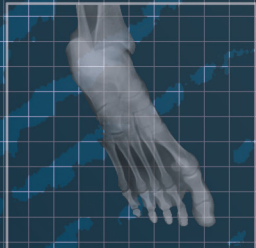
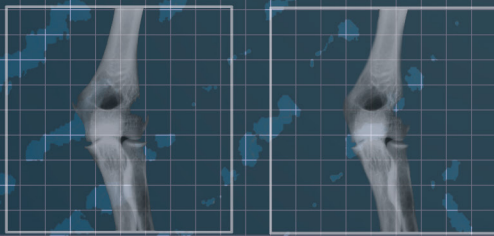


follow your interest in ...

F●RENSICS



STEM Careers Pack 8
Suitable for
Upper primary teachers
Careers counsellors
Year 7–9 science teachers



Government of South Australia
Department for Education and
Child Development

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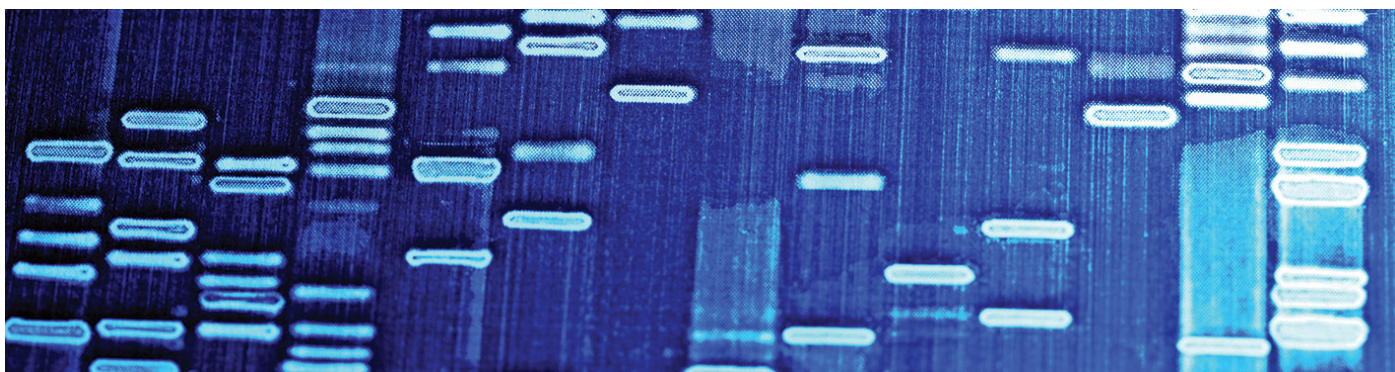
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How to Use this Pack:

- Designed to be used as a whole, or select individual tasks.
- In conjunction with units of work on Science Understanding and Science Inquiry Skills.

Introduction



Follow your interests in...

Each STEM Career Pack provides teachers with a sequential set of tasks and information, including interviews, to take into the classroom. The Packs are aimed at: helping students to understand the nature of scientific knowledge, how science influences society and how society influences science (ie Australian Curriculum: Science, Science as a Human Endeavour); and making students aware of the wide variety of exciting STEM careers they could aspire to.

STEM Career Packs 5–8 focus on four interest areas: 3D printing, Art Conservation, Robotics and Forensics. It is anticipated that students who don't typically 'like' 'science' but are interested in 3D printers, art restoration, robots or CSI television shows, will come to see how their interests relate to the science they study at school and STEM career possibilities.

Bringing STEM careers to life:

There is a current shortage of people, particularly women studying and working in STEM (also referred to in these Packs as 'science'). There are many factors at play supported by a substantial body of research; two of these factors are addressed in these Packs. The first of these factors is that students find it difficult to identify themselves with scientists, technologists, engineers and mathematicians; they can't picture themselves working in a STEM career¹. The second factor addressed here is that many students are simply unaware of the STEM careers available, what day to day work is entailed and what pathways lead into these careers².

Why is it important to address these factors in the middle years? Research has shown that experiences prior to 14 years of age are pivotal in developing students' interests in science, and influencing career choices³.

'When asked about when they became interested in science, 48 per cent of the students traced the origin of their interest to junior secondary school; 12 per cent mentioned primary school...'¹.

¹ Office of the Chief Scientist 2012, Health of Australian Science. Australian Government, Canberra.

² Panizzon, D & Westwell, M. 2009, Engaging students in STEM-related subjects. What does the research evidence say? Flinders Centre for Science Education in the 21st Century, Adelaide.

³ Tytler, R, Osborne, J, Williams, G, Tytler, K, Cripps Clark, J, 2008, Opening up pathways: Engagement in STEM across the Primary–Secondary school transition. Australian Department of Education, Employment and Workplace relations, Australia.

What do we want them to learn?

What is the intended learning?

It is intended that students will learn what forensic science is and how the work of forensic scientists compares to that of characters in the popular TV shows and movies; a popularity which may entice students to enter this field. Students will learn that there are rapid changes and developments in forensic technology and methods, making very real the lifelong learning adage. Students will learn about and consider the sorts of ethical issues related to forensics, in particular the topical issue of DNA data banks. Students will also gain knowledge of careers in forensics and the important role these careers play in society.

What do students bring?

Students are likely to have seen television shows or may have used basic forensic methods at school and have their own beliefs and ideas about forensic science procedures. They may have undertaken their own forensic techniques such as fingerprinting or analysing handwriting. Students' ideas and experiences will be built upon and developed throughout this unit of work.



