Science - Investigating science Evaluating data - secondary source research transcript

(Duration 22 minutes 44 seconds)

(uplifting music)

Hello, and welcome to this presentation on planning and conducting investigations. This presentation was put together for Investigating science, but it may be used for any Stage six science subject. Firstly, I would like to pay my respect and acknowledge the traditional custodians of the land on which this meeting takes place, and also pay my respect to elders both past and present.

This presentation accompanies the document, “Investigating science, guides and scaffolds for secondary source and first hand investigations”. As indicated by the title, we will be looking at secondary source research and how to evaluate secondary information. We will be looking at how to evaluate quantitative data. And we will also look at some scaffolds and self-evaluation checklists for firsthand investigations. The page numbers you see listed there are those from the accompanying document.

So, in this first section about secondary source research, we will look at what is the purpose of secondary source research, how can we go about evaluating secondary information using the CRAAP test, and also very briefly talk about referencing, and I will present you with the scaffold that you might find useful for summarising information. So, what is the purpose of secondary source research? Secondary source research happens at the beginning of every scientific journey, and there are two main reasons for this. The first is that we want to consolidate information about specific areas of science, and so that we can develop our knowledge and understanding of those areas. The second is so that we can lay the foundations for scientific inquiry. So, we want to build upon the knowledge and experiences of others to identify knowledge gaps and also avoid unnecessary investigation. And once we've identified those knowledge gaps, we can develop our own inquiry questions and subsequent hypotheses, and also develop valid and reliable research methods, because we can see what others have done before and what has worked and what has not worked so well. Secondary source research is also really important for validation and replication studies, which is sometimes undervalued in our publish or perish culture, but they're really important in-built self-checking mechanisms of science to ensure that science can self-correct itself if it gets things a little bit wrong.

So, the product of secondary source research is a literature review, and I'm often asked how is that different to background information? So just like background information, a literature review will define terminology, it will describe and explain concepts, and you will use different sources, but the difference with the literature review is that the sources that you are using are only peer-reviewed literature. And you're going to go into a much deeper analysis of the information in those sources than you would in the background information. So you want to take all the different information from all the different sources and squish it together and see where they are similar, where they are different, and you try and synthesise that information according to themes or ideas so you can identify gaps in the research that you might then exploit and research yourself. Now because you are pulling information from different sources and you're squishing it together, it's really important to tell the reader where each piece of information came from and not give the impression that all the information was either from the same source or from you, or you don't actually know where that specific information comes from. So because it's really important to show where each piece of information comes from, we include in-text citations, and I'll speak a little bit more about that in a little bit.

So there are two types of literature reviews, depending on the purpose of your review. There's a narrative review, which is really just a summary of all the relevant ideas in a topic area, and then communicate a broad understanding of the field and who the players are and what kind of research they're doing. The second is a systematic review where you're going beyond the narrative. So you're really looking for the evidence for developing your own scientific hypotheses. So you want to come up, find what the gaps in understanding are, what are the conflicting theories, and then you want to present the information in a way that shows the reader how you have developed your research question and your hypotheses. Now in these systematic reviews, you're also reviewing the information from the point of view of the scientific method. So you're looking for specific data methodologies. You're looking for the information that can help you design valid investigations and also perform validation and replication studies. The reason why I wanted to talk about this today is because in Investigating science you're presented with a whole lot of case studies that you might get asked questions about. Now often they're presented to you from a narrative point of view, just from a summary of what happens. The problem is if you're asked a question that you really need to demonstrate a scientific understanding of those cases, then you really need to be looking at it from a systematic review point of view. You need to be throwing your understanding of the scientific method at those reviews and really break down those case studies so you are better prepared to answer any kind of question.

So that brings us to evaluating secondary information. So how do we make sure the information we are using is valid and reliable? And so a really useful tool is to use the CRAAP test. So the CRAAP test was developed at the California State University. It's widely used by universities around the world, including here in Australia. And it is recommended by the Department for use in science in New South Wales. Now, my students have said that they find this approach much more useful for evaluating sources, rather than just asking if the source is valid and reliable. And so to show you how useful this test is, I'm going to give you a real-life example that I had in my physics class this year.

