10. Using Wolfram SystemModeler
in school-based assessment for
VCE Systems Engineering

This video provides an overview of how *Wolfram SystemModeler* can be used to respond to a design brief for the creation of an integrated controlled system to meet an identified problem, need, opportunity or situation. The video specifically provides ideas for ways to research, devise, design and model design options, as well as offer ways to run diagnostic test procedures and interpret data as part of school-based assessment.

[Transcript

**Colin:** [00:00:20] So Christopher would like a better study design is that we genuinely reward students for things going wrong. Right. And this is realistic because engineering is like this. We often get things wrong more often than we get things right. And the important thing is that we learn from these things and our study design allows students to develop an intention. And it's from this intention we can really measure achievement. So we've got criteria that measures their achievement along the way. And the students can collect any evidence they like into a portfolio, which we now call a record of achievement. And part of the developing an intention starts off with criteria one, doesn't it?

**Chris:** [00:00:58] It certainly does, yeah, Colin. So criteria one, the students have to think about opportunities, needs, situations, that they can go and explore. And within that, obviously your demonstration, whith the Arduino there, shows how they can use Wolfram and Arduino, to basically show how an integrated system can work. So yeah. Colin, you used an LDR and an LED as an output, but obviously we can start using relay so we can control a mechanical system as well as an electronics system with that. And again, if the students can model it, that's fantastic and allows them to explore those options and that interconnection between the electronics and the mechanical systems.

**Colin:** [00:01:41] And how good is it that they get a visual representation of exactly what's going on. So in our experiment, we set up a voltage divider network and we had an output. And as you say the LED was there as a proxy because that could be a relay. It could be any sort of other device which drives a load. So you can drive a mechanical load and the students can annotate the output from Mathematica into their portfolio to show this particular input is causing this particular output. There is almost no better way to show it. And if they integrate that with some video of the experiment, they've ticked that box. haven't they.

**Chris:** [00:02:16] Superb from that point of view. I mean, they do have that visual representation. And as Colin, you said there, you know, they can do an e-portfolio where there is a video and it shows exactly what they're trying to achieve.

**Colin:** [00:02:27] What about criteria two?

**Chris:** [00:02:28] Criteria two is a really interesting one. I find that when my students are working on their records of work, they tend to get bogged down in thinking of everything as one big system. Here with Wolfram, and also Arduino integrated into that, they are able to pick apart the whole system into individual parts and they can store modelling everything. Obviously it's gonna be in the perfect world at that point and we don't live in a perfect world. So they can start to, as they move through, investigate why the model's not quite acting as it should be once they get onto the production stages.

**Colin:** [00:03:05] That's really useful too, because the model in our systems modeler is perfect. It does exactly what it's meant to do. Just as a theoretical calculation tells you, a pulley will do a certain thing. But when you actually go and measure the real outputs, you'll find that there's a mismatch. There's a disconnect. So we need to really talk about, in our portfolios, records of achievement, why the model doesn't match the reality. And the cool thing about Wolfram is that students can actually go and put in inefficiencies in their system and see, they can work out, okay, I think this is the reason why there's a problem and why the reality doesn't match the perfect model. And they can model that imperfection and see whether it comes out. So a really nice activity for the students. But also it tells us that modelling is important, but it has limitations.

**Chris:** [00:03:59] That's very much so. And the lovely thing about Wolfram as well as it can make those visuals come to life. So obviously as they're starting to do the regular work, they can put their graphs and say, OK, this is where things are going wrong in my model and how can I model something more accurate?

**Colin:** [00:04:16] Super. And finally, the one we want to discuss is Criteria 6, which isn't part of developing intention, but it's a criteria that's useful to do fairly early on in the piece because it's really looking at the students conducting an experiment during their project and they can do this experimental work right from beginning to the end.

**Chris:** [00:04:37] And so it doesn't have to be a real experiment as well. So again, that software, they can use the software modeling to do that. Sorry to interrupt.

**Colin:** [00:04:44] No. I mean, that's that's good, too, because it'll be another interesting thing for the students to do is to do, okay, we'll do an experiment in SystemModeler as we did a few times today. Volt Divider Network, for example. And then they can do the experiment with the real components and do a comparison so they can almost do like a mini whole of study activity in one criteria and get some early feedback and that will inform how they write their whole record of achievement.

**Chris:** [00:05:18] Yeah, definitely. And again, it comes down to those graphics, too, that they can start pulling in just to make it more readable and more, I suppose you could say user friendly. So I mean, it is wonderful being able to teach a subject like this. Obviously we love it when the students work doesn't quite go according to plan and giving them the tools where they can actually go around and start to walk around and see potentially why their projects or subsystems within their project type functioning correctly is a very, very useful thing to have.