Investigating Science – Improving student writing transcript

(Duration 26 minutes 38 seconds)

(soft music)

In this video, we will be trying to expand on a couple of the points that are raised in this document about how to improve your writing. Before I start I'd like to pay my respect and acknowledge the traditional custodians of the land on which this meeting takes place and also pay respect to Elders both past and present.

When you're writing in science in particular, obviously the focus here is Investigating Science, I want you to think about how you can make your writing more effective to show what you really know. How many times have you got back an assessment task and thought, “well I didn't get the marks but I did the work, I think I know what I'm talking about but the marks don’t reflect it?” So we're looking at how you can lift your writing and how you can structure your work better and what you can incorporate to achieve a higher level and show your actual understanding.

This particular document looks at five things that can help you with your writing in Investigating Science. The first one is breaking down case study narratives into systematic summaries, reflecting the scientific method, so summaries can be applied broadly and effectively in responses. What this means is that in Investigating Science, you are studying about the nature and practice of science in the real world. As a result, it doesn't really help you to summarise your case studies throughout the course as a narrative, a narrative like a story, first this happened and then that happened. It's more effective for you to summarise your case studies as a process reflecting the scientific method because the questions that you get in an exam are never going to ask you what happened first in this little story, in this little case study, what happened second. The questions will always be really specific and will relate to the scientific method. What was valid? Was the process applied valid in this case study? Why? How do you know this? It'll always be very, very specific to the scientific method. So before you even start to write, the first thing you need to do is break down your summaries into a new format so we'll be looking at that in a little bit more detail.

The second and third point are probably on hopefully things that you're already doing in class, identifying key terms and what they mean when responding to questions and critically evaluating written exam questions and responses by breaking down the components of the question and identifying how to respond effectively. What these two are focusing on is looking at how do you identify the key terms in a question, identify what vocabulary you need to incorporate in your response and how your response should be sequenced. It could also be looking at a student sample answer and then looking at what are the elements of the sample answer that responded to the marking criteria and to the question, and to what degree have they responded to the marking criteria and the question. What is strong about the student response? How could it be improved? It could also be things like making up a marking criteria, because to make up a marking criteria you have to understand what elements need to be included in response, grading and different levels of responses so that you can identify what responses look like. So these are the sorts of things that you might be doing in class but there's examples included here to help you as well.

The fourth point here, we're going to spend some time on, in this particular video, it is evaluating a student response to an assessment task against the marking criteria to clarify the level of achievement. The idea here is that we're going to look at a Year 11 sample of writing, where the student was as part of a depth study required to make a model and then reflect on their model. So we're going to look at what the student does address and how they address it and then look at what are the structural elements that could be improved on in that response and what about the key vocab. How could the vocabulary be used to be more specific to show a deeper understanding? And the last example, there is a Year 12 sample of writing. It's an essay and what you can do there, is you'll be annotating the essay to look at the structural elements of the essay and then identify key structural features of the essay as an informational text. In Stage six Science one of the things that you're going to be focusing on is, you're obviously going to be focusing on, because you're thinking about, “what am I going to be ranked at the end of the year?” So you're always going to be looking at “what's the marking criteria, what do I need to do to meet the marking criteria?”. But don't forget that the marking criteria isn't the entire story, you also need to not just mark off things as you go and go “done that, done that, done that”, you have to think “to what extent, how well have you addressed each of the elements in the marking criteria?”. So when you start to do that, you have to think about how can you improve your writing to meet those higher levels of achievement. And the two things that I'd like you to consider are the science performance band descriptions. There are six of them and I want you to think about how you perform against those descriptions, not just against the marking criteria. Then also consider the National Literacy Learning Progression because that gives you the features and characteristics of the higher levels of writing. I'm just going flick over to that now and we can discuss that in a little bit more detail.

