# Transcript

## Professor Eric Mazur, Dr. Claire Brown, and Gail Bray, discuss what it means to advance the quality and status of teaching.

Duration: 36:33 minutes

The views expressed here are those of the individuals involved, and do not necessarily represent the views of the Victorian Department of Education.

**CLAIRE BROWN:**

Eric, welcome back to Australia. First time after the pandemic had locked us all down. Welcome back.

**ERIC MAZUR:**

Thank you for having me.

**CLAIRE BROWN:**

And tell us what brings you back this time? You've been engaged by the Victorian Academy of Teaching and Leadership to talk about advancing the quality and status of teaching, why does that matter to you?

**ERIC MAZUR:**

Well, I'm an educator first of all, I've taught for let's see close to 40 years and during those 40 years I've been very interested in working hard on improving learning.

**CLAIRE BROWN:**

Yes, you have, and I've heard you say, 'learning is learning is learning' so even though you're teaching at Harvard and teaching first year foundation physics, why do you say, 'learning is learning is learning'?

**ERIC MAZUR:**

The way the human brain is wired, it's set by millions of years of evolution, and I think that no matter at what level you look the basic principles of learning are the same whether it's young children or middle school students or adults later in life. We need to satisfy that intrinsic curiosity of human nature.

**CLAIRE BROWN:**

So, you're doing a session for some of our teachers around questioning and I think that you believe that asking good questions is foundational to engaged learning experiences. Can you talk a little bit more about that?

**ERIC MAZUR:**

Yeah, I think historically the main vehicle for teaching has been teaching by telling, the lecturer. And when I started teaching many years ago, many decades ago, I essentially lectured because that's the only thing I knew about education, my own experience as a student and I sort of projected that experience onto my students only to discover that in spite of my high ratings as a lecturer, my students weren't really learning what I wanted them to learn. And in retrospect, you know I should have known all along. First of all, you know over 2000 years ago Socrates already said we should teach by questioning rather than by telling and here I was in the 20th century, because it was in the 20th century now the 21st, that I started teaching, here I was essentially reading the textbook to my students and it took quite a few number of years to discover that that was not very effective and that made me switch to a more active form of engagement and to essentially design questions that sort of probed my students at a level that was very different from the one that otherwise would happen.

**CLAIRE BROWN:**

Now I hear that you don't even have a classroom anymore. What are you doing?

**ERIC MAZUR:**

No. In the last 10 years, I've I think dramatically changed my approach to education. I switched to more active forms of engagement and the flipped classroom, which sort of originated in my classroom 30 years ago. But then 10 years ago, I realised that what I'd done was really nothing more than sort of putting a band-aid over a broken system and you know I'm teaching physics to students who would do everything to avoid the subject. They're either pre-medical students who want to go into medical school and who have to take physics because it's a requirement or they're engineering students who cannot even begin their engineering studies before they've completed an introductory physics course. So, it's seen as a requirement and the students enter this course with very little intrinsic desire to learn physics because essentially, they've had a very poor experience in high school with science courses where a lot of focus was on road memorisation.

And even though I try to sort of promote a more intrinsic desire to learn in my courses by telling them 'Look learning physics teaches you a lot of skills that are going to be valuable in your future career', I realise that's a little bit like your mother telling you eat spinach because it's good for you. Right, I mean you sort of reluctantly agree to eating that spinach, we don't really want to eat spinach. So, in a sense, I was shoving down my textbook down the throats of my students.

So, I decided then, you know what I'm just going to put the content of the course aside and I'm going to centre my course on projects, and I try to add a component of social good or empathy to my projects. And initially maybe the project doesn't even have that much obvious connection to physics and once the students are really excited and the empathy or social good really helps with that, once they're really excited about the project, I tell them 'Here. You may want to have a look at this book'. The textbook from before, you know because it may help you with your project. So, in a sense the content of the course, instead of being some kind of an abstract goal in the minds of the students, becomes a way for the students to accomplish something that is much more meaningful in their brain.

So that's one aspect. The second aspect is that I decided to pivot from the standard individual based approach to a team-based approach. And in retrospect, I can't believe that it took me so long to make that step, right.

Education throughout, you know essentially from an early age to college is focused on the individual. Students come to class and yes, they're sitting there with others, but they're focused on the instructor in front of the class and then they go home, and they work on their assignments. Mostly alone, sometimes together but mostly alone because they're going to be evaluated individually. And then at the end of the semester or whenever they go to a big hall where they're separated from any other living human being and any of our modern communication devices and they are sort of "tested" quote unquote on their individual skills. And at the end of education, we send students into the workplace, and we discover that people can get along with each other because we've never taught them how to work with others and how to embrace diversity and how to maximise creativity by making use of you know many diverse talents.

