POTENTIA MENTIS

cognitive performance + academic potential

Study and Motivation

Kinross Wolaroi School

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Potentia Mentis
THE SCIENCE OF ACADEMIC PERFORMANCE

STUDY SKILLS

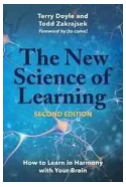
Introduction

Welcome to a series of six sessions in which you are provided with a range of research-based strategies to maximise learning and study. In the past students were given well meaning, 'generic' advice about study ...' make summary notes, re read material etc' We now know that many of these ideas were actually counterproductive and the reason we know is simple: technology. The advent of Functional Magnetic Resonance Imaging (FMRI) in particular has enabled researchers to actually watch the brain at as it 'learns'. This in turn has led to more specific research into the most effective ways to enable this learning to be consolidated and used efficiently. And that's what *you're* about to learn in this course.

What is Study?

The working definition that we'll use in this course is:

Study/Learning involves using research-based strategies to help the brain take in, encode, store, and recall information with a high level of accuracy and fluency.



Textbook

The recommended textbook for the course is '***The New Science of Learning'*** (Doyle, Zakarajsek) – you are encouraged to purchase the book before commencing the course.

Links to purchase and read reviews of the book can be found – here.

(eBook format is recommended because you can download and begin using immediately)

You are also encouraged to enrol in the Massive Open Online Course (MOOC) below.

Learning How to Learn (Dr Barbara Oakley)

Youth Version – Year 5 – Year 7

Adult Version – Year 8 – Year 12

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Course and Session Structure

Each session will focus on one or two study strategies including some brief, neuroscientific context (the '*why*') as well as *how* they work.

The strategy will be explicitly *described,* and you will be directed to *apply* that skill/s, set your own *measurable criteria* for its effectiveness, and make a note of any questions that arise.

A short **homework task** will be set to *consolidate* the skill and you are encouraged to complete a pre-reading or other activity in preparation for the following week.

Remember: Learning any new skill occurs along a continuum;

1. **Unconscious Incompetence:** I don't know anything about study skills, and I don't know that I don't know!
2. **Conscious Incompetence**: I'm aware that I may not know what or how to study effectively.
3. **Conscious Competence**: I'm starting to understand and apply these skills but it's still taking a lot of cognitive effort to remember how they work.
4. **Unconscious Competence**: I'm now using these skills fluently because I know exactly how they work.

Before you begin the course, it is recommended that you;

Purchase: *New Science of Learning.*

Read: Chapter 1 – *A New Look at Learning*

And finally, you can email me directly with any questions

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Session 1

How the Brain Learns

All parts of the brain have a role to play in learning;

When you're sitting in class, visual information enters and is processed via the *Occipital Lobe*, auditory information in the *Auditory Cortex* and your *Frontal Lobe* is helping you to concentrate and supress distractions as well as holding this information in short term memory.

This sensory information travels as electrical and chemical signals along nerves in the brain called Neurons and is assimilated to create a 'package' of information or network of neural information. When this information is reactivated, the brain forms memories. More frequent reactivation = stronger neural connections = 'stronger' memories.

Short- and Long-Term Memory

At the end of a typical day at school, you arrive home with several mental 'packages' of information, one from each subject period. At this stage these packages are stored in your **Short Term or Working Memory.** This is where study comes in!

If you don't *do anything* with this information, it will quickly fade and ultimately disappear altogether. The purpose of study, particularly the skills we're about to look at, is to help move this information to **Long Term Memory.** This makes it freely available for later use e.g. During the examination period.

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Attention in Class

Effective information storage begins with attention. When you can focus and 'pay' attention in class or on Zoom, information taken in is more likely to be accurate and detailed. Attention is more than just looking at the teacher.

Selective Attention is your ability to tune out distractions and *really focus* on what is important at the time. Sustained attention is your ability to do this for increasing periods of time.

Read more about different types of attention – **here.**

Try the **Stroop Test.** (a common tool used to measure attention)

Developing your selective attention is often likened to going to the gym and working your muscles, in other words, it takes effort, but you'll be motivated to keep going when you see results – you're building your own computer!

What helps the Brain to 'Pay' Attention in Class?

How to help yourself focus in class:

- Make sure you have something to eat and drink at each break time. Your brain needs glycogen to sustain attention.
- Be on time (rushing into the room late means it will take you longer to focus)
- Have your equipment and books ready.
- Ask to sit near the front of you notice that this helps
- Ask to sit away from the window if you find yourself constantly looking outside.
- Do some quiet breathing when class begins. Just be aware of your breath and watch how your mind settles.
- 'Catch' yourself when your mind begins to wander and bring it back to the task.
- Take a mental break when you're really finding it hard to 'bring your focus back.' Many teachers will schedule this type of break in their class, but you'll also find natural opportunities within the flow of a lesson where you can just let your mind wander for 2-3 minutes – this is an equally important part of the learning process – watch Dr Oakley discussing the brain's 'focus' and 'default/diffuse' mode – **here.**

Before reading the next chapter;

Watch: The Neuron

Interact: Brainfacts.org

Read: How are Memories Formed? – QLD Brain Institute

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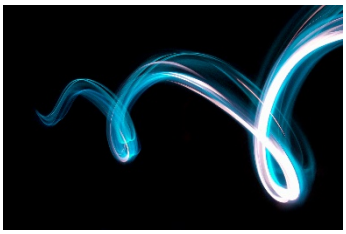
Session 2

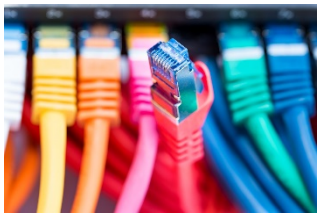
Retrieval Practice

'Traditional' study methods such as reading and re reading notes, typically describe various ways of reviewing information, a bit like pouring water into a bucket repeatedly. Neuroscientific research has confirmed that it is far more helpful to use your study time *drawing the information out* of your long-term memory – this is exactly what you need to do on exam day. This is called Retrieval Practice.