On the 20th of May this year, one of my students wrote a post in our Google classroom saying, "Miss, the news about evidence being found "for a parallel universe existing” is so interesting and exciting." And I thought, "Wow, why haven't I heard about this? "Let's check this out." And that began a journey over the next few days looking at how to actually evaluate information to find out if it is real or not. We Googled evidence for parallel universe. And we came up with these hits. Now, a quick look at these sources, we have New Scientist, which has a pretty good reputation, we've got the New York Post, which I haven't heard of before. Remember, it's the New York Times or the Washington Post are your main publications that we've heard of before. There's another one here, WIO News, never heard of that one before. And then we've got the fourth hit there is the Sun, which is a tabloid publication from the UK. So, then I'm starting to get some warning bells here. So we had a look at it from the point of view of CRAAP.

So before we go any further, let's take a closer look of what the CRAAP test is. So we've got C-R-A-A-P. C is for currency. So C is when was this information published? So we would like to have information as recent as possible, but you also got to be mindful of information that has just been published. Has it gone through peer-review kind of processes? Is it actually so current it hasn't actually had time to be tested? Then we've got R for relevance. So what is the information? How does it relate to what you're actually looking for? We've got A for authority, so the source of information. So this is often what you would think about when you're thinking, "Is it a valid source?" So who's the author, who's the publisher, what are their credentials, who are they affiliated with, are they actually qualified to write on the topic? You might have a professor in astrophysics talking about something in biology, so are they actually qualified to write on that topic? The second A is for accuracy. So what is the reliability and the truthfulness and the correctness of the content itself? So has the information been reviewed or refereed? So we keep that in mind when we think about currency as well of the publications we're looking for. And the last one there is P for purpose. Why has that information been published? What is the purpose? Is it to sell something, is it to entertain, or is it to inform? And you're looking at things like what is the writing? Does the writing appear to be objective and impartial, or is there a bias in the tone of how it's written?

So let's apply the CRAAP test to our Google search. So in terms of currency, the information is very recent, which is great, but you also need to question, is it so recent that it hasn't had a chance to go through a peer-review process yet? Okay, in terms of the relevance, well, all these sources are directly relevant to what we're interested in, so that's good. But in terms of authority, you need to be thinking about who would be making this announcement if it was for real? So we've got new scientists there, which is a proper scientific magazine, but those other sources that we have there, the Sun, the New York post, they're not the type of sources you would be expecting to make these kind of announcements.

So we took a closer look at the best source in the list. So New Scientist. If you click on the link, it takes you to an article called, "We may have spotted a parallel universe going backwards in time." Boy, that sounds exciting. Let's apply the CRAAP test to it. So we looked at currency first. It says that the strange finding was made in 2016. So that was perhaps up to four years ago, which seems like quite a long time, but you need to be thinking about the peer-reviewed process, and it can take a bit of time between when findings are made before they actually go through the peer-review process. But what did strike us as unusual is if we look at the date of this article being the 8th of April, 2020, so this was a month-and-a-half before we did this Google search. We thought, "Well, wouldn't that information have filtered "through to mainstream media if it was correct by now?" So we thought we'd just put that aside for the moment. Let's keep going. Well, let's look at the purpose of it. Let's look at the language used in this particular article. So if we look at the tagline here, "Strange particles observed by an experiment in Antarctica could be evidence of an alternative reality where everything is upside-down." So using words like things going backwards in time, everything is upside-down, these are not necessarily objective choices in language. So it made us question what's the purpose of this article? And so we thought we would dig a little bit deeper into that.

Now before I move on, I have circled this particular gentleman, Peter Gorham. So he is presented as the expert in the field, and we will look at him a little bit later on. So we thought we'd take a closer look at the credibility of New Scientist. Now this has a really good reputation. So this particular magazine was set up to take scientific information and make it accessible to everybody. So historically it has a great reputation, but we looked, we found out that it was sold in 2017, and as part of the sales process and the announcement of the sales, it says, "Kingston Acquisitions Limited are aiming to increase the New Scientist's digital products and appeal to a wider audience." So that raised the question in terms of how would they be aiming to do that? If their purpose is to appeal to a wider audience, are they still going to remain completely factual, or is there going to be a bit more of a storytelling element to it?