So, I think that as educators we have sort of a moral obligation, to you know teach people how to work together and that's one of my goals now, one of the four main goals in my course, is to develop collaboration skills in a very diverse team. I purposely diversify the teams of students and mix them up after each project. We can talk about the other goals later if you want.

And then the third thing, the third change that I made which was prompted in part by the pandemic and the need to teach remotely during one full year or a year and a half, and that is that I all of a sudden start to see the classroom as an incredible constraint on education, I mean the physical classroom. I changed my classroom from auditorium to a flat flexible space but in a sense, I was still the instructor, and I could only teach when the classroom was available.

One of the things that remote teaching taught me was that the availability of a physical classroom all of a sudden became irrelevant. I didn't have to book a specific classroom to teach my course. Teams or Zooms or wherever you teach is always available and I also realised rather than having the students come to my classroom, what I should really do is have the students form their own virtual space to learn in and then I visit them when they need me.

Of course, we were sent back to the physical classroom once that was possible again, but I decided to sort of ask myself, well in what respect is it really essential that I have a classroom, other than that there has to be a physical space for the students to get together.

And so if you were to walk into my course now, you'd see that the students are spread out over a building in lots of different spaces, do work on different activities at different time, some are in the maker space, other are in the active learning lab, others are in a skill session in a flexible classroom and others are working on curricular matters in a force learning space. Also, and this was, I'm kind of excited by this although it's really not that incredibly important, you know initially I would have the students come to one of these spaces and I would make some announcement and only after those announcements are made with the class start.

This year I said to myself, you know why would the student have to wait for me to tell them when to start working. When I go to my office, I don't have to wait till the president of the University says, 'Okay you may now begin working'. I begin working whenever you know the people, I want to work with are there. So, I said you know what, I'm going to tell my students look the class is available between this time and that time and you just have to do your work between those. You start whenever your team is complete. If your team, some of your team members come late, you know it's none of my business, you figure it out with them. Which sort of creates a social, you know responsibility for the learning, and you start whenever you start, and you end whenever you're done.

So now when my class starts and visitors to my class are really surprised about it, I just sit at the table and the students filter in, you know not all exactly at the same time, but some will come and start working 10 minutes early, that never happened before. 100% of the students or close to 100% of the students attend also something that does not happen typically in an introductory science class and the whole process is much more relaxed and focused in a sense, than I've ever seen before. So yeah, so that's a big shift.

But here's the key point, I think the key point is that I really think that effective learning spaces should be designed to look like the future workplace of the students. Not like an amphitheatre. Amphitheatres were developed for performances. Many instructors are not so great performers trying to hold the attention of students and you know learning is not a spectator sport. You have to, you have to work. It's the learner who has to do the hard work and the role of the teacher is really to be the coach, the guide on the side so to speak, rather than the sage on the stage.

**CLAIRE BROWN:**

So, you've just been to this beautiful technology school, what do you think about when you see this is the learning space?

**ERIC MAZUR:**

I love it. I absolutely love it and it's giving me a lot of food for thought. I think that it will be great if we could design all learning spaces like this. Do away with the walls of the physical classroom, in a sense have a much more fluid environment just like we have a much more fluid environment in the workspace, so I'm excited.

**CLAIRE BROWN:**

And Gail, I'd like to invite you to talk about what have you seen as being transformative about the learning experience for both students and the teachers who come through this space?

**GAIL BRAY:**

Yeah, oh look there's so many things and I think the first one is really going back to 2020 when COVID hit and we're such a practical hands-on learning environment and to try and move those programs into the remote and still keep our young people engaged. The interesting thing that happened was 67% of teachers use technology for the first time because they were using virtual classrooms. So, the upskilling of digital literacy for our teaching community was something that was interesting to observe.

Keeping young people engaged as you were saying in that environment became the biggest challenge. So, it was about our teachers thinking not so much and you know an hour session but actually we were dropping them down to 30 minutes but interactive 30-minute sessions. So, there's no lecturing, no talking to the students. We had to really look at tools like Menti for example to get those polls happening. We had to look at software that allowed the students to create, so our game development program became one of our most popular and we would have young people actually coming to the after-school program to actually be involved in some of the challenges around game design and game development that we were doing. So, making it more about the challenges versus you know making them sort of sit and listen.