I've just flipped over to the appendix. Appendix one, towards the end of the document, and what I've done here is I've put the science performance band descriptions alongside the National Literacy Learning Progressions. And if you look at the second dot point, the second of six for the science performance band descriptions, this one relates to how you write and how you express yourself. It says “communicate scientific understanding succinctly, logically, and consistently using correct and precise scientific terms and application of nomenclature in a variety of formats and a wide range of contexts”. So that's telling you quite a bit about what it expects your writing and your expression to look like. And sometimes we think that that's not important in science, but clearly it is, because it's one of the key indicators for a band six performance. So when you're writing for more extended response or a longer response questions and exams, extended responses like an essay, et cetera, you need to show these elements in your writing. When you think about how your writing is constructed, informational text has three different elements of construction. How do you craft your ideas? How do you put your ideas together? Okay, and text form and features. What kind of terminology you use? How to express yourself? and the last vocabulary.

So your National Literacy Learning Progressions can be good for giving you ideas of what indicators of what the informational text may look like and may include. So it gives you a bit of information on what goes into making this quite dense sort of dot point about your performance in terms of writing. So that's something that I will definitely refer to it if I were you, to help you with your writing. Okay, let's go to our first example.

[Slide reads: Breaking down the narrative – Why break down the narrative?  
Why break down the narrative?

By breaking down the narrative of case studies and systematically summarising it using specific terminology and relating it to the scientific method, you will be better prepared to adapt your understanding to any kind of question that could be asked. This is because you will be able to more effectively demonstrate your understanding of the nature and practice of science in real life. By summarising each example critically through the lens of the scientific method rather than simply remembering the narrative of the scenario, you will be able to apply your understanding to any question more easily and respond with greater depth and clarity.]

Okay, so the first example in this document is about how to break down the narrative and as I indicated earlier, it's important to break down the narrative in the case studies that are looked at in the Investigating Science course because of the actual very nature of this course because Investigating Science is looking at the nature and the practice of scientific investigation and scientific discovery. It is really, really important that when you're looking at case studies, that you do not summarise your case studies as a story. You should summarise them really strategically as a process, because the questions that you'll be asked, will always relate to the scientific method rather than a story based on what happened first or what happened next. Okay, if you do this, it'll help you demonstrate your understanding with a greater depth and greater clarity. And also in an exam you don't want the pressure of remembering, “in my summary where did I talk about that?” You want to actually remember your work as a process and it'll be more easy to access. Now, how do you break up the narrative?

[Slide reads: One. Breaking down the narrative

How to break down the narrative?

* You are encouraged to delve deeper into the examples given in the syllabus. In stage 6 science, you learn to conduct secondary research investigations, and this should be applied to the case studies within the course. The following example relates to the systematic process of science through the scientific method.
* To respond effectively to HSC style questions, you need to have a more detailed understanding of the scientific methodology, scientific reasoning and evidence that supports the reasoning. In the following activity you will use an article as an example on how to breakdown the narrative and apply the summary to the case study.]

In this document I've included questions to help you break down your case study in terms of the scientific method. When you do this at home you might be able to fit it into a table, a one page summary table, where the question is in one column and the answer in another. But I've just done this as a straight question for you in this particular document. And what I would suggest to you, is when you're looking at case studies, is to try and access scholarly articles. Don't just go to Google and the first site that comes up with an example, I'll go “okay, that explains that sample”. Try and look up a scholarly article. In this particular example we're going to look at the Edward Jenner example, where it looks at the history of smallpox and vaccination.

[Slide reads: Access a scholarly article  
As you read the article and complete the questions, you should notice:

* Scholarly articles are more likely to have a greater depth of the scientific process embedded in the narrative.
* The case study highlights the nature and practice of science, the influences of science and how solutions to problems and improvements are suggested.
* Note how the scientific method is voiced.]

So what I've done here for you is I've accessed an article which is a little bit more scholarly in nature and as a result what you should notice when you read through it, is that this article will have a greater depth of the scientific process within its narrative, within it's story. Because it'll still be a story, you're not going to look up a Google site and automatically this exact case study that you want is actually summarised as a scientific process. This is something you have to do, so it's something that you actively need to summarise in a particular form. You'll also notice that if you access a more scholarly article, you're likely to get an article that has more information about influences on the investigations, things that influenced the science and solutions of problems and improvements that were suggested. And hopefully you'll notice also that the scientific method is more strongly voiced in a scholarly article. So before you stop me and actually read this article and answer the questions, I just want to go through some of the questions with you.