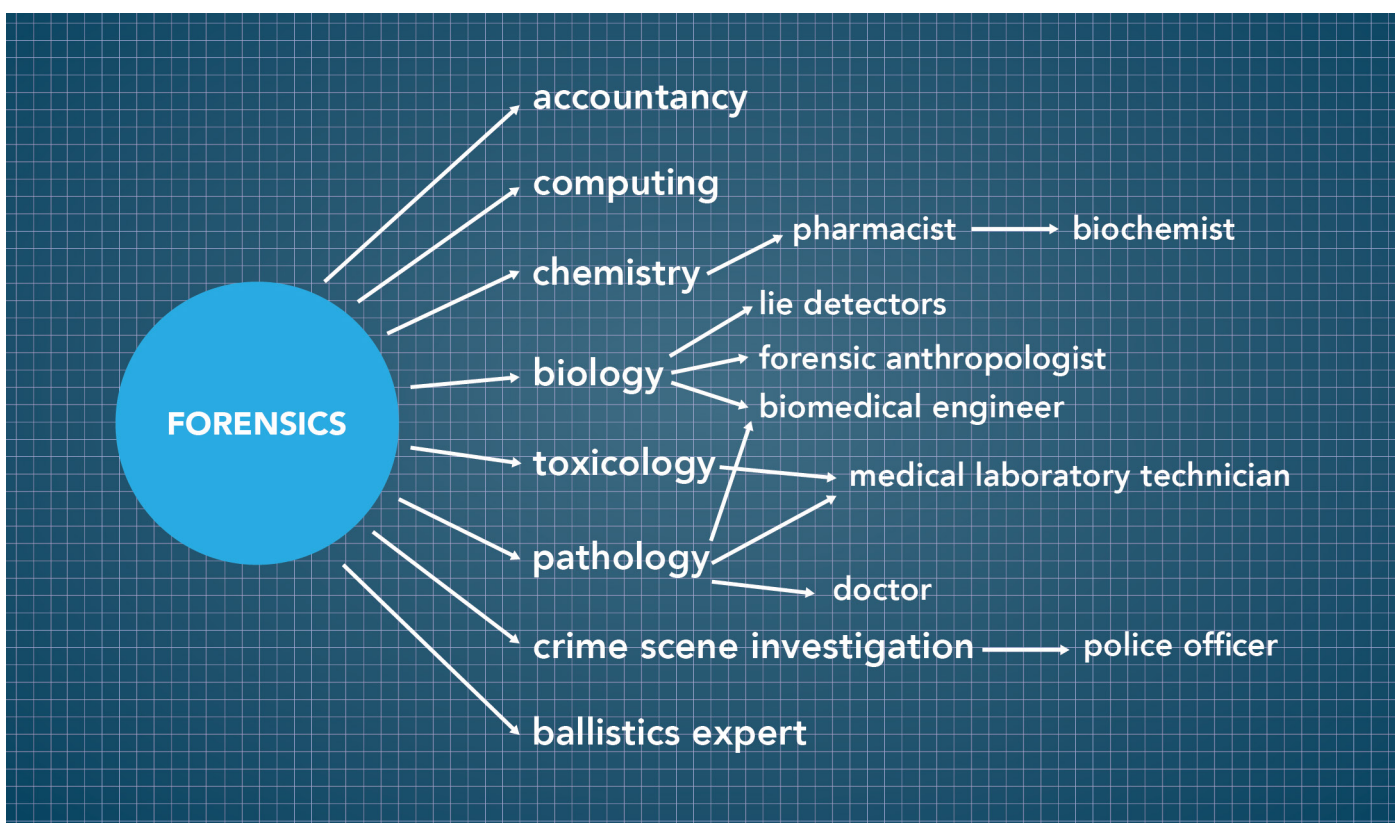
- We need students to understand that STEM is all around us, even in areas we might not have realised.

- Forensics is very popular currently, however the practices as seen on the screen are not always accurate but the important role it plays in society is true.

- We need a future supply of aspiring scientists, technologists, engineers and mathematicians, both women and men.

How will we know if they got it?

What could the intended learning look like at this level?



The **Australian Curriculum: Science** focus for this unit is **Science as a Human Endeavour**. Students will look at areas within forensic science and the role it plays in society. They will learn about the potential and current applications of forensic science, its limits and the ethical concerns it raises. As well as identifying and questioning their own beliefs and those of others, students will understand why such beliefs should be openly questioned and how they can do this in a constructive, respectful manner. Students will be able to demonstrate an increase in their knowledge of science careers as well as the role of science in society.

Teachers use the intended learning, as indicated in the Quick Reference Table for this unit, in conjunction with the achievement standards in the integration of the Tasks or the development of whole units of learning and assessment.

Students will demonstrate development towards the following Australian Curriculum skills and dispositions overleaf.