Regular retrieval of information from memory, reactivates and strengthens the neural connections to that information. When this process is repeated often enough, and with increasingly longer periods of time in between, the brain prioritises theses connections and strengthens them even further by a process known as **myelination** making the electrical signals travel even faster.



More Retrieval Practice is a bit like creating a super-fast, broadband connection to the information you need!



Examples of Retrieval Practice include;

- Information Download – Write all you can remember about a topic, then check your notes and add any detail you may have missed.
- Practice exam papers
- Quizlet and flashcards
- Verbal quizzes with a friend

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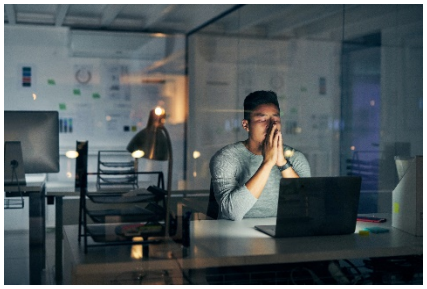
Spacing/Spaced Practice/Distributed Practice

Spaced Practice simply means, spreading out your study sessions over weeks and months rather than cramming the night before an exam.

The **most likely explanation** for the effectiveness of Spacing is that it further strengthens neural connections by making them 'work harder' to re-create patterns of memory. As a result, the brain prioritises this information making it more easily accessible.



Spaced practice is best incorporated into your structured study schedule by blocking in revision sessions at increasingly long intervals. **Note** – the length of these intervals should be individualised, i.e. based on your own experience of what works best. For example, you may know that in your case information needs to be first reviewed no later than one day after class and then reviewed again after 3 days etc.

Before reading the next chapter;

Download Resources - **Retrievalpractice.org**

Watch - **Retrieval Practice**

Read - **The Benefits of Retrieval Practice in Learning**

Read – **The Spacing Effect**

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LEARN TO STUDY USING...

Retrieval Practice

PRACTICE BRINGING INFORMATION TO MIND

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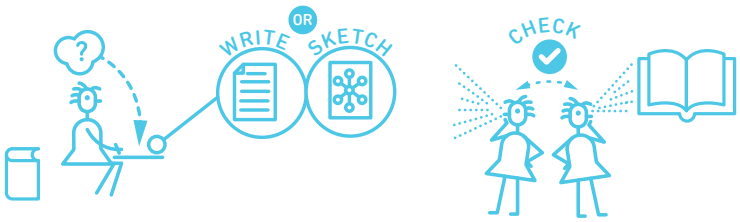
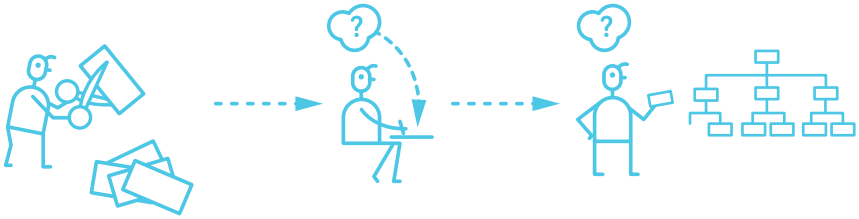
HOW TO DO IT

Put away your class materials, and write or sketch everything you know. Be as thorough as possible. Then, check your class materials for accuracy and important points you missed.



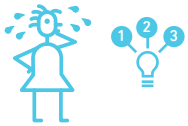
Take as many practice tests as you can get your hands on. If you don't have ready-made tests, try making your own and trading with a friend who has done the same.

You can also make flashcards. Just make sure you practice recalling the information on them, and go beyond definitions by thinking of links between ideas.

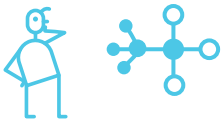


HOLD ON!

Retrieval practice works best when you go back to check your class materials for accuracy afterward.



Retrieval is hard! If you're struggling, identify the things you've missed from your class materials, and work your way up to recalling it on your own with the class materials closed.



Don't only recall words and definitions. Make sure to recall main ideas, how things are related or different from one another, and new examples.

RESEARCH

Read more about retrieval practice as a study strategy

Roediger, H. L., Putnam, A. L., & Smith, M. A. (2011). Ten benefits of testing and their applications to educational practice. In J. Mestre & B. Ross (Eds.), *Psychology of learning and motivation: Cognition in education*, (pp. 1-36). Oxford: Elsevier.

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LEARN TO STUDY USING...