[Screen shows online display of the question sheet]

You can see that all of these questions, they don't have really long responses, each part has short sets of responses but all of them are going to relate to the process of discovery. What were the initial observations? What were the scientists investigating? Why was it important? What hypothesis did the scientists make? The methodology, how were the variables controlled? Were they controlled? Were there any ethical considerations or complications, technological considerations, safety considerations? So you can see that all these questions relate to method and process, okay? Results, et cetera and because that's what this whole subject is about, the nature and practice of science.

So what I'd love you to do now is to pause me, have a read of this article and answer the questions and reflect on whether it actually gives you a better understanding of the case study compared to a straight narrative, okay? Hopefully you will find a lot of value in this and you should be able to apply then these sorts of summaries into exams much more effectively and show your knowledge much more readily. Okay, good luck with that one and we'll move on to the next example. (soft music)

[Slide reads: Pause here  
You may download and read the article on Jenner and the history of smallpox, (Module eight, question one) or you may choose other articles, such as those in the booklet . Breaking down a narrative in a systematic way will build your capacity in applying the Working Scientifically skills.]

Well, I hope you found the Jenner article informative and I hope you were able to easily summarise that information into a more logical process, a process or a methodology that you would need to apply in questions in an exam. If you're unsure about whether that's a really effective process what I urge you to do is to look at a question in an exam and look at well how you would answer it if you just looked at the original article and then look at the question and is it easier to answer it when you look at your summary that summarised as a process that reflects a scientific method? I think if you consider it that way, you'll see the value in summarising and you'll take that little bit of extra effort to summarise your notes in a systematic way. On to the next one.

[Slide reads: Evaluating a Year 11 in-class student response – Making my responses better by reviewing a peer. See page 17 of your booklet  
Year 11 students were required to build and display a model, then evaluate the model for an in-class writing task:

This task requires you to ask a question about something you have wondered about, and then build a working model to explain the answer. The model must show the dynamics behind the answer to your question such that it can be used to make and explain future predictions. In other words, you must be able to:

* change something in your model
* see a corresponding change in your model’s predicted outcome
* use the model to infer a logical explanation for the predicted outcome]

The next area that I wanted to look at was point four in this document, which is evaluating a Year 11 in-class student response. So often when you've written something and you get some information or some feedback and some students will say, “well, I still don't know how to make it better.” So by looking sometimes at someone else's response, we're going to evaluate the student response and then I'm going to show you how you might be able to think about it a little bit differently to show and be able to demonstrate a higher level. So this student, what they had to do, they had to make a model as part of their depth study. Their model needed to change a variable and look at how that changed variable changed the outcome and they also needed to make some logical explanation for the predicted outcome. So that the model needed to do something, needed to change something and needed to show something, okay? And once they did this, they actually had to present this at a science fair, they also then needed to reflect on their model.

The student was given an evaluation so they're being evaluated on how they could demonstrate the understanding of the science concept in the model and whether their model evaluated, evidenced the model and its application simply predicting and explaining scientific phenomena. So does it explain the phenomena well ,evaluate the materials used and any logical improvements in the model. So you can see that there's a gradation of achievement and what they needed to do for each level of achievement for this particular reflection.

The model that the student made was a simple sand erosion model, where they had a sandbank that to mimic the coastline and water and they used a particular device to make different types of waves and look at what actually happened when they make the waves, what happened to the sand. This is kind of like a bit of a before and after (image on screen of the experiment), you can see that the sandbank is eroding over time.

[Slide reads: Student response with coding for logical progression and use of terminology page One:

Sand erosion was my scientific phenomena that I was testing. (one). There were many positive/negatives that came with my model such as; the materials not being right of the sand not behaving the way I wanted it to (two). I used a foil base to hold my liquid experiment which was a big mistake as it bends out of shape and is not for tested, but then with the help from my teacher I realised that I can make this experiment more fair tested by using a clear plastic container (three). When water comes into contact to sand, sand tends to sit at the base, that happened to me so I needed a way to make the sand at one side, so I made a ‘wave beach water’, with laminated paper, that I wet to make the same beach every time (for a valid experiment) (four), since I was testing sand erosion I had to make sure to have very simple instructions and a warning sign saying ‘Do not spill, Do not mix’, this helped my end product A lot Because throughout the science fair I saw people taking that warning sign very seriously(five). In the future I would make couple of changes, first being using a longer container to make sure that the waves were being made easily to avoid spillage But also to avoid over mixing (six) this was a problem Because in my feedback people were saying how I could have shown a really good concept of sand erosion and the way we use the model would improve

