Scott Adamson - Can I cover all course content *AND* promote active learning?

Video transcript

Active learning, technology, assessment initiatives, and the list goes on and on and on. Do you ever ask yourself, “how am I going to find the time to cover all the content that I need to cover in my course?”

Well, my name is Scott Adamson and I'm math faculty at Chandler-Gilbert Community College in the Phoenix, Arizona area. I've been in math education for 33 years...going on 33 years, the last 23 now at Chandler-Gilbert. And if there's one thing I know about teaching and learning is that it's complex. It's a very complex endeavor because it involves human beings and their brains. But if there is the one thing I've learned about it in with the last 33 years is this: our students more than ever need to be actively engaged. It's necessary that for them to be engaged in their learning and thinking and reasoning and problem-solving. But that does lead to the question - when we engage our students, how do we find the time to cover the content for our courses. Well, we’re going to talk about that here today. And I'm going to just tell you right up front that there is no easy answer. This is a challenging question. I can't just give you the three tips so you can cover all your content. It's deeper than that. But I hope this video gives you something to think about.

Before we get into the details of answering that question or at least providing some thoughtful considerations about the question, let’s just spend a brief moment on active learning. At least from my perspective, what are we talking about? Well, I’m going to draw from the MAA and their Instructional Practices Guide, first of all, where we read this:

Effective teaching and deep learning require student engagement with content both inside and outside the classroom.

Deep learning...student engagement...

We must gather the courage to venture down the path of uncertainty and try new evidence-based strategies that actively engage students in the learning experience.

But also...the Conference Board on the Mathematical Sciences has a position statement or a report on active learning in post-secondary mathematics education. And they say...or they…

....call on institutions of higher education, mathematics departments and mathematics faculty, public policy makers, and funding agencies to invest time and resources to ensure that effective active learning is incorporated into post-secondary mathematics classrooms.

So on the one hand, how do we cover all the material if we’re doing active learning? On the other hand, we should be doing active learning!

Something that I've been very involved in recently it's called the Thinking Classroom. Peter Liljedahl has some research on building a thinking classroom. I'm a big proponent of it and one of the big takeaways from Liljedahl's work is this idea of the vertical non-permanent surface. Let that soak in for a minute...vertical...non-permanent surface. It's important that students are vertical. Yea, we could have them sitting at a desk with surfaces, permanent or not... but to have them up at a board with a vertical non-permanent surfaces matter in his research.

So you might say, "just call it a white board." But whiteboards can be horizontal, too. So it's important for us to acknowledge the vertical-ness of the non-permanent surface. So if you were to ask me in my classroom on a day-to-day basis - I would say 50 to 75% of my teaching time...students are at the board. Now I'm not just watching doing nothing...I'm very busy. I'm actively engaged in listening to students, responding to their thinking. My lessons move according to the thinking of the student as they work on the vertical non-permanent surfaces.

Here's what it looks like. This is a calculus 3 class at one point in time. You see many of them at vertical non-permanent surfaces but then you see some at horizontal non-permanent surfaces...because sometimes our learning spaces are just what they are and we have to do our best.

But this is what it looks like...students actively engaged in thinking, reasoning, problem-solving, modeling...making sense of the mathematics for themselves...not just watching how well I've made sense of the mathematics. They're involved in discussion and collaboration. They share with one another and explain their own thinking to one another.

But I know it leads to the question...how can you cover all the topics when students are engaged in these kinds of activities and projects and discussions?

And then people always ask me, doesn't it take longer to cover the material when students are engaged? And, I have the answers to these questions.

How can I cover all the topics? I probably don't. Doesn't it take longer? Yes.

There you go! There's the answers to the questions!

Now...but really...you're going to say...wait a minute...that's it? Just don't cover the content? Just take longer? That's the answer to the question? Let's talk about this some more. I have some questions that I would like to ask...when I'm asked those questions...how do you cover all the content? Doesn't it take longer? Yes!

But I have some questions to return. What are your learning goals for any class that you teach? I'm talking about learning goals...not teaching goals... because I've seen some teachers have teaching goals...and the teaching goal is to cover all the chapters in the book. But what are your learning goals for your students. Here's mine.

The Common Core Standards in K-12 have these math practices...they're called... these are standards for mathematics educators in K-12 that we hope students have the opportunity to develop.

Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Construct viable arguments and critique the reasoning of others.

Remember, this is what students are to be doing in the classroom.

Model with mathematics - apply to real world phenomena.
Use appropriate tools.
We want our students to attend to precision.
Look for and make use of structure.
Look for and express regularity in repeated reasoning.

So, I do have some real answers. And one of the real answers about this question is this: I think we need to choose to engage in difficult conversations. How are we going to cover all the material...if we believe MAA and CBMS and this push for active learning that it's better for our students...then let's engage in difficult conversations about how we're going to do that.