So we looked at what it would take to get an article published by New Scientist if we weren't on staff. So they do have freelancers. So we looked that up, and down on the bottom we can see here that it publishes only new research, so research that's been published in the past week. It says, "We do not publish news articles about research presented one month ago, unless there is a justifiable news hook." So that took our attention because you know a news hook, it's like click-bait, something where you're trying to get people in. And having said that, this was a finding in 2016, so it made us question, well, why are they publishing it now unless they came up with a news hook? So now we had a question mark over the purpose of the article from our most credible source. So we thought, let's get back to the original question. If this was real, which authority would we expect to make an announcement? So we did a search, "NASA evidence of parallel universe," and actually came back with nothing. So knowing that the authority before was listed as Peter Gorham, we did a search, "Peter Gorham, Antarctica parallel universe." So we came back with a hit. Now the source itself, the Daily Mail is a tabloid; it's not a CRAAP source. But then we did get a little bit more information out of it. So we found out where Peter Gorham works. So he's from the University of Hawaii. So we thought we'd follow that track a little bit. So the next day we found this article from the University of Hawaii, and it's talking about how one of their professors had made a discovery in Antarctica which may herald a new model of physics. So excellent, we're starting to get more to an authoritative source. But if we have a look down here on May 21st, 2020, on the day we happened to be looking, there was an editor's note. So media incorrectly connects University of Hawaii research to parallel universe theory. Wow. So this is the first time that we've started finding, well, actually, maybe that original information that we had was not right. But what was good about this article, it gave us a little bit more background into the actual research project.

So by now we've realised that the published information is changing on a day-by-day basis. So the next day we followed it up with the same Google search again. "NASA, evidence of parallel universe." We've got some more hits like from Forbes, "Has NASA found a parallel universe," et cetera. But what got our attention is there was a hit from ScienceAlert. So ScienceAlert is a really good website and it has an app, and it collates the latest announcements and news releases from places like NASA. And it had an article called, "Here's The Real Truth Behind That Viral NASA Finds Parallel..." So we decided to click on it and have a look. So I'm going to read the first three paragraphs of this article. "Every time tabloids and social media dramatically mishandle a science news story, the urge to unplug the internet and plug it back in is excruciatingly strong. If you've heard the recent claim that NASA detected a parallel universe in Antarctica where time runs backwards, we're glad you've now clicked on this article. So strap yourselves in for the truth. "It seems that for this tabloid science story, some speculative theoretical physics which might have had distant roots in plausibility was amplified for sensational reasons," the University of Hawaii at Manoa experimental particle physicist Peter Gorham told ScienceAlert."

So yes, the language here is not objective at all. It's narrative, it's storytelling, but it's trying to tell you the story of how this all happened. Now interestingly, what I love about this, they actually went to the authority, the person whose project it was, Peter Gorham, and got his take on it. So what happened? So the respectable New Scientist magazine published a pay-walled feature on April 8 discussing some anomalous results coming from an experiment in Antarctica. So the term ‘pay-walled’ instantly raises alarm bells in terms of the purpose of the article. So that's really about click-bait. They want people to get interested in this article and pay money to see it. Now if we have a look in terms of accuracy, I want you to come down here. So let's go back to our authority, Peter Gorham. So as Gorham, who was the principal investigator, told ScienceAlert, "We have encountered a small number of anomalies in our data, and once we have exhausted all of the possible explanations within the standard model of physics, only then is it time to consider other ideas that push those boundaries. We are not really there yet. Certainly not at the point of where parallel universes are necessary." So what he's saying is, is we had some unusual things in our data. We're still trying to figure out what they mean, but we're definitely not at the point of saying it points to a parallel universe.

So does this information pass the CRAAP test? Well, clearly it doesn't. That's not to say at some point in the future when they're analysing their data it doesn't change our understanding of physics, but at this point in time, we definitely can say that that information is not valid nor is it reliable. So here are some tips for developing a list of quality sources. So maintain a record. Read widely on your topic using the internet, books, scientific journals and wherever you can get information from. Check potential resources for currency, relevance, authority, accuracy and purpose. So do the CRAAP test and keep a note of anything that you find useful. Add to your bibliography as you go. Do not leave your bibliography until the end or you may have trouble finding the resource again, especially if it's an online resource. And also, use an appropriate referencing style as you go. It'll help you to get better at it, which you will find particularly useful if you go to university.