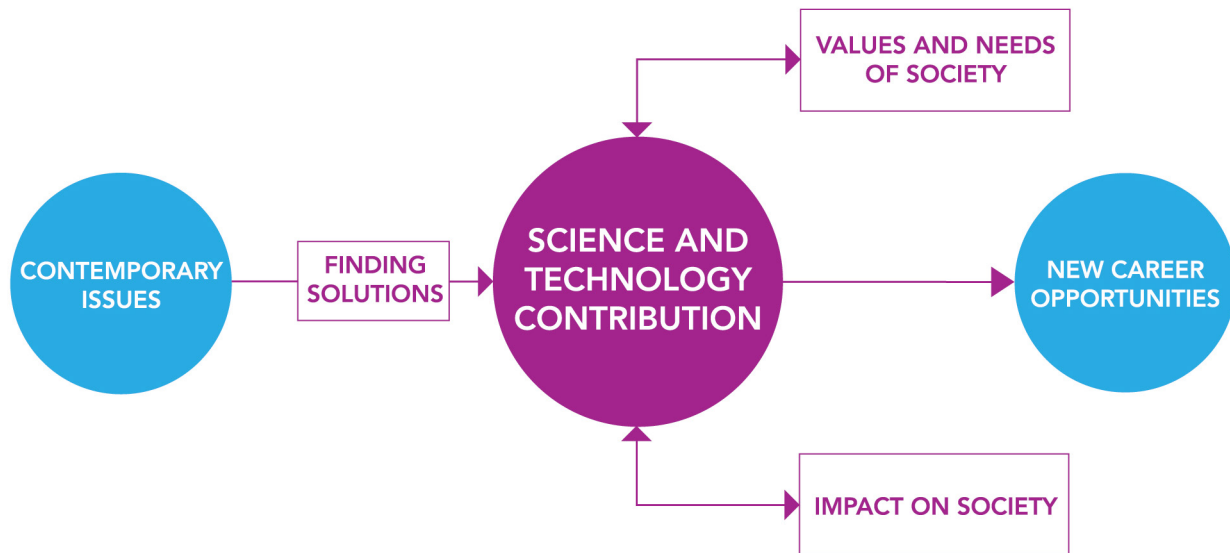
Quick reference table

Australian Curriculum: Science as a Human Endeavour

Australian Curriculum: Science as a Human Endeavour	Tasks				
Year 7	1	2	3	4	5
ACSHE120 - Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations.					
ACSHE121 - Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management.					
ACSHE224 - People use understanding and skills from across the disciplines of science in their occupations.					
Year 8					
ACSHE135 - Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations.					
ACSHE136 - Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management.					
ACSHE227 - People use understanding and skills from across the disciplines of science in their occupations.					
Year 9					
ACSHE158 - Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries.					
ACSHE160 - People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions.					
ACSHE161 - Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities.					
ACSHE228 - The values and needs of contemporary society can influence the focus of scientific research.					
Year 10					
ACSHE192 - Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries.					
ACSHE194 - People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions.					
ACSHE195 - Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities.					
ACSHE230 - The values and needs of contemporary society can influence the focus of scientific research.					
General Capabilities					
Personal and Social Capability: social awareness; and self-awareness					
Ethical Understanding: understanding ethical concepts and issues; reasoning in decision making and action; exploring values, rights and responsibilities.					
Critical and Creative Thinking: inquiring – identifying, exploring and clarifying information ideas; generating ideas, possibilities and actions; reflecting on thinking and processes; analysing, synthesising and evaluating reasoning and procedures.					
Literacy					

How will we know if they got it?

What evidence will enable us to assess the intended learning?



Science as a Human Endeavour

1. Students' knowledge and understanding of how professionals use forensics.
2. Students' understanding of the role of science, technology, engineering and maths (STEM) in forensic science and the STEM careers involved.

Personal and Social Capability and Critical and Creative Thinking

3. Students' ability and disposition to reflect on their own and others' beliefs.
4. Students' ability to participate in a whole class discussion.

Ethical Understanding and Critical and Creative Thinking

5. Students' ability to identify current and future ethical issues relating to forensics and to articulate their position with reasons on these issues.
6. Students' ability to participate in reasoned discussion with peers (in pairs, small groups, or whole class) including the ability and disposition to draw on evidence and an underlying ethical principle when making informed decisions, as well as to evaluate their own and others' reasons.

What will we do to get there?

How will we engage, challenge and support their learning?



Tasks will draw on students' prior knowledge, relate learning to students' everyday lives and provide opportunities for students to direct their own learning. Throughout the unit, students will be expected to:

- reflect on their own ideas about forensics and how the ideas of others may differ from their own;
- understand how people use forensics to solve crimes and solve problems;
- engage in reflection and analysis during whole class discussions, group activities and peer assessment tasks; and
- understand the ethical considerations involved.

The three big ideas of the South Australia Teaching for Effective Learning framework (TfEL), were used in designing this unit:

Create safe conditions for rigorous learning

Focus – building a community of learners

Develop expert learners

Focus – expanding strategies for thinking, learning and working collaboratively

Personalise and connect learning

Focus – building on learners' understanding.

Tasks

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Task 1:

What is forensic science?

Australian Curriculum Links			
Year 7 ACSHE 121	Year 8 ACSHE 136	Year 9 ACSHE 160 ACSHE 228	Year 10 ACSHE 230
Personal and Social Capability Critical and Creative Thinking			

Part 1: Forensic scientists and CSI on the screen
As a class, collated on the board, ask students to:

- List of the characters in movies and TV shows that carry out CSI (Crime Scene Investigation) and forensic work
- Identify the skills they need for their job

Then discuss:

- the features of their personalities that make them suited to their work
- whether students find the work appealing or not and why or why not
- why forensic science is so popular on TV and in movies

Part 2: What is forensic science?

Students read the following basic summary of forensic processes. Throughout the reading are questions for students to consider, research and respond to. Written responses to these questions could be used as an assessment piece for this unit for students in Year 9 and 10; students in Years 7 and 8 will need support to answer these questions.

Activity: Student reading

What is forensics?

Forensics consists of three separate processes. The first process takes place when evidence is recorded and collected from a crime scene, this is generally known as the crime scene analysis. In many cases, the crime scene is investigated with a suspect or a hypothesis in mind, so something is only considered evidence when it is related to what is already known about the crime being investigated. Knowing how to collect



specimens in order to preserve them and reduce contamination is well documented in forensics, but knowing what to collect, especially when lacking details of the crime, is particularly difficult – even for the experts.

Questions:

1. How can anyone be certain a crime scene has been properly investigated?
2. What is the role of bias when collecting evidence to support the idea that a particular suspect is guilty?
3. What would be the benefits and drawbacks of collecting everything from a crime scene as 'evidence'?

In the second stage of the process, specimens considered to be evidence are brought back to the laboratory to be analysed, interpreted and evaluated. This means they are examined or tested using scientific experimentation. Here, for example, drugs are identified, body fluids are profiled and where possible matched, and weapons examined against the crime scene (for any marks they might leave).

Task 1:

What is forensic science?

Australian Curriculum Links			
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Personal and Social Capability Critical and Creative Thinking			

In their own words

Claude Roux, the director of The Centre of Forensic Science at the Sydney University of Technology (UTS) says forensic evidence, "... is quite fragile and it can be corrupted, it can be destroyed, lost very quickly and it can be contaminated."

Contamination or cross transfer of potential evidence is a very real concern; which is why there are standard practices in place to minimise human error.

"All forensic science organisations operate to very strict standards of quality and assurance," says Professor James Robertson, director of The National Centre of Forensic Studies at the University of Canberra. Most laboratories have an accreditation through the National Association of Testing Authorities (NATA), a third party body that verifies the appropriate standards are being met. Lab scientists must also do ongoing proficiency tests through NATA to show that they are getting the right results.

"Everything that's done at the end of the day goes through a technical review process to try and make sure that there's no possibility that an incorrect result would leave the laboratory," said Robertson.

Questions:

4. If blood of the victim and accused is found on both parties, what does this tell us about how the crime happened?
5. How should different pieces of evidence be weighted? That is, is some evidence more important than other pieces of evidence and how does anyone decide this?
6. What is the role of error in test results, such as false positives (saying something is true when it is not) and false negatives (saying something is negative when it is not).
7. How reliable do the test results need to be before we can think about using them in court?
8. How do we know when our specimen really is a match? For example, if we compare two cars that may have been involved in a crime, there are many features that are similar and different, to what level do we compare these features before we say which car was the car involved in the crime?

