That's something that can be done.

But also, the building of the network and the community of practice around the use of multiple-choice questions. The professional development experience that that can foster, traditionally are really quite powerful. That cross-pollination if you like of expertise and understanding, in relation to MCQ design is really quite, really useful professional development.

Andrew Field: Okay and just to say thank you so much, both of you for your time today.

We will follow this presentation with many more links and suggestions about further opportunities from all organisations part of Cambridge Assessment. So, thank you very much for your time. Thanks.

Simon Child: Thank you.