The MAA IP Guide specifically says,

We must gather the courage to advocate beyond our own classroom for students-centered instructional strategies that promote equitable access to mathematics for all students. We stand at a crossroads, and we must choose the path of transformation...we must choose the path of transformation...in order to fulfill our professional responsibility to our students. The IP Guide can serve as a catalyst for community-wide transformation toward improved learning experiences and equitable access to mathematics for all students. Society deserves nothing less.

So...a difficult conversation...does everything require the same amount of attention? Like, do we have to cover all the content equally? Do students need to spend hours and hours plugging numbers into the quadratic formula? Or do they need to know what it means to solve a quadratic and what the solutions represent?

We might consider updating our course competencies so that they are not just a long list...a laundry list of things to do. Are some competencies antiquated? Are we preparing our students for 2020? Or are we preparing for them for 1957? We might consider updating our common final exams to focus on the assessment and the development of the math practices...remember those 8 math practices from the Common Core. So if you're saying, "I would like to deal with that competency less or do that one differently…but it's on the common final." Well, let's have the difficult conversation about our common finals and see what they're assessing.

Are we assessing student's ability to compute when an inexpensive device will do the computation much faster and more accurately? Or are we assessing our student's ability to make sense, to make viable arguments, to model with mathematics, etc.?

And then finally, consider how meaningful tasks in an active learning environment can address many course competencies at once. What makes a task meaningful? And you know...these days...the internet has so many resources that we can find good, quality, rigorous tasks that are engaging for our students. We should take advantage of them. I'm going to share with you one now.

Music with Mater the Greater video - 9:21 - 9:38

What you just experienced is what we're going to call Act 1 of a challenging, active task for students. They watch the clip...maybe it's a photo...maybe it's just a situation that is posed...but in this case, the video clip is played and right away students wonder, "did he make it?" And now students can engage in the problem-solving, the modeling, the thinking required to find out under what situation does he make it or not. We don't tell them everything they need...we wait for students to ask...what information do you need in order to solve this problem?

Then we move into Act 2...and Act 2 is where we take what we know and try to answer the question at hand. We agree upon the question: does he make it or not? Does Lightening McQueen survive?

And one of the things we might want to find out is: what are the distances here?

So...I looked it up...a sedan is typically 184 inches long and in this picture...that little blip that is Lightening McQueen measures point zero, seven, nine (0.079) inches. The distance across the canyon...at least from ramp to ramp...is eleven inches. So, proportionally, it's 25,620 inches...a couple thousand feet... about four-tenths of a mile.

Now students can apply what they know about quadratics...and the path this is taking could probably can be considered quadratic and we can see what's going on here. I'll share with you all the Desmos stuff in a minute but...I just want you to see how students might engage.

So they're using Desmos, they're making Desmos...if I could say it this way...they're coding Desmos to produce a model of Lightning McQueen blasting off across Carburetor Canyon. And in doing so we might have to make decisions: like notice I put the origin right at the launching off place. And then I might want to think about the vertex of this parabola. I might want to think about the zeros...the horizontal intercepts...there would be one there on the left...the one on the right would be zero, zero which is convenient. But we might have adjust that zero and we would see under what situation does he make it and does he not make it. Now in this modeling process, as you'll see later, we could be using the quadratic in intercept...no...in factored form,

in vertex form, in standard form...so we're addressing a lot of course competencies all in one task.

So here's the behind the scenes of Desmos...lots of ways I can now engage in this process. But then here's the question I would really start to push at:

Which quadratic form did you choose and why?
I would have...maybe have students convert from one to the other...and what's the advantage of the different forms of the quadratic...standard, factored, vertex form?
What was that advantage of placing in the origin at the ramp...I would let that happen or not happen...maybe a student across the room does it and another student doesn't and we do some sharing and students start to see the advantage of that.
And then when is there a successful jump and when is there not?

If we go with the standard form than maybe I'd ask the question: what do the input quantities and output quantities represent? Notice in this case...it's not a height versus time like we traditionally do...it's actually a horizontal distance...vertical distance kind of a situation.

Act 3 is this: we don't just look in the back of the book and see what happens. We watch the clip and see.

Mater the Greater video clip:

McQueen: What happened?
Mater: You didn't make it...well, see ya later…c'mon guys, let's go!

I hope you found this video helpful. I know it's not going to just answer your questions…the three simple ways that you can cover all your content and all your students are successful. It's not what this is about. This is about having the difficult conversations...to transform our programs, transform our classrooms, transform maybe our teaching and learning to be more active for our students so that our students can learn. Also, when students are engaged in problems like I shared with you today, their attitude about mathematics increases, their ability to think and reason increases. Now, I'm just telling you this from my experiences. It's not a perfect thing in the world because we're still dealing with humans and their brains. But it does present the opportunity for students to engage in mathematical thinking and reasoning and learn to appreciate and maybe even love mathematics.