So, a lot of what we did in COVID was quite interesting but what that allowed us to do was to redesign a lot of our spaces here at the tech school and as you're saying Eric, that you know the physical space and really making sure that we stayed true to what is happening out there in industry. And the feedback that we've had from students and when you watch them when they came back on site and they were able to physically engage, it's just the laughter. The laughter that you hear when young people are in the space is something that will be my legacy I think when I think back about memories of Wyndham Tech School.

When they see the Esports Arena and just can't wait to get in there because of the project-based approach that we have here and the hands-on practical approach that we have here, the students are engaged. You know you've seen the equipment in this space, and we've had no damage. The students are so engaged in what they're learning when they're here, we don't have to worry about discipline because they're having fun and we can have up to 100 students in here doing that.

So, watching what we did in remote, taking lessons from there. Watching what we're now doing physically has really to your point about spinach, what we do I talk about hiding the vegetables. So, because when the young students come in here and I suppose that Esports and game development's a good example, there's a lot of coding that goes on and a lot of young people when you say, 'Do you want to do coding?' will say 'I'm no good at coding or programming. I don't want to do it'. But they're doing it in environments like in Unreal Engine or they're doing it through cyber security or doing it through other platforms, they don't know that they're coding, and they walk out creating something that they're really really proud of.

So, there's lots of what you're saying Eric around the work that you're doing in the university space, you know that's taken time to evolve. I think what we're doing here now through Wyndham Tech School is actually creating a model that our partner schools can actually take back and implement through coaching. So yeah, there's lots of, I think education is becoming really exciting and I think as our teachers understand what's possible and really challenge what they've been taught at university and really challenge what's happening in their own school. And a lot of it's just intuition, just go with your gut. If young people are sitting there bored and not engaging and not turning up to school, there's a reason for that and how does Wyndham Tech School play a role in that.

**ERIC MAZUR:**

So out of curiosity for me, have you retained anything from the remote setting, or have you discovered any things you can do quite effectively in a remote setting that will be good to continue to just broaden the reach of your program? Or has it all gone back to in person?

**GAIL BRAY:**

For a lot of it because of the mental health and well-being that our schools and principals clearly communicated, all they've wanted is the young people to get back to school physically. Just get them anything that we could do to help them because a lot of that mental health that happened was a lot of young people didn't want to come back to school post-COVID. So, our mandate really, what we've been able to provide our schools is the practical. So, we're really focused on that practical engaging but in saying that we've set up a remote model. And the remote model is to our schools that can't get physical access to Wyndham Tech School.

So, a lot of the learnings through COVID we've taken into that model and what we've found to work, is not to teach the students. So, what we're doing is, we're teaching the teachers a lot of our programs like cyber security for example or our robotics.

and our I think our game design and development is really popular, our Esports entrepreneurship program. So, we're teaching the teachers that remotely and then they are actually teaching that to the students physically because there was a lot of post-traumatic stress for young people having to be online to learn. It just wasn't something that was proven to be of benefit to them. So, we flipped that in a way where we thought well, we'll train the trainer, we'll train the teachers in how to deliver our programs which are very different to how they teach, and we remain as their coach. But nothing significant in teaching year seven to twelves.

**ERIC MAZUR:**

I'm thinking for example, suppose that a student really gets into one of your projects here, after being here physically. There might be a way of continuing the engagement beyond their, you know limited visit here. Right let's say they get into coding.

**GAIL BRAY:**

Yep

**ERIC MAZUR:**

They could, for the coding they don't need to particularly be here. They could do that remotely too and they would maintain a connection to your centre. So that's, I was thinking along those lines. The benefit of both an in-person visit, and you know continued engagement through some kind of online activity. I wouldn't require the student to travel back here.

**GAIL BRAY:**

Yep, okay yeah, I think that connection remains with what we call our partner school. So, we have 43, I think we mentioned partner schools that actually access our services. So that connection remains with the school, so they might do let's say cyber security and they spend three days or five days with us. We then through virtual communication would have that partnership with the teachers back at the home school so we can continue to coach them, they can continue to stay connected to us because the major challenge that our schools have is keeping up with the world of work and all the changes that are happening in the STEM space.

So, we will definitely stay connected to the schools. The students are connected to their school, and we act as that connection to the partner school. So, the model hasn't been set up to enable us to have direct access to students. But when you get to pathways, you start talking now about what's happening in the polytechnic, in VET - Vocational Education and Training and higher ed, that definitely is occurring. Where you will have that flipped classroom model, where the knowledge is delivered you know virtually but the actual practical hands-on and what you were talking about before with your students, where they come in and they're excited and they're coming 10 minutes early because when they're coming on campus there's value for them.