As the waves are stronger it takes more of the sand away from the base But it also made the house that I built with wooden stamps slide away showing us humans should stay away from building near beaches and such bodies of water.(seven)

As smaller waves were made you can see by moving the ‘wavemaker’, that nothing much happened but over time that will have a very huge impact on the way sand is being taken out and also spat back at the beach.(eight)

While I was working on making the model I came across websites that was built by scientists, they were talking about sand erosion is not only about taking sand away from the beach, but also same sand being spat back at the beach making shore I had that information in my head. I started building my model, (nine) I used thicker sand from the beach on the side while childrens play sand on the base, later realised this was a mistake as everything blended at the end.(10) But eather way sand erosion was on display in smaller and quicker version though my experiment.(11)

There are spelling and/or grammatical errors in this student sample]

Now, what I'd like you to do is take a couple of minutes to actually just read this response, I don't want to read it all for you. You'll notice it's coded slightly, don't worry about those numbers just yet because we'll be looking at them later but this is exactly what the student wrote as response to the question. So just read it and then I'd like you just to answer these two questions.

The first one is use the marking criteria in table five to mark the work and number two, use the performance band descriptors in the appendix that I showed you before to justify the performance band that the work would fall under.

And then once you've done that, explain whether you expect to get similar results between the criteria, meaning between the marking criteria and the performance band descriptors, should they be similar? Yes or no and why? So just take a couple of minutes to do that and then come back to me. (soft music)

Okay, so hopefully you've taken a little bit of time and had a read through the student work and had a chance to then look at the marking criteria to mark the student work. Have a look at the performance band descriptors to see where the work might have fallen under, what band level and explain whether there should be similarities between the mark that they got on the marking criteria and the band descriptors.

So if we just go back to the marking criteria, what you probably notice is the student isn't really achieving at that excellent level. They don't necessarily demonstrate an extensive understanding of the scientific concept. They describe what happens, they show an understanding of the model and what it does and how it works. They discuss, relate the model to scientific phenomena but they don't really evaluate very well. That's one of the major weaknesses of this particular student work is that evaluation is almost non-existent, it's implied but it's not expressed. And you can't mark what's implied, you have to mark what is expressed. So immediately, because the student does not really evaluate, does probably discuss the materials used and justify the materials used, but probably does a little bit in terms of the materials but doesn't necessarily evaluate the model itself and doesn't really demonstrate an extensive or a good understanding of the scientific concept, they demonstrate probably satisfactory. So I think in this area the mark is probably around this area of the sound. There's probably some elements of the basic, but why I chose this particular student sample is because while it's not sophisticated writing, the student does in fact explain some elements of their methodology.

A little bit haphazard, but does sort of hint at the methodology, does discuss problems encountered and steps to overcome the issues and manage the variables. The student identified the model as fair and valid. They identified how the model was dynamic and the effect of changing the independent variable. So the student does do several things within their response and their reflection, they just don't do it necessarily very well. So what you probably noticed in the marking criteria is a fair piece of work and it's probably in that range of being sound, there's some elements of the basic but probably overall it will be a sound achievement.

However, the student's work could be a lot stronger if they did a couple of things. In the performance band descriptors, remember it said communicate scientific understanding, the dot second point, succinctly, logically and consistently using correct and precise scientific terms. Now, one of the things that this particular response lacks is that it's not necessarily logical and cohesive.

Because if you look at this table, what I've done is I've tried to summarise what the student has written against the scientific process. Notice what I'm doing again, like I did in the first example, I want to examine this as a scientific process. So that's going to give me my logical progression in my thinking. And you can see that when I map out the coding, the student goes from one to two, to nine, like this is all over the place. When I line it up against the scientific process, the student hasn't shown that logical progression of method.

What I've also done here in the coding is, I've tried to increase the cohesion through aligning with the scientific process. But also, what I've tried to do is to improve some of the terminology that was used within the student work and in some cases where information was implied, I've tried to actually express what was implied.