Spaced Practice

SPACE OUT YOUR STUDYING OVER TIME

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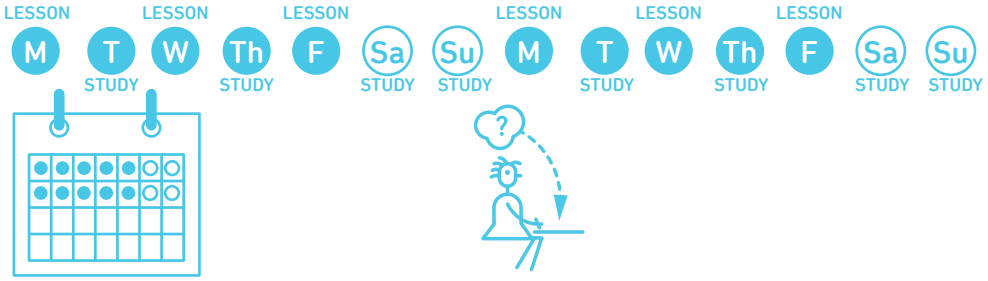
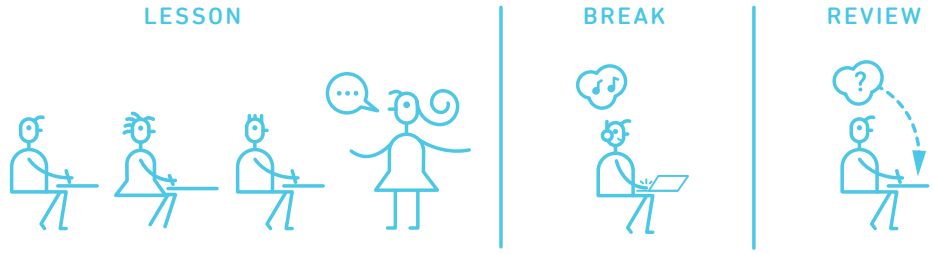
HOW TO DO IT

Start planning early for exams, and set aside a little bit of time every day. Five hours spread out over two weeks is better than the same five hours all at once.



Review information from each class, but not immediately after class.

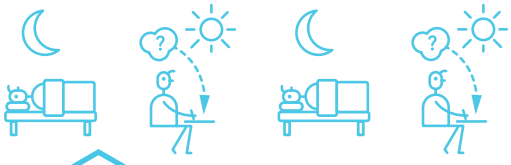


After you review information from the most recent class, make sure to go back and study important older information to keep it fresh.

HOLD ON!

When you sit down to study, make sure you are using effective study strategies rather than just re-reading your class notes.

This may seem difficult and you may forget some information from day to day, but this is actually a good thing! This forces you to retrieve information from memory (see Retrieval Practice poster).



Create small spaces (a few days) and do a little bit over time, so that it adds up!

RESEARCH

Read more about spaced pratice as a study strategy

Benjamin, A. S., & Tullis, J. (2010). What makes distributed practice effective? *Cognitive Psychology*, *61*, 228-247.

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Session 3

Elaboration and Dual Coding

Elaboration

Elaboration is a broad concept that includes a variety of strategies to help connect information with prior knowledge, creating more complete networks of memory and understanding.

By asking ourselves questions about the information, we create new neural connections and begin to understand how concepts are linked. Think of a time you went to a new holiday destination. On the first day you walked to the CBD from your house. The next day you might go to the local shopping centre. After a few days you had a clear mental picture for how all the local streets linked up to create a mental map of the city.

Elaborative Interrogation just means working with a study partner and asking each other 'follow up' questions:

How does this work?

Why is it done this way?

What would happen if?

Listen to an explanation of Elaborative Interrogation - **here.**

Other Elaborative strategies include;

- Creating Mind Maps
- Explaining a concept to someone who is unfamiliar with concepts – see the **Feynman Technique**
- Working with a study partner and asking each other elaborative interrogation questions to deepen knowledge.

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Dual Coding

Dual Coding Theory is based on the understanding that your brain processes and stores visual and other information differently. When you look at ideas and concepts via different media, your brain will create a more comprehensive network of information about that topic. For example, when you **read** Romeo and Juliet, **listen** to an audio version *and* **watch** one of the film versions, you now have a variety of sources to draw on when responding to an exam question. You'll more easily recall important quotes from the text and may also picture the same scene from the film. It's a bit like having a backup of information that you can draw on.



Note: Dual Coding, or the fact that you enjoy looking at pictures does not mean that have a 'visual Learning Style" – this theory has been **comprehensively disproven.**

Other examples of **Dual Coding** include;

- Drawing a cartoon strip to show plot structure.
- Looking at the pictures in your Geography textbook and writing your own description of the concepts they are depicting.

Watch: **Elaborative Interrogation**

Watch: **Dual Coding Theory**

Before reading the next chapter:

- Without looking at your notes, dictate your verbal explanation of a concept, theory or idea you're studying into the voice memo app on your phone. Imagine you are speaking to someone who knows nothing about this concept or idea.
- Now listen back, were there any gaps in your knowledge, did your explanation follow a clear chronological order? did you start by providing some context? (activating prior knowledge?
- Repeat the exercise with a different subject.

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LEARN TO STUDY USING...

Elaboration

EXPLAIN AND DESCRIBE IDEAS WITH MANY DETAILS

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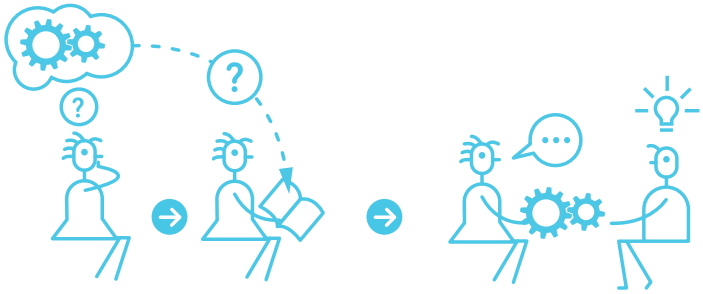
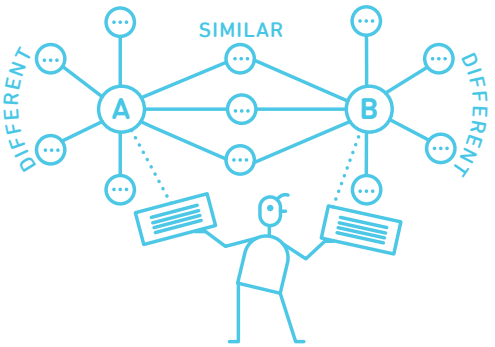
HOW TO DO IT