**ERIC MAZUR:**

Right

**GAIL BRAY:**

And that's why they're coming on campus, and I think that's what we deliver through our polytechnic and our higher ed. So, Wyndham Tech School is a bit of an enigma in the model because we don't actually enrol students if that makes sense.

**ERIC MAZUR:**

Right

**GAIL BRAY:**

Yeah, we partner with the schools.

**CLAIRE BROWN:**

Something that both of you do pretty uniquely is around assessment and I'm going to kind of take this into two different places for each of you. Eric, you never assess your students work as I understand it. You set up projects that have an external assessment aspect to them. So, I'll get you to talk about that, in a sense it's slightly applied learning for the audience that the project has been targeted for and equally your work Gail here with industry partners, local industry partners. That's a form of assessment that's real life so I'd like each of you to talk about that take on assessment that you both have.

**ERIC MAZUR:**

Yeah so, I do assess. I do evaluate my students; I mean I have to but for the projects I discovered right in the very first year that I was teaching this course that I sort of had an internal conflict. My role as an educator is really to lift up my students as high as possible. I essentially want my students to stand on my shoulders and to solve the problems that I cannot solve so I'm really their coach during most of the learning process. And then when I started doing project-based learning, my first attempt at it, you know I was the one judging my students project and I discovered an incredible discomfort because I knew how hard these students had worked on the project. I wanted to give them all the highest possible grade. I found it difficult to even differentiate between different teams’ project and that sort of highlighted something that I never realised before and it is that as educators were often put into sort of you know Jekyll and Hyde role. And on one side we're the coach trying to elevate our students as high as possible but on the other hand we're the judge too and that's really you know, a very uncomfortable position to be especially when you're more on the creative end of the you know, cognitive skills.

And one that would not be accepted in any other you know part of society right, I mean if you're coaching a figure skater and you go to the Olympics, you don't say 'Do your best, you know I'm going to judge you now', that would be totally unacceptable. But for some odd reason educators are supposed to be doing both the teaching and evaluation which I think is impossible.

The way we get away with it is essentially by limiting our assessment mostly to lower order thinking skills which can be judged objectively, right but we really want to get to higher level thinking skills and more towards the creative end of the spectrum and there you know, I think the objectivity becomes less and therefore there's that discomfort. So I've solved that problem by simply stepping back from the evaluation and bringing in others to do the evaluation who don't have a relationship with my students.

For example, let's talk about something that took place the night before I boarded the plane here for Australia. I had a fair for the first project in my course, the students had to design a magic trick that used static electricity. The first part of the course for middle schoolers. Well since it is a magic trick for middle schoolers, who are better judges than middle schoolers themselves, so at the fair we brought in middle schoolers to evaluate the students and you know I can be there with the students to remain their coach rather than all of a sudden becoming the judge.

At other instances, I may bring in the engineering students, sorry the engineering professors, who the students have in other courses to evaluate the project. So those are some of the examples but yeah, I've tried to sort of resolve that coach/judge conflict that we often have as educators by bringing in other evaluators.

**CLAIRE BROWN:**

And then in a similar vein, your kind of assessment piece of how well students do the tasks in this space, are sometimes in partnership with industry, solving real life problems. Do you want to talk about that?

**GAIL BRAY:**

Yeah, so the assessment or we don't assess but I guess what we do through our project-based learning, is the students were given a task and a problem to solve and they have a certain amount of time to come up with a solution. We already know the answer, so for example with one of our robotic programs we had to fill the syringes for the COVID vaccination centre. So my team actually problem solved it and knew what the answer was and then we give that to our students and they have to go through that journey and come up with an answer.

So there's a standard that's set from every project with our partnership with Velisha Farms, the students have to look at a production line, come up with improvements and then pitch their improvements back to the business and when Catherine Velisha, the CEO came out and she actually was listening to all the pitches or you know the solutions, she actually said to the students that what they came up with was the same standard as what she'd paid thousands of dollars to consultants to come up with those same solutions. So you know our young people are actually you know, delivering standards of work that employers you know, would say are some of the best that they've seen.