Task 1:

What is forensic science?

Australian Curriculum Links			
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Personal and Social Capability Critical and Creative Thinking			

Once lab tests have been done, the results of the analyses come back and are collated. From this information the investigators will try to reconstruct events and determine if their hypothesis was correct.

In the third stage of the forensic process, evidence is presented to court where the experts are cross-examined. The outcome of this process helps inform a judge or jury to make decisions about gaol sentences. Forensic scientists must be very sure to be scientifically rigorous and impartial in presenting their results.



“All these different domains in which forensic scientists are involved make the job much more challenging and more interesting in my view,” said Roux.

Questions:

9. In court, should all evidence be presented to support a particular theory, or should all the theories be presented and, given the evidence, decisions made over which is most likely?
10. If the judge or jury are not scientists, does it matter if they don't understand the tests carried out on the evidence when it is explained to them?
11. How do the judge or jury weigh the evidence presented to them when making a decision?
12. Should the evidence that is presented be aimed at convicting the guilty or clearing the innocent? Does it matter?

Ask students to suggest at least two more questions about forensics that they would like answered.

Task 2: Forensic scientists at work

Australian Curriculum Links			
Year 7 ACSHE 120 ACSHE 121 ACSHE 224	Year 8 ACSHE 135 ACSHE 136 ACSHE 227	Year 9 ACSHE 158 ACSHE 160 ACSHE 161 ACSHE 228	Year 10 ACSHE 192 ACSHE 194 ACSHE 195 ACSHE 230
Personal and Social Capability Critical and Creative Thinking Literacy			

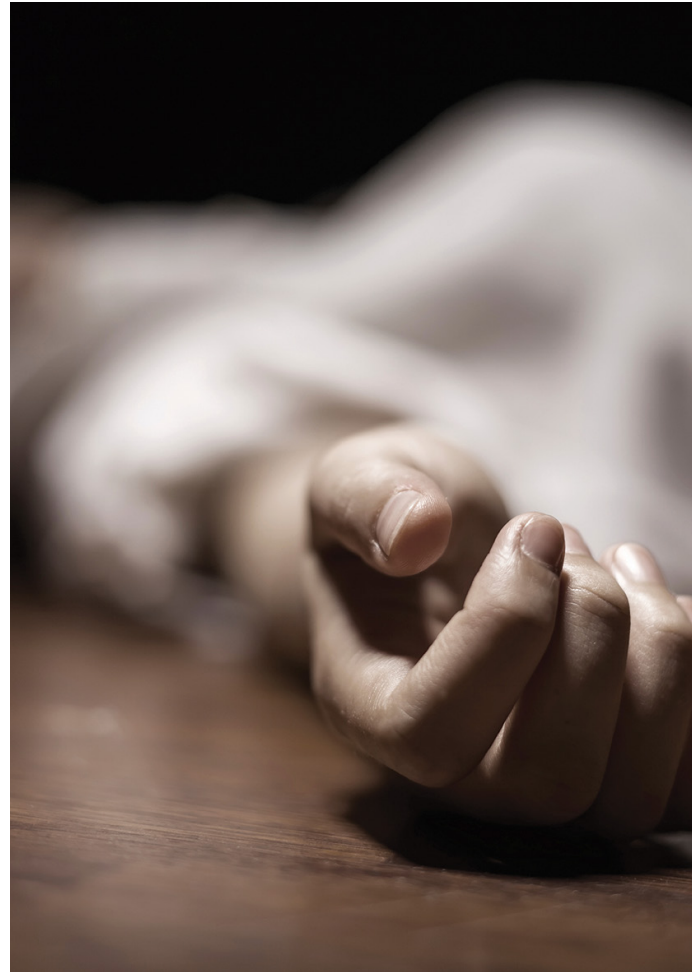
Part 1: Crime Science Investigation – methods and skills

Students read the following fictional crime scene description and, working in pairs or individually, imagine they arrive on the scene to investigate. Students are to put together a brief step-by-step description or plan of how they would investigate the scene then share and discuss their plans as a class. For example, students should think about: What evidence to collect? What data to record? What skills will they need to use? Students should always justify their responses.

Crime Scene:

A murder was committed overnight. The victim was identified as a single, 30-year-old woman. Her body was found lying on the floor of her laboratory at 7.17 am by a cleaner. The body was cold and stiff, suggesting that the victim had been dead for several hours. The laboratory was a mess with equipment scattered over the benches and on the floor. Shortly after a medical examiner came and removed the body in order to carry out an autopsy. Photos were taken of where the body had been found. None of the other items in the laboratory were disturbed.

The autopsy report was conclusive; it identified the murder weapon as a blunt object that had fractured the skull. The victim had cuts and bruising to the face and arms.



Task 2: Forensic scientists at work

Australian Curriculum Links			
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Personal and Social Capability Critical and Creative Thinking Literacy			

Part 2: The forensic science inquiry process
Students are to read through the following information and note the jobs and skills outlined on the STEM handout (page 17) (builds on Task 1 Part 1). Then have students watch the forensic science interviews (page 16) and add any additional information to the notes they have already made.

Activity: Student Reading Everything leaves a trace

Even the smallest of clues left behind at a crime scene can indicate who was there, and what happened. A fragment of fabric here and a couple of human hairs there can be all that is needed to put a culprit in the hands of the criminal justice system.

Forensic science involves the detection, analysis and exploitation of information from traces left by a crime. However, this definition is evolving, with many forensic techniques now being used in crime prevention and identifying victims of man-made and natural disasters. Forensic science is interdisciplinary by nature, encompassing biology, chemistry, engineering, toxicology or really any science that can aid in crime investigation. The types of crimes can also widely vary, ranging from homicide to arson to fraud.



Even the smallest of clues left behind at a crime scene can indicate who was there, and what happened.

Task 2: Forensic scientists at work

Australian Curriculum Links			
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Personal and Social Capability Critical and Creative Thinking Literacy			



James Robertson, director of The National Centre of Forensic Studies at the University of Canberra says forensic science is a highly rewarding field as it enables you to solve “real-world problems”. “You’re contributing in a useful, social way by helping victims, as well as contributing to a just outcome for people who are charged with committing crimes,” he says.