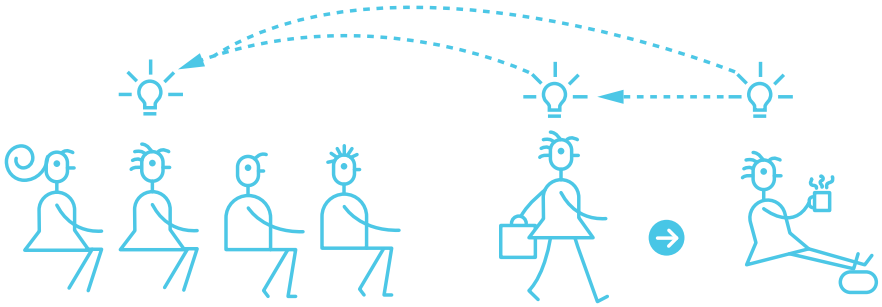
Ask yourself questions while you are studying about how things work and why, and then find the answers in your class materials and discuss them with your classmates.



As you elaborate, make connections between different ideas to explain how they work together. Take two ideas and think of ways they are similar and different.



Describe how the ideas you are studying apply to your own experiences or memories. As you go through your day, make connections to the ideas you are learning in class.



HOLD ON!

Make sure the way you are explaining and describing an idea is accurate. Don't overextend the elaborations, and always check your class materials or ask your teacher.

Work your way up so that you can describe and explain without looking at your class materials.

RESEARCH

Read more about elaboration as a study strategy

McDaniel, M. A., & Donnelly, C. M. (1996). Learning with analogy and elaborative interrogation. *Journal of Educational Psychology, 88*, 508-519.

Wong, B. Y. L. (1985). Self-questioning instructional research: A review. *Review of Educational Research, 55*, 227-268.

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LEARN TO STUDY USING...

Dual Coding

COMBINE WORDS AND VISUALS

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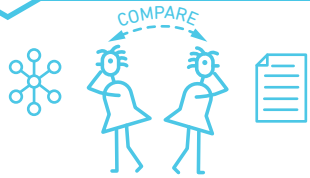
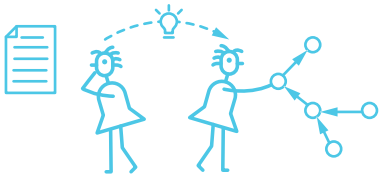
HOW TO DO IT



Look at your class materials and find visuals. Look over the visuals and compare to the words.

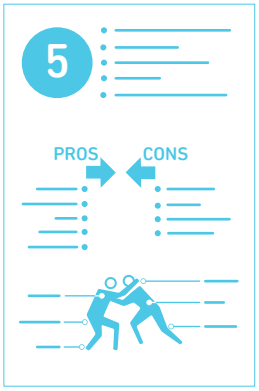
Look at visuals, and explain in your own words what they mean.

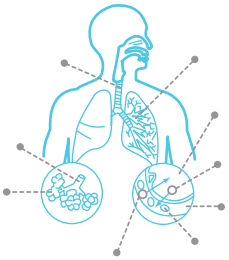


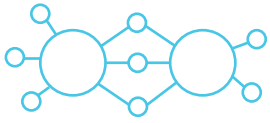
Take information that you are trying to learn, and draw visuals to go along with it.

HOLD ON!

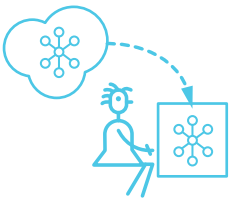
Try to come up with different ways to represent the information visually, for example an infographic, a timeline, a cartoon strip, or a diagram of parts that work together.







Work your way up to drawing what you know from memory.



RESEARCH

Read more about dual coding as a study strategy

Mayer, R. E., & Anderson, R. B. (1992). The instructive animation: Helping students build connections between words and pictures in multimedia learning. *Journal of Educational Psychology*, *4*, 444-452.

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Session 4

Notetaking and Interleaving

Notetaking

Making notes in class, and as part of your study routine, is a key part of the learning process. Effective notetaking (and making) is much more than just highlighting and summarising. Notetaking should not be a 'passive' activity in which you simply transcribe information, nor is it something you do *in preparation* for studying. When done well, notetaking is a study/learning skill in itself.

There is no ideal method for taking notes, you'll need to experiment and find what works best for you. If you can answer 'yes' to each question from the checklist below, you're on the right track!

- My notes are easy to understand and refer to when I'm revising material.
- My notes are written in my *own words* rather than being a transcription from the textbook.
- My notes can be easily used to implement the study strategies in this course including: Retrieval Practice, Elaboration and Interleaving – (see the SGS Notetaking template and process on the following pages)
- My notes can be read and understood by somebody who knows nothing about the subject.

Typed or Handwritten?

Research highlights the fact that, for most students, handwriting rather than typing notes, results in more detailed recall of information. One reason this occurs is that typed notes are more likely to be a verbatim recording of information rather than your own interpretation of the salient points – in other words the act of handwriting notes in your own words requires some **Elaboration.**

Read more about handwriting V typing - **here**

Important - Your handwriting MUST be legible! - there is little point in making brilliant notes that you cannot read.

Watch: **Five Different Notetaking Methods**

Read: **5 Effective Notetaking Methods**

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Interleaving

In the early stages of reviewing your study notes for a topic, you'll usually be working in chronological order and sticking to a single unit of work - looking at information from Week 1, then Week 2 etc.