And our students don't get any pressure from being assessed, there is no pressure. There is no you're going to be assessed now. It's challenges like they may have some competitions and some challenges. What we're looking at is teamwork, we're looking at the diversity in their thinking, we're teaching them the value of listening from each other. We put timings, like they've got to finish certain tasks by a certain time and through that interaction that they have that's a form of, we're basically are assessing them through the whole thing because it's about what they produce and in a lot of classrooms today students can sit there for, you know an hour or two and produce nothing. You know but they're sitting, and they're being learnt, taught but they actually don't produce anything. Whereas here through Wyndham Tech School, there's a start, there's a middle, there's an end and there's a presentation at the end that they have to do back to the class. So yeah, it's an interesting spin on assessment I think with what's happening in universities and what's happening here at the tech school.

**ERIC MAZUR:**

I think also that the lack of high stakes assessment in your environment is excellent because that frees the students to take risks and to be more creative. It removes the stigma out of failing and you know there can be no creativity without failure so that's great. I wish I had the same degree of freedom at my own school. I still have to hand in a grade at the end of the semester, and I think that you know grades are a huge disservice to creativity so that constrains a little bit what I do but I try as much as possible to have a narrative evaluation to focus on feedback rather than on scoring.

**GAIL BRAY:**

And I think the world of education has to change. Like you think education came from churches, that's where education started out and that production line of learning that still occurs in primary, secondary you know and even in universities. I think what we're doing, with what you're doing and similar to what we're doing here at the tech school, it's about challenging what's been done for years because of the speed of change. Like never before have we seen the speed of change that we're experiencing now. You know ChatGPT has come up as an example of a massive change in how we aggregate information and potentially solve problems through machine learning, and I just think we have to change what we're doing otherwise we're not going to be to provide the economy with the workforce that they need to grow and to be sustainable into the future. So yeah, I don't know where you sit with that Eric but it's really about the need for that change to start to happen in education faster than what it's happening right now.

**CLAIRE BROWN:**

So I have one last question for both of you. If I could give you a magic wand and you could change something about education, what would it be?

**ERIC MAZUR:**

Give me that magic wand. Well, I think the last subject that we discussed, assessment, is a key barrier to improving education and I think that unless we collectively start to rethink how we assess students, it's going to be very difficult to implement lasting, to have a lasting change on education. I mean, we know that most employers, if not all employers don't hire anybody by just looking at a transcript from a school or university. You interview people because you know that the transcript doesn't really tell the story and doesn't really tell you what you really need to know about your future employees. And I think that most educators know that you know grades and scores don't do justice to an individual. I mean how can you take the complexity of a human individual and fold it into a set of simple numerical or alphabetical symbols.

So, I don't know, and you know grades have not been used for a very long time in education. I think it's probably about 150 years that universities and schools have started to rank people. So, I think it's time now to start rethinking that and to ask ourselves how can we have a more meaningful evaluation of our students that doesn't consist of high-stakes testing that as I said before stigmatises failure, makes students risk averse and essentially you know kills creativity in the bud. So, I think we need to rethink assessment. That would be the place where I most need the magic wand because it's impossible. I've tried it at my own institution, and I can get people very excited about this subject but in the end, nothing changes because you know students, employers, parents they all want that transcript. So, send me that magic wand.

**CLAIRE BROWN:**

And Gail, your magic wand?

**GAIL BRAY:**

Yeah I would bring industry closer to education. I just think with the speed of change as I've said, if we can bring industry closer, help with co-creation, look at that more in-depth project-based learning, link to job outcomes and also less focus on the curriculum and more focus on the skills required for work. And sometimes the curriculum is just so full it's really hard for teachers to really engage with young people in a way that they can learn effectively in their classroom. So yeah, I'd bring industry closer to education.

**CLAIRE BROWN:**

And very last question, Eric you made reference before about the guiding principles that underpin your first-year foundation physics course now and you said you would come back to them. So, do you want to just summarise what those principles, guiding principles are that you have?

**ERIC MAZUR:**

Project-based learning. Team-based learning. Assessment is there too; I didn't say that in the beginning, but I try to change the assessment by having it in four different or I think that's what you were referring to. I essentially, I used to basically only assess content knowledge. Now that's only about a quarter of the overall assessment. The first one is Self-directed learning, to what extent can a student control and take responsibility for their own learning. Two, collaborative teamwork. Three, content learning and four, professionalism which involves ethics and engagement and so on.

So, my evaluation is much more diverse in a sense than it used to be and now you can understand why I'm so reluctant to end with a single grade because I have to fold the assessment in those four different dimensions into something that really becomes nearly meaningless. So, assessment and then the last one is sort of redesigning the learning space of which we see here. A beautiful example.

**CLAIRE BROWN:**

Brilliant. Thank you both very much.

**GAIL BRAY:**

Thanks Claire.

**ERIC MAZUR:**

Thank you for having us.