Popular crime shows usually feature a small, multi-talented team, but real-life forensic scientists are highly specialised. Forensic science disciplines can be divided into three broad categories: field, laboratory and medical. Crime scene investigators work ‘in the field’. They might take photographs, collect evidence or examine the overall scene as it lies. As testing is sometimes done on site, there is a lot of crossover between field and laboratory jobs.

Laboratory forensic scientists identify traces such as paint, fibres, illicit drugs or explosive residues. They may also match fingerprints – the National Automated Fingerprint Identification System in Australia contains over 3.3 million records collected by police and immigration authorities.

Other traces left at a crime scene can include blood, saliva, hair and skin, which can yield traces of DNA. DNA profiling allows forensic scientists to identify a person as well as the type of bodily material found. They can test against over 700,000 records on the National Criminal Investigation DNA Database taken from crime scenes, missing persons and convicted offenders. DNA profiling is becoming more efficient as newer techniques require less biological material and technology allows for more automated processing. In the future, tests are even expected to be able to determine characteristics such as hair and eye colour from a DNA sample.

Task 2: Forensic scientists at work

Australian Curriculum Links			
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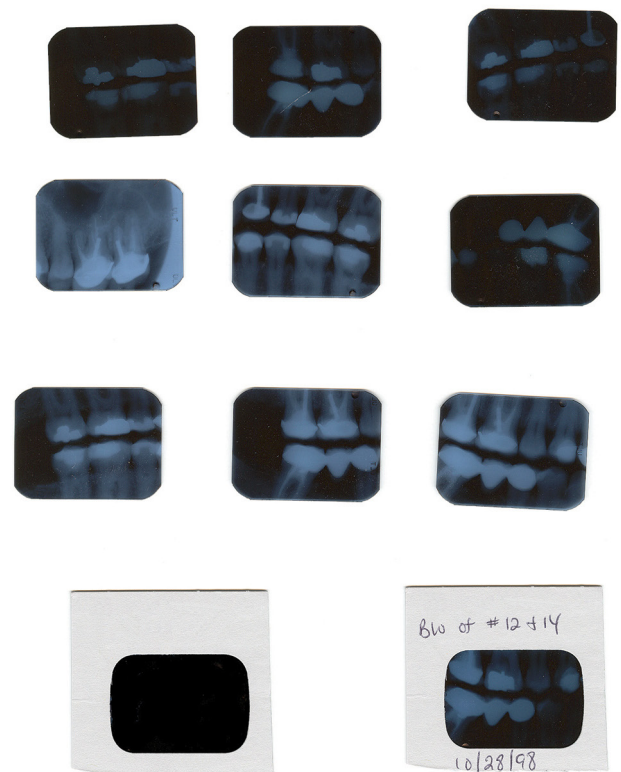
Forensic medicine is the oldest form of forensics. To determine a victim's time and cause of death, you would request that a pathologist conducts a post-mortem examination. After which, a forensic odontologist could identify the individual from their dental records. If behaviour needs to be assessed, psychiatrists and psychologists can assess how a person's mental state might have influenced them in the crime.

Beyond the lab

Technology plays an integral role in crime scene investigation. Some of the more unlikely forensic laboratory scientists include IT specialists, who might recover evidence from a mobile phone or examine computer hardware and software. Everything we do nowadays leaves a digital trail behind us – the money we spend, the places we go, even the apps we use all collect data on our whereabouts and behaviour. This data is indispensable to add to the evidence that can go towards incriminating someone of a crime. It's not just about making a conviction. Forensic accountants present to courts the transactions involved in insurance payouts, calculating risk, and tracing funds that need to be recovered, to name just a few examples. There are also 'questioned document examiners', who work to identify handwriting, as well as paper, inks and toners in order to verify a document's authenticity.

Even old-fashioned photography is indispensable as a record-keeping device in crime investigations. It is a legal requirement that a scene is photographed before anything is moved. "It's a very good way of accurately recording what's at a scene in situ," says Sarah Cresswell, a senior

lecturer in forensic science at Griffith University. Crime scene photographs can be used to present evidence in court and digital manipulation means that images can be enhanced to allow for low light, and life size images can be printed to compare something like shoe imprints to a real shoe sole. Incriminating footage or photographs can also be used as evidence on their own.



Forensic odontologists with their extensive knowledge of the makeup of the human mouth, are able to collect dental evidence from a variety of sources and use it to identify both victims and suspects.

Task 2: Forensic scientists at work

Australian Curriculum Links			
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Personal and Social Capability Critical and Creative Thinking Literacy			

Beyond the lab

Not all clues are captured by photography and the naked eye. Traces of bloodstains that have been cleaned up can be revealed with certain chemicals. Luminol is a chemical that exhibits a luminescent reaction when combined with the iron in haemoglobin in blood. When sprayed evenly over a surface, any trace bloodstains will display a blue glow. "Luminol is one of a range of different materials we can use to visualise suspected bloodstains. It's bright and colourful so it's easy to see," says Cresswell.