Interleaving is a study technique in which you begin to mix up your study notes, so that your brain is forced to make connections – 'where does this fit into the bigger picture?'

Watch: Interleaving - (The Learning Scientists)

A simple example of how to use interleaving when studying is to keep all your notes for each subject in a manila folder, with notes from each unit of work paperclipped together. For Science you might have a unit of study notes on cells and another on the endocrine system. When you feel confident that you understand your notes on cells and the endocrine system in order, then mix up those pages within each separate topic and review.

When you feel *really* confident, then mix up you notes on cells and those on the endocrine system and you'll start to make connections about how cells work *within* the endocrine system.

Important – Do NOT use interleaving to mix up subjects and *only* use interleaving once you are confident you have a good understanding of the information in sequence.

Before reading the next chapter:

Practice - using the various notetaking formats described for at least 4 different subjects.

Read - Chapters 2 and 3 from; *New Science of Learning*

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LEARN TO STUDY USING...

Interleaving

SWITCH BETWEEN IDEAS WHILE YOU STUDY

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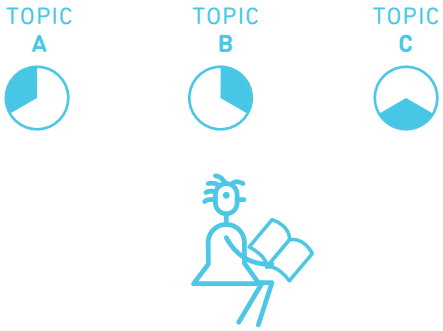
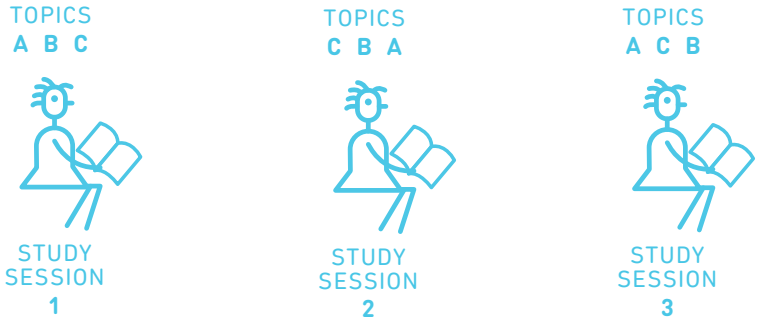
HOW TO DO IT

Switch between ideas during a study session. Don't study one idea for too long.



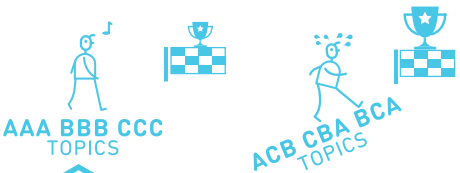
Go back over the ideas again in different orders to strengthen your understanding.



Make links between different ideas as you switch between them.

HOLD ON!

While it's good to switch between ideas, don't switch too often, or spend too little time on any one idea; you need to make sure you understand them.



Interleaving will feel harder than studying the same thing for a long time. But don't worry - this is actually helpful to your learning!

RESEARCH

Read more about interleaving as a study strategy

Rohrer, D. (2012). Interleaving helps students distinguish among similar concepts. *Educational Psychology Review, 24*, 355-367.

Content by Yana Weinstein (University of Massachusetts Lowell) & Megan Smith (Rhode Island College) | Illustrations by Oliver Caviglioli (teachinghow2s.com/cogsci)
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LEARN TO STUDY USING...

Concrete Examples

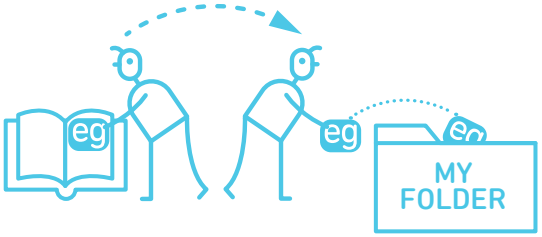
USE SPECIFIC EXAMPLES TO UNDERSTAND ABSTRACT IDEAS

LEARNINGSCIENTISTS.ORG

CC BY NC ND

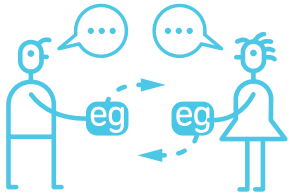
HOW TO DO IT

Collect examples your teacher has used, and look in your class materials for as many examples as you can find.



Make the link between the idea you are studying and each example, so that you understand how the example applies to the idea.

Share examples with friends, and explain them to each other for added benefits.



HOLD ON!

You may find examples on the internet that are not used appropriately. Make sure your examples are correct - check with your teacher.

Ultimately, creating your own relevant examples will be the most helpful for learning.

RESEARCH

Read more about concrete examples as a study strategy

Rawson, K. A., Thomas, R. C., & Jacoby, L. L. (2014). The power of examples: Illustrative examples enhance conceptual learning of declarative concepts. *Educational Psychology Review, 27*, 483-504.

Content by Yana Weinstein (University of Massachusetts Lowell) & Megan Smith (Rhode Island College) | Illustrations by Oliver Caviglioli (teachinghow2s.com/cogsci)
Funding provided by the APS Fund for Teaching and Public Understanding of Psychological Science

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Session 5

Creating a Study Schedule including Sleep, Diet and Exercise

An important part of effective study and exam preparation is organising your study sessions into a regular schedule that incorporates all the strategies described.