So for example, in the results here, that related to point seven and eight so we'll have a look at the student work in point seven and eight. And you can see in this area the student says, as the waves are stronger, so he understands that bigger waves are stronger, it's implied therefore that the student understands that stronger waves have more energy. So it's a shame this wasn't expressed any way in terms of an evaluation. So as the waves are stronger, ‘it takes more of the sand away from the base but it also made the house that I built with wooden stampons slide away showing us humans should stay away from building near beaches and such bodies of water. As the waves were made, you can see by moving the wavemaker that nothing much happened but over time that will have a very huge impact on the way sand is being taken out and also spat back at the beach.’

So this is something interesting with their results but let's have a look at how they could have worded this part of their investigation. ‘Small waves have no overall impact on the sand mound. Sand appears to be removed and replaced from the edge of the beach and does not encroach deeper into the mound where the house was located. Larger waves removed significantly more sand which was not replaced with the water movement in and out. This resulted in the erosion encroaching on the mound and destabilizing the house which collapsed.’ So you can see this really significant difference in expression, I haven't used really difficult terms, difficult words but I've just expressed the same sort of understanding in a slightly different way. It's a little bit more logical and a little bit more clear as to what the results were.

The reason that this student didn't access the higher bands or the higher levels of achievement is because they completely lacked this analysis of their findings and relating their findings to the topic. The topic they're doing is models. Why are they making models and models are made to mimic real life and if they're not relating their model to what could happen in real life, then they're really missing a point. Now saying that the student did try, let's go back again, sorry I'm going back and forth all the time but the student did say, ‘showing us humans should stay away from building near beaches and such bodies of water’. So they're showing some sort of evaluation but isn't really expressing why, it doesn't express the whole situation. So let's have a look at what an alternative analysis might look like. It says “the use of stronger waves in this model resulted in a large amount of sand being removed from the mound mimicking the coastline. This resulted in the destabilization of the foundation piece of the house being compromised and sliding into the water. These results demonstrate that houses built along coastline could be considered dangerous when the subsoil is made of sand and swell is high. By contrast, small modelled waves did not have a significant impact on the sand mound or the house stability because the energy of the waves was not enough to erode the sand beyond the water's edge, and this was readily replaced with the water movement”.

So you can see the student actually implied a lot of this analysis in their response, the teacher can't mark, a marker cannot mark, what you imply. They can only mark what you express, okay? You might imply something but you have to actually express it for it to be marked and acknowledged. Again, I haven't used really difficult terms, I have used some terms like destabilization of the foundation and the subsoil being a sand. So these are things that the student could have come across and should have come across in some of their background and their background was a little bit probably lacking but in doing some of their background research, these terms should have been actually pretty evident. And it's about, this is where the weakest probably point in the student work is the analysis, the expression analysis of the results and the final evaluation because at the end of the day they're asked to evaluate and the student was really weak in this area and they just sort of ended their reflection. But if they had said, as they sort of hinted at that “the model was successful in demonstrating that wave energy and associated wave size leads to significant sand erosion which can affect houses built on sandy subsoil near the beach. In addition, the model highlighted that smaller waves with less energy did not erode sand to the detriment of the beach as the eroded sand was really replaced with wave movement.” So if they had actually done some sort of evaluation that was a little bit more holistic and related to houses built on sandy subsoil so related to the real life scenario, then they would have shown that connection between model and the real life, okay?

So these are things that you have to think about when you’re writing an in-depth response. Think about not just what happened, but what happened in a specific ,in the scientific process. If you followed a process when you did your investigation, make sure you follow some sort of process when you're responding and reflecting on what you did. And then make sure that you're using terminology that fully expresses what you know. This student's work is not terrible, it's not bad, it's just lacking detail, it's lacking order. If I just repeat to you again, the performance band descriptor communicates scientific understanding succinctly, logically and consistently using correct and precise scientific terms so they're lacking that, those elements in their expression.

I hope that these two examples have been helpful to you. As I said, there's another example below this one, that looks at a Year 12 sample of work. And it's an essay and it's looking at some of those elements of their writing and creating informational text.

So do think about your writing, do think about how you express yourself and consider those summaries people, because I think that's a critical thing to helping you respond to questions and exams. Thanks very much for your time and good luck in the HSC.

(soft music).

End of transcript