Forensic biology



Forensic chemistry



RACHEL, art and forensics



Forensic toxicology



Forensic pathology



JASON, SAPOL CSI



RACHEL, problem solving

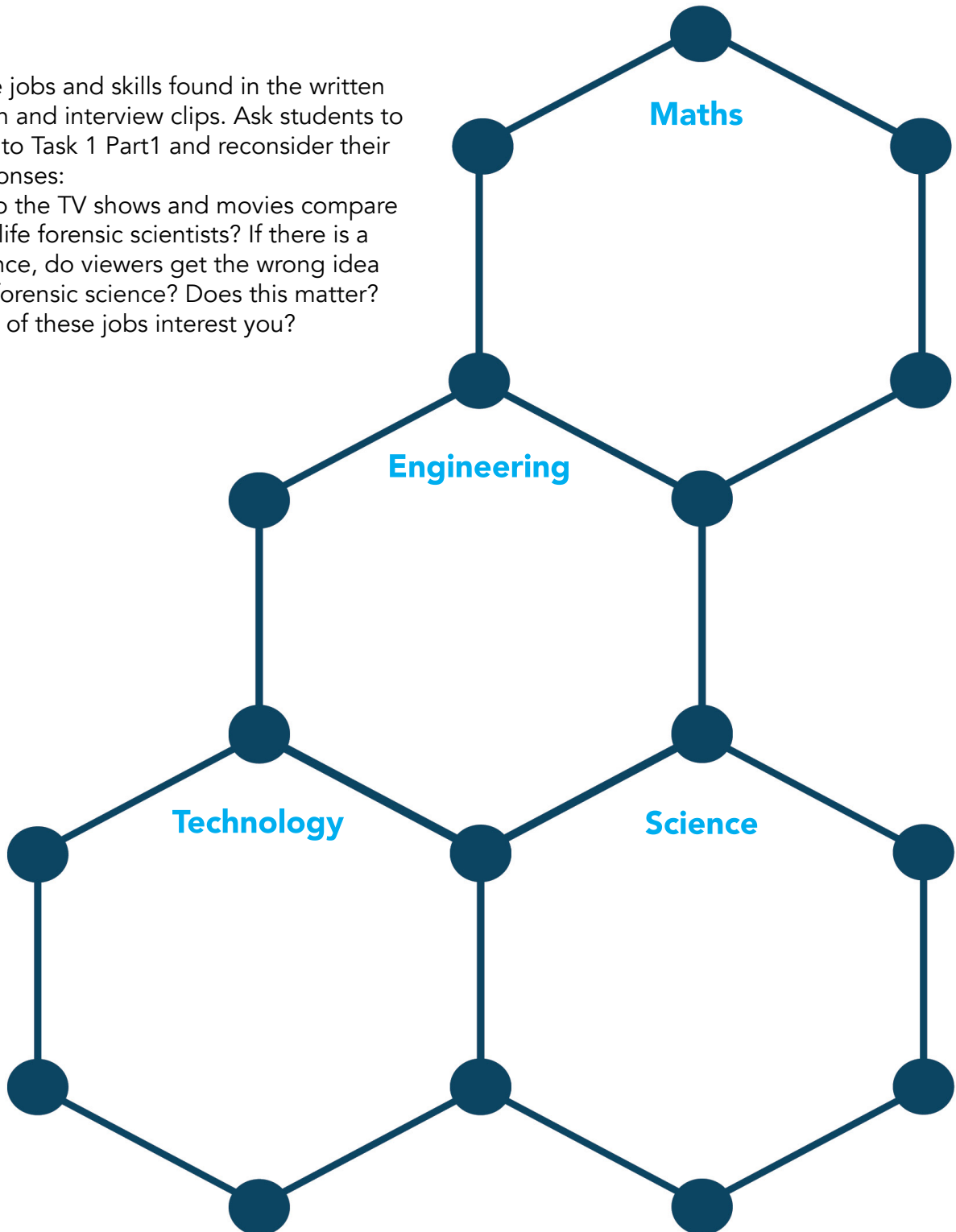
Note: Although Rachel doesn't work in a forensic science field, her work uses forensic methods and similar technology. It might be interesting for students to consider the similarities between her work and the work of others featured here.

Task 2: Forensic scientists at work

Australian Curriculum Links			
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Personal and Social Capability Critical and Creative Thinking Literacy			

Record the jobs and skills found in the written information and interview clips. Ask students to think back to Task 1 Part1 and reconsider their initial responses:

- How do the TV shows and movies compare to real life forensic scientists? If there is a difference, do viewers get the wrong idea about forensic science? Does this matter?
- Do any of these jobs interest you?



Task 3: Forensic science timeline

Australian Curriculum Links			
Year 7 ACSHE 120 ACSHE 121	Year 8 ACSHE 135 ACSHE 136	Year 9 ACSHE 158 ACSHE 228	Year 10 ACSHE 192 ACSHE 230
Critical and Creative Thinking			

Students are to examine the timeline (below) and discuss which of the listed technologies they think has made the biggest impact on forensic science. Which are inventions and which are discoveries? Which invention or discovery was the most important in changing the way forensic investigations are carried out, or improving the quality of the findings? Explain your reasons.

Ask students to project themselves into the future and imagine what forensics might look like in 20 or 50 years' time: the science, the technology and jobs. You could have students engage in a class discussion, make a list of what they imagine, or describe a hypothetical crime and how it might be solved.

Date	Event Timeline
44BC	The first recorded autopsy was that of Julius Caesar.
1540s	The first forensics textbook was produced.
1600s	French doctor Ambroise Paré laid the foundations for modern forensic pathology through his study of trauma on human organs.
1820	Eugène François Vidocq pioneered the first use of ballistics and began taking plaster casts of shoe imprints.
1830	Chemist James Marsh used standard scientific testing to determine that a man murdered his grandfather by arsenic poisoning. This assay is now known as the Marsh test.
1890	First use of the Henry System for fingerprint classification. Edmund Locard developed the 12 matching points for fingerprint comparison. He was also responsible for one of the principle tenets of forensic science, that of "every contact leaves a trace".
1910	The first method for determining ABO blood groups from dried bloodstains was developed.
1920	Dr Calvin Goddard used comparison microscopy to compare shell casings from the scene of the St Valentine's Day Massacre, which led to a raid on Al 'Scarface' Capone's home and the recovery of two of the weapons from the crime.
1930s	Luminol began to be used in the identification of blood stains.
1980s	Development of DNA profiling, and the establishment of DNA databases such as CODIS, which can be used for comparison of DNA profiles recovered from crime scenes and suspects.