Having a study schedule helps to build a positive study habit and reduce 'decision fatigue'

Procedural Memory and Decision Fatigue

When you break down what's involved a typical study session, there are several things that happen before you get to your destination of sitting down and beginning to work. These fall into two categories: physical behaviours and mental decisions.

Physical Behaviours	Mental Decisions
- Unpacking school bag - Having something to eat - Organising study area - Setting up study equipment	- What will I study? - How will I study? - How long will I study for? - What do I need to achieve in this session?

Physical behaviour can be 'learned' by frequent repetition, this is called **Procedural Memory**. You can build your procedural memory as part of developing a study habit by;

- Unpacking your bag as soon as you get home each day
- Always having a snack just before you begin a study session
- Setting up your study area the same way (doing this in advance is a good idea) – this doesn't mean you need to study in the same spot each day, in fact **research suggests** that studying in various locations can help your brain to encode and retrieve information more accurately.

Decision Fatigue

Having to make too many decisions before actually beginning a study session can deplete cognitive resources (particularly those that support motivation) this is called **decision fatigue.**

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By deciding what, when, where and how you're going to study *in advance*, you'll have more cognitive resource at your disposal to focus and learn.

Outlook calendar is a great tool that you can use to block out time in advance, enter specific detail about what, where and how you'll study and set a reminder for each session.

Watch: How to Make a Study Schedule

Read: Make a Study Timetable

Read: Six Ways to Create the Ultimate Study Spot

Procrastination

You will have heard Professor Oakley discussing procrastination as part of the Learning How to Learn MOOC. Procrastination just means putting something off instead of doing it straight away (or when you had scheduled it) Usually this happens because your brain doesn't think of that activity as being as fun or rewarding as what you'd rather be doing instead; chatting to friends, gaming, watching Netflix etc. This requires self-regulation, a key life skill;

Watch: The Marshmallow Test.

In addition to using the strategies above, Prof Oakley recommends The Pomodoro Technique (already discussed) with a big emphasis on rewarding yourself in each break.

Read: Top 10 Ways to Avoid Procrastination

Sleep, Diet and Exercise

Sleep is critically important for information storage, organisation and recall. When you sleep it's as if a housekeeper enters your mental room and tidies up, throwing away what isn't necessary and storing the important things neatly in their correct place. Sleep is when the consolidation phase of memory is, well, consolidated!

Read some research on sleep and memory consolidation – here.

Some tips for maintaining a good sleep regime;

- NO screens at least 60 min before bedtime.
- Go to bed at the same time each night.
- Avoid caffeinated or sugary food and drink, especially in the afternoon or evening.
- Keep a sleep diary for a week and note, how refreshed you feel on waking and how consistent your sleep patterns are.
- If you must make the occasional choice between going to bed at a 'normal' time or staying up to do homework, choose sleep. You'll do a better job with your homework the next morning. If this is an ongoing issue, you should tell your Tutor.

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Diet and Exercise

Exercise literally increases the size of your Hippocampus, one of the most important brain regions involved in long-term memory storage. Diet is equally important for your brain to function optimally. Your brain runs on glycogen (glucose) and glycogen stores are needed for, and depleted by, hard cognitive effort.

Read more about sleep and memory - **here.**
Read more about glucose and the brain - **here.**

One of the many benefits of being at school is regular, compulsory participation in sport. You can help yourself by;

- Exercising immediately *before* a study session - make a note of how much more efficiently you're able to focus and take in information after a run or ride.
- Ensuring that much of your exercise is aerobic - your brain loves oxygen!
- Sticking with a regular exercise habit during holidays (and extended periods of online learning!)
- Eating regular meals, especially before study or learning.
- Avoiding sugary, processed foods that cause a brief sugar spike followed by a blood sugar 'crash' - (brain fog, irritability, poor self-regulation)

Before reading the next chapter:
Think about your best, and worst, exam performance and make some (honest) notes about your attitude, planning and preparation in each case.

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Session 6

Exam Preparation and Test Anxiety

Performing well in exams is not as difficult as we often think. When you break down the skills required, it's a fairly simple combination of **preparation and practice.**

Preparation

Being well prepared is the key to success in exams (and most other areas of life)

Some tips include;

- **Study Effectively** – Use Retrieval Practice and associated techniques.
- **Separate Foundation Knowledge and Skills** for each subject.
- **Foundation Knowledge** is information that you need to be able to **access quickly and fluently –** this needs to be learned at a mastery level.
- **Skills** are things you'll need to be able **to do** in exams and need to be practiced.
- **Space out study** – Spacing study over weeks leads to more effective storage of information. Cramming at the last-minute means that information is stored in short term memory, taking up valuable cognitive resources that now cannot be utilised in responding to questions.
- **Do Past Papers** – and ENSURE you get feedback on your performance. Past papers are only an effective preparation tool if you seek out and act on feedback about common errors and areas for focus. Timed practice is particularly important if you commonly run out of time.
- Make sure your **study environment is light, quiet and well ventilated** – (your room is often not the most effective place to study because it contains too many potential distractions and is associated with other activities – including sleep!)
- **Remove phone and other potential distractions** from your study environment.
- **Minimise time spent on social media and similar** technology-based activities. This type of interaction trains the brain to skim information rather than read for meaning which is often the cause of careless mistakes.

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Before the Exam

- **Adequate Sleep** – Sleep is the time when information is processed and stored - a minimum of 8 hours per night is recommended. No technology at least 90 min before bedtime is a good rule to ensure quality sleep.
- **Aerobic Exercise** – Aerobic exercise increases the size of the Hippocampus – the part of the brain that plays an important role in long term memory.
- **Avoid Stimulants** – Stimulants like caffeine may provide a short term benefit but can cause a blood sugar crash making focus and recall difficult.
- **Don't try anything new on exam day** – the day of the exam is NOT the time to try a new strategy, food or any other experiment to improve performance. Exam day IS the time to implement strategies that you've been using consistently during your study period.