And that brings us to the next thing I want to talk about today, which is referencing. So firstly, I often get asked, "Should I be using a reference list or a bibliography? What's the difference?" So a bibliography we use for background information. We use it when we're just giving general information and it's a list of all the secondary sources we used, and it's in alphabetical order by the author's surname. Now we only use a bibliography when it does not require in-text citations, but if we're doing a literature review, when you are combining information from different sources then you also must use in-text citations with the corresponding entry in the list of references. So what is an in-text citation? They're just pointers that tell the reader where the information came from. They point to the correct source in the reference list. And the reference lists only include sources that you have directly referred to through in-text citations. If you do not have an in-text citation for a reference, it doesn't go in your reference list. Similarly, everything in your reference list must have an in-text citation.

So how do we format references? What are the rules? Well, in science we use a parenthesis system. So that just means the systems involving brackets. Now you don't have to get too worried about knowing how to do these different referencing styles. There are plenty of tools that will help you. You just need to check with your teacher for the required format, and then you can ask your librarian for help. But I do want to point out what are the things that need to go in a reference so that you know what items you need to make sure you have. So you need to have the author's name first, so surname first, and remember everything is alphabetical by surname, the year of publication, and needs to have the title of publication, now this is in italics. In addition, if that's applicable, the place of publication and the publisher. So in terms of in-text citations, there's only two pieces of information you need. So you need a list of all the surnames of your authors and the year that it's published. So one trick with doing in-text citations is making sure you do not double-up on information. So you only put the parts in brackets that are missing from the sentence. So for example, that first sentence here, "Johns and Mewhort's (2005) study on priming discovered," so you notice we didn't repeat the author's last name inside the brackets in the in-text citation. An alternative way of doing it, if you want to have the author's name in the brackets, is by saying a study examining priming. So in brackets, (Johns and Mewhort, 2009) discovered..." So if you're finding in your sentence you're writing the authors twice or the years twice, then you need to fix up your in-text citation.

And lastly here, if the same idea occurs in multiple sources, include all the sources in one in-text citation, and you just separate them by a semi-colon. Now this is a really cool way of showing how you synthesise information from multiple sources. So it shows that your secondary research is reliable. So as I mentioned before, don't get too caught up in trying to memorise formatting rules. There are plenty of tools out there to help you. One of my favorites is Google Scholar. So instead of doing a Google search, do a Google Scholar search. The great thing about it is you can actually filter your results based on time of publication. So it's great for making sure that your sources are current. But what I particularly love about it, when it gives you your hits, down here we have this, they look like 99s, so double quotation marks. If you click on it, it actually gives you how to cite that particular source in all the different possible formats. So you can just copy and paste the format that applies to you. It is a great tool.

The last thing I want to talk about in terms of secondary source research is the scaffold. So the scaffold is useful for collecting your information from your various sources. The scaffold I will present looks a little bit different to what's in your guide, but this is just how we do it at our school. So here's an example of the scaffold looking at the inquiry question, "Why do we have seasons?" It's really important to have your inquiry question at the top of any summary, because it's how you make sure that the information you select is relevant to that inquiry question. Then we have the title of our source and our bibliography details. So this is not a reference at this point in time, because you don't know if it's actually going into your final product, but it is information that you're using to get background information, so we're calling it a bibliography. And instead of doing a CRAAP test at this point in time, which can be quite detailed as you've seen, at this point we're just looking, is it a trustworthy, is it a valid source? So is it a government website, for example? And we're also looking to see if it's reliable, so does it have the same information as other valid websites? And then we move on to summarise the information, only the information that's relevant to that inquiry question. Now how this looks will depend on your teacher. So it might be fine just to do dot-points, or you might be asked to write in full paragraphs so you can practice your writing skills. But what's really important is that at this point you put it in your own words. If you put it in your own words here, and then you're using this to create your final product, for example, your literature review, you will then be automatically paraphrasing it and putting in your own words, and you're not going to get in trouble in terms of plagiarism.

And lastly, so this is what that scaffold looks like in terms of a blank template for our students. Our students have done this a few times, so they understand that IQ is inquiry question, T for title, B for bibliography, V for validity, R for reliability and S for summary. And so students have this in their books as a reminder of the information that they're looking for when they're summarizing information. So that brings us to the end of the presentation today. I know it was a long one, but I hope you found it useful. I just wanted to acknowledge a couple of documents that are on our science website from the Department of Education. So evaluating scientific data is a great source for looking at how to evaluate data. It also adds a bit more information in terms of how to handle calculations involving uncertainty. And the other document I want to talk about here is developing the literature review. So this was designed more for science extension students, but it is equally applicable to other stage six science subjects. All right and that's it from me for today. Thank you for listening.

(uplifting music) (crackling)

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