Task 4: Forensics and the scientific method

Australian Curriculum Links			
Year 7 ACSHE 224	Year 8 ACSHE 227	Year 9 ACSHE 160 ACSHE 228	Year 10 ACSHE 194 ACSHE 230
Critical and Creative Thinking			



JASON, SAPOL CSI, problem solving

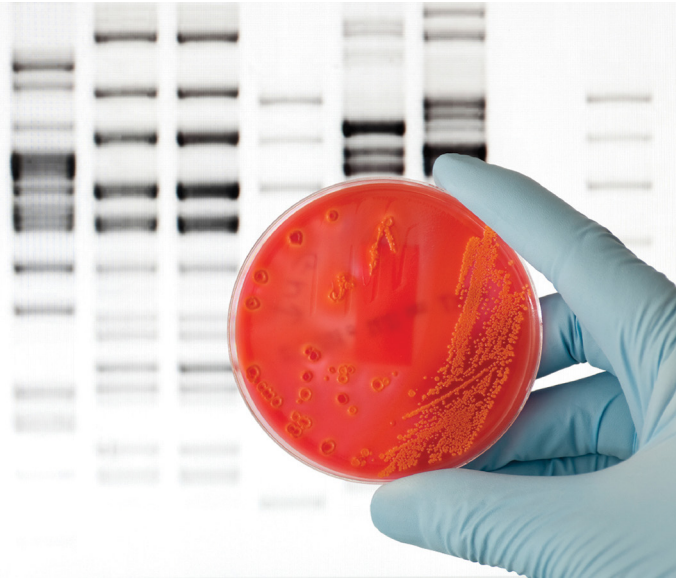
Students are to watch Jason's Problem Solving clip in which he discusses the scientific method he uses in his work. Ask students to note this method and then compare it to the scientific methods they use in the classroom when doing science experiments and outside of the classroom when they are solving a problem. Students will come to see the similarities between the methods used and that they are all variations on the scientific method. The step that may differ may be peer review, however students might think of problems they solve outside of the classroom that also require peer review.

Suggestions for Assessing Task 4

Here you could assess students' actual understanding of the scientific method and their ability to transfer that understanding across various situations and circumstances.

Task 5: Ethics and forensics

Australian Curriculum Links			
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Personal and Social Capability Ethical Understanding Critical and Creative Thinking			



Explain to students that one of the tools forensic scientists could use to help identify DNA samples is a collection of everyone's DNA, kept in a huge digital DNA database. Such a database may make it easier for forensic scientists to match crime scene DNA samples with a specific person but this sort of data collection does raise ethical questions. You may need to provide students with a brief description of what a DNA database is. (For example: http://en.wikipedia.org/wiki/National_DNA_database) and refer back to page 14 of this pack.

To prepare students for thinking about the ethical issues around DNA databases introduce them to a piece of stimulus; an article, news items, movie clip that raises the idea of DNA databases, how they work and why they are controversial. You could read to students or have them read one or more of the following online items or some other piece of stimulus.

Suggestions for stimulus

- Australian Government, National DNA database systems
<http://www.alrc.gov.au/publications/43-dna-database-systems/dna-database-systems>
- Emerging DNA technology will impinge on privacy: civil liberties Australia
<http://www.canberratimes.com.au/act-news/emerging-dna-technology-will-impinge-on-privacy-civil-liberties-australia-20131116-2xnzt.html>
- Russia's top forensics officer backs fingerprint, DNA database
<http://en.ria.ru/russia/20100401/158391007.html>
- Should we fear DNA testing?
<http://www.theguardian.com/commentisfree/2013/nov/03/dna-testing-privacy-concerns-benefits>
- Law change 'to ID tsunami dead'
http://news.bbc.co.uk/2/hi/uk_news/4356131.stm
- Cost barrier to establishing DNA database
<http://www.odt.co.nz/news/dunedin/289246/cost-barrier-establishing-dna-database>

Task 5: Ethics and forensics

Australian Curriculum Links			
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Personal and Social Capability Ethical Understanding Critical and Creative Thinking			

Ask students to give you their initial response to the question – would you register your DNA? Then, ask them to think about where they stand on this issue of DNA databases: Should we have National DNA databases – why/why not? Give students a few minutes to think about this question for themselves. Have each student write down their stance and list their reasons.

Draw on the board 3 columns: Yes, we should have a National DNA database/No, we should not have a National DNA database/I'm not sure. You can either ask students randomly to offer their position and reasons making sure that eventually everyone speaks. Or you can address each position in turn and record students' responses. It is recommended that you record students' names next to their reasons on the board and always clarify with students that you have accurately captured their thoughts.

The table (pg 23) lists some of the reasons students might give but it is not exhaustive. If there is an important reason that students don't raise you should raise it and encourage the students to discuss it and decide in which column it should go.

This exercise typically raises both ethical (how we ought to behave and treat others) and empirical (factual) questions that will need to be answered. You should now work with students to categorise each question as either empirical or ethical and record this too.

You may like to try and answer 'easy' questions while collating students' reasons (asking individual students to research a point while the class continues to discuss) or you could record all the questions and split the class into research groups to tackle the empirical questions.

The ethical questions really should only be discussed once all the empirical questions have been answered as they could have great bearing on what must be considered in answering the ethical questions. For example, there is no reason to argue a point on the basis of an incident where DNA databases shouldn't be allowed because there are no laws around how that information can be used or because the database is available for teachers or employers to use at will. Facts must be accurate; this is one criteria of a 'good' reason.



DNA can be collected from virtually anywhere. It could be a hair, saliva, blood, semen, skin, sweat, mucus or earwax. All it takes is a few cells to obtain enough DNA information to identify a suspect with near certainty.

Task 5: Ethics and forensics

Australian Curriculum Links			
Year 7 ACSHE 120 ACSHE 121	Year 8 ACSHE 135 ACSHE 136	Year 9 ACSHE 158 ACSHE 160 ACSHE 161 ACSHE 228	Year 10 ACSHE 192 ACSHE 194 ACSHE 195 ACSHE 230
Personal and Social Capability Ethical Understanding Critical and Creative Thinking			

What is important here is that students practice giving reasons and evaluating their own and others' reasons. This is an important disposition and set of skills to develop in students in relation to science and everyday life. Raising and addressing ethical questions in the classroom ought to be encouraged and is supported by the Australian Curriculum: General Capability: Ethical Understanding. There are many resources to support teachers in this task, most notably, resources captured under 'Philosophy for Children' and 'Community of Inquiry'.

Ask students to look back at their original piece of writing outlining their position and reasons and share whether or not they have changed their position and/or their reasons and explain (in writing or verbally) why or why not. Perhaps there was a piece of evidence they didn't have when they first chose a position on the issue, or a peer made a point they hadn't previously considered. Students can also explain what they have learnt about the topic and about how to answer ethical questions.