Understanding Exam Questions

Understanding the exam question may sound like an obvious strategy but is often a place where careless mistakes are made. Look at past papers and ask your teachers about the **type of responses** that you'll need to demonstrate for each subject.

Exam questions are designed to elicit a variety of responses to demonstrate your knowledge. These include;

- **Recalling** – You may be asked to recall facts, dates, observations etc. These are best learned using Retrieval Practice and must be accurate.

- **Comprehending** – You may be asked to identify main ideas or themes, describe the meaning or significance of something or identify differences and similarities. Having mastery of the foundation subject content allows you to devote all your cognitive resources to genuinely comprehending and responding to the question.
-
- **Applying Knowledge** – You may be asked to apply your knowledge to unfamiliar situations or problems. This requires mastery knowledge of themes, techniques etc making them easier to identify and discuss in an unfamiliar context.

- **Analysing** – You may be asked to infer meaning and conclusions from information you're presented with. This requires an ability to link directly to the evidence presented to you and use subject specific language.

- **Evaluating** – You may be asked to construct a well-informed opinion on a stimulus. You'll be expected to draw on and describe subject knowledge often as part of a comparison.

- **Synthesising** - You may be asked to integrate your knowledge from multiple sources to solve a problem or arrive at a thesis.

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Exam Technique

Technique is just as important in exams as it is in sport or music. Good exam technique simply means having a plan that is well rehearsed.

- **Use reading time well** – Skim the paper taking note of relative weighting for each section and allocate time accordingly.
- **Draft a plan if appropriate –** For example draft a framework for an extended response and add bullet points within each section.
- **Write legibly!** – Your writing must be readable by an unfamiliar marker. Writing less is a better option than writing many pages that no one can read.

Short Answer Questions – most short answer questions require you to follow simple paragraph structure such as – PETAL (Point. Evidence. Technique. Analyse. Link)

- NOTE - The specifics of this format will vary for different subjects and you'll need to practice subject specific responses. Evidence in History for example needs to be very specific including dates and places.

Multiple Choice Questions

- Read the question carefully – it can be tempting when doing multiple choice questions to jump to what may look like the correct answer before fully reading the question and being clear about what is being asked.
- Eliminate obviously incorrect answers – usually at least 2 answers will be clearly incorrect.
- Be on the lookout for words such as *not*, *sometimes*, *always*, and *never*. An answer that includes *always* must be irrefutable. If this is not the case, then the answer is not correct. The same applies for the word *never*. If an answer option includes *never,* a single counterexample will indicate the answer is not correct.
- Correct multiple-choice answers will usually contain more information.
- If two answers appear to be correct, then 'all of the above' is usually the correct option.

Extended Response Questions

- Highlight the **directive words** within the question - exactly what are you being asked to do?
- Follow a clear essay writing formula that is well structured and includes;

- Introduction, supporting paragraphs and conclusion
- A thesis statement if applicable
- A response to all parts of the question or task
- Development of your argument using specific quotes and techniques if pertinent

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- **Don't attempt to regurgitate pre-memorised essays** – as a rule it is a risky strategy to try and memorise then reproduce an essay, particularly if you're faced with a question you weren't expecting.

- **Put yourself in the position of the examiner** – The examiner wants to see evidence of your knowledge and skills – do NOT assume knowledge on their part and leave out information. You won't lose marks for including too much information.
- **If you run out of time use bullet points –** If you're out of time (or genuinely stuck and unable to continue) write bullet points of all you can recall from that topic – you'll still pick up marks for demonstrating your knowledge.

After the Exam

Remember that the exam is a valuable **learning tool**, highlighting knowledge, skill gaps and areas of strength.

Use the Post Exam template to reflect on your exam experience and plan for next time

Exam Anxiety

It's completely normal to be slightly anxious before an exam and research shows that some anxiety is adaptive, helping you to focus.

Some tips to help with **low level anxiety** include;

- Focus on your breathing for a few minutes
- Use some positive self-talk
- Write down your specific concerns before the exam – read the research here.

MOST IMPORTANTLY - if you feel anxious, worried or depressed you should see the School Counsellor and tell your parents.

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ORGANISATION

Organisation is often used as an 'umbrella' term…*'I'm totally disorganised..…. he's very organised'* etc
However, the trait of organisation is rarely this 'black and white'. Organisation is actually the result of several sub skills that (ideally) work fluently together.
One description of these subskills is outlined below and comes from a clinical tool called Children's Organisational Skills Scales (COSS).

These categories (and potential indicators of a deficit in each area) are described below;

Task Planning
Ability to meet deadlines and describe steps needed to complete tasks.
Sample questions/criteria

- Has trouble knowing how to begin task
- Becomes overwhelmed with trying to manage multiple tasks
- Runs out of time before assignment or class task is complete
- Often does not get homework done on time

Organised Actions
Competent use of organisational supports such as calendars, diary and routines.
Sample questions/criteria

- Homework is neat
- Desk is neat
- Makes drafts before completing written work
- Has separate folders for each subject

Memory and Materials Management
Ability to monitor progress of assignments, recall due dates, manage schoolbooks and other equipment.
Sample questions/criteria

- Regularly forgets equipment
- Regularly loses things at school
- Forgets to return library books on time
- Often does not have writing or other materials for lesson

How can I get more Organised?