Suggestions for Assessing Task 5

Peer assessment of reasoning and discussion skills: as a class, prior to engaging in the task, develop a set of criteria for a reasoned whole class discussion. Students should be able to identify basic criteria for engaging in whole class discussion. Students could also use these criteria to assess their own reasoning and discussion skills and even identify a specific skill which they would like to focus on developing. As for the reasoning elements, you could develop your own checklist using the criteria for Community of Inquiry discussions or use the checklist on the RiAus website:

http://riaus.org.au/wp-content/uploads/2013/05/SBTH_Reasoning_Skills_checklist.pdf. Ultimately you want students to be skilled at clearly articulating their position and reasons on an issue and be prepared to reassess this position and their reasons in the light of new evidence, circumstances or other relevant considerations.

Note: the terms 'morally' and 'ethically' are used interchangeably in this resource

There are many resources to support teachers in this task, most notably, resources captured under 'Philosophy for Children' and 'Community of Inquiry'. Here are some resources that will be helpful: Institute for the Advancement of Philosophy for Children (IAPC) www.montclair.edu/cehs/academics/centers-and-institutes/iapc/what-is/

- DeHaan, C., MacColl, S. & McCutcheon, L. (1995) *Philosophy with Kids*, Book 3, Hawthorn: ACER, pp. 13-17
- Cam, P. (1995) *Thinking Together*, Sydney: Hale & Iremonger, pp. 41-54
- White, T (1988) *Right and wrong a brief guide to understanding ethics*. New Jersey, Prentice Hall.
- Burgh, G., Field, T. & Freakley, M. (2006) *Ethics and the Community of Inquiry: education for deliberative democracy*. Australia: Thomson Social Science Press.

The Philosophy for Children movement uses Community of Inquiry as its primary methodology. In the pack 'You can be a scientist' the Community of Inquiry method was referred to in relation to whole class guided discussions. This same methodology should be used for whole class discussions of ethical questions.

Task 5: Ethics and forensics

Australian Curriculum Links			
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Personal and Social Capability Ethical Understanding Critical and Creative Thinking			

Should we have National DNA databases

– why/why not?

(Anticipated student responses – list not exhaustive)

Yes, we should have a National DNA database	No, we should not have a National DNA database	I'm not sure
We could find out who committed crimes in the past, which would close cases and help victims and their families.	It is an invasion of our privacy. People would know who I was related to. That information shouldn't be publically available.	I'm not sure; I need to know more about the privacy rules before making a decision. If the rules are clear and don't allow info to be made available to just anyone then it might be okay.
When there are natural disasters it will help us to identify victims and connect them with family and do it fast.	It would cost so much money to build the database, collect the DNA and maintain it that it just wouldn't be worth it.	It would depend at what age or why the DNA was recorded. Do all babies get recorded when born? All criminals? Everyone who goes to the doctor? Only when you turn 18?
If there are clear laws about who can and can't access the information and what the info can and can't be used for then it would be okay.	Even if we did have someone's DNA and their name, if we didn't have their current address or phone number what good is the information.	
There should be a National Database in other countries but in Australia we don't need one as we don't have that many criminals or natural disasters.	There could be rules and laws in place to police who can access the information and why but these rules can always be broken and the information is too personal to risk it. The damage that could be done is too much to risk it.	
Yes, we should have a database to fight crime but it should only be voluntary not compulsory.	What if people could see if I have a genetic disease – that sort of information is private and shouldn't be recorded outside medical documents. What if employers found out and didn't hire me because I was going to get sick in 10 years' time?	
It might act as a deterrent for criminals and so prevent crime.	No it wouldn't stop crime. There would still be crimes of passion.	
It would stop people from being wrongly accused of a crime if there was DNA evidence and a match found in the database.	We could still end up wrongly convicting people if there is a problem with the database or human error.	

Task 6: Personal reflection

There are a number of ways to engage students in reflection of the tasks they have completed. You could use some or all of the following options.

Ask students:

- How do you use forensic methods in your everyday life?
- How do forensic scientists help society? What is the important role they play?
- Will you look at the forensic science and CSI TV shows differently knowing what you do now? Why/why not?
- What is the most interesting thing you have learnt in this unit?



Resources

Websites

A brief history of forensic science, RiAus

<http://riaus.org.au/articles/a-brief-history-of-forensic-science/>

Fingerprints, firearms and foul play, RiAus

<http://riaus.org.au/articles/fingerprints-firearms-and-foul-play/>

The Forensic Teacher magazine

<http://www.theforensicteacher.com/Home.html>

Australian Institute of Criminology Career Information

http://www.aic.gov.au/criminal_justice_system/resources/criminologycareers.html

Crime and Forensics, NewScientist

<http://www.newscientist.com/topic/crime-and-forensics>

Relevant articles/reports

Faulty forensic science under fire, Nature News, 4 February 2014

<http://www.nature.com/news/faulty-forensic-science-under-fire-1.14664>

DNA Analysis exposes flaws in inexact forensic science, New York Times, May 18 2014

<http://www.nytimes.com/2014/05/19/us/dna-analysis-exposes-an-inexact-forensic-science.html>

Videos

PDplus special edition: Forensic science

<http://riaus.org.au/events/pdplus-special-edition-forensic-science/>

How to become a forensic scientist. - Short introduction to roles in an investigation (1.41)

<http://www.youtube.com/watch?v=kEkk13J3YIk>

Careers in forensic science. A PowerPoint presentation by a high school teacher. (11.51)

<http://www.youtube.com/watch?v=8HejH18bErA>

What is forensic science? Specific jobs and branches of science, shows lab work and interviews with different skilled workers. (4.06)

http://www.youtube.com/watch?v=_58XsN6XJWQ

Forensic scientist career overview. Lists many of the jobs and tests carried out. (1.48)

<http://www.youtube.com/watch?v=pO8jUKx6tok>

An ABC report on forensic dentistry (1.27)

<http://www.abc.net.au/news/2011-10-17/forensic-scientists-put-the-bite-on-crime/3575798>

Ri Aus STEM careers

STEM Careers Pack 8: Follow your interest in ... Forensics is a publication of RiAus (Royal Institution of Australia) in partnership with DECD (Department for Education and Child Development). 2014.

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Child Development