- Think about which of these 2 areas you most need to work on, is it task *planning* or *execution*? (Putting the plan into action), and focus accordingly
- Do all that you can to 'free up' cognitive resources – Pre-Frontal Cortex in particular.
- Build habits and routines
- Plan in advance to reduce decision fatigue

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Procrastination

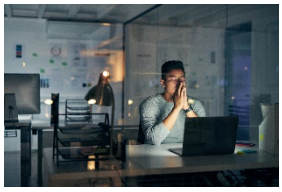
In simplest terms procrastination means delaying or postponing something. In the online learning context, it also means additional stress and reduced academic performance. Like organisation (which is closely related) procrastination is not some genetic trait that others have and you don't. Nor is it a mysterious 'entity' that is controlling your life and rendering you powerless.

It is simply an unhelpful pattern of behaviour that can be reversed as easily as it was established.

The tips below provide some guidance.

- **Get as much done as you can in class time**. It's easier to procrastinate when working online because there is no one physically monitoring what you're actually doing in the lesson. Getting as much done during the lesson, just as you would on site, prevents the backlog of work that often causes procrastination.

- **Catch the procrastination self-talk**……. and notice how it feels. The self-talk of procrastination usually sounds something like….*'I'll do that tomorrow; I have plenty of time'.* This brings an immediate sense of relief; your brain releases a shot of dopamine, and an unhelpful behavioural pattern begins to develop. Watch this self-talk arise without acting on it and it will quickly lose its potency. Giving yourself *a reward after* you've competed the task will help to establish a more helpful behavioural pattern.



- **Work with a group of friends**. Working with a small group of friends helps to 'share the load' of motivation. In other words, it's not all up to you. Encouraging each other with occasional, short 'build ups' just as you might on the sporting field also helps.

- **Break tasks down** …… and do the 'easy' stuff to build behavioural momentum. Every school task has some components that can be done more easily than others: bullet points, topic sentences for each paragraph, title page etc. Doing these things on days when you feel like procrastinating helps build confidence that you're in control of the situation. Note: the 'easy' parts of each larger task do NOT include open ended tasks such as research. These can also be procrastination 'black holes'

- **Replace the 'Thrill'.** Researchers have identified a subgroup of procrastinators who claim to enjoy the 'thrill 'of having to work at the last minute. Even for the most academically gifted boy, this is a mistake. You might get the adrenaline rush, but the quality of your work will be less than what you would have produced had you approached it in a more considered manner. You can still enjoy challenging yourself by doing timebound tasks, but not leaving them until the last minute provides opportunity for reviewing, refining, and editing your work.

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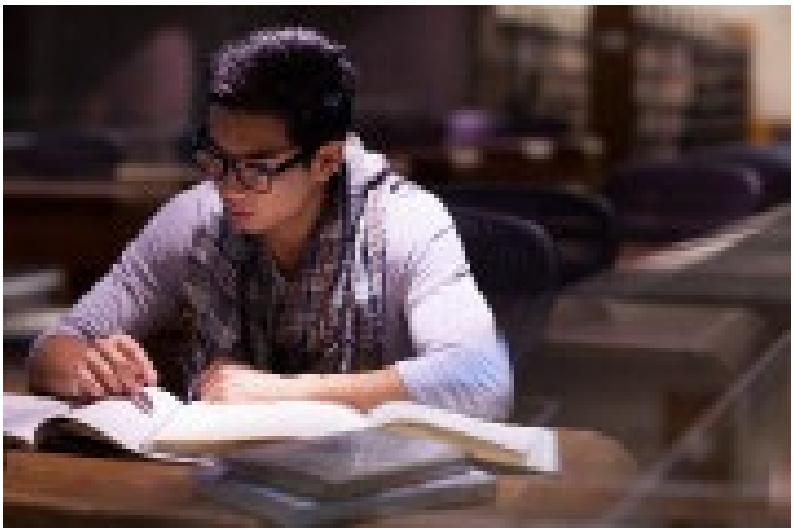
INTRODUCTION



Being well organised is a critical part of the learning process – when you are well organised you take in and store information more efficiently because you have more cognitive resource at your disposal. Being organised also helps us to feel 'in control' which reduces the stress that can occur when trying to manage multiple assessments, extra-curricular commitments and prepare for examinations.

This short guide is designed to help you develop the habits and routines that will maximise your learning potential.

Each section includes –

- Some brief contextual information
- A checklist of organisational information
- Additional resources including links to readings, videos and more.

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A USEFUL STARTING POINT

The Children's Organisational Skills Scales (COSS) break organisation down into three subcategories. It can be helpful to think about each of these areas and identify your strengths and areas for development.

1. **TASK PLANNING** – breaking down tasks, allocating time for sub tasks, know when to begin task, know how to begin task, do not run out of time, don't get overwhelmed by work
2. **ORGANISED ACTIONS** – check my work carefully, have separate folders for each subject, use calendar and TO-DO lists, make rough drafts and outlines
3. **MEMORY AND MATERIALS** – remember dates of exams and assessments, remember my equipment each day.

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PLANNING AND ORGANISTAION

HOME

Your home environment is a powerful behavioural cue – a neat, orderly study area will help you to feel that things are ‘in control’ while a messy work area will do the opposite. Your home study area can be likened to a ‘gymnasium’ where you build the positive habits and routines that will provide the foundation for maximising learning and getting the most out of school.

Most importantly, your home study area should be inviting – positive emotions help with motivation and memory.

Ideally, your home workspace is a dedicated area that you only use for schoolwork and study. If this is not possible then it can be helpful to have a ‘study box’ of equipment (and other ‘props’) that you can set up anywhere to create your own portable study space.

Use the checklist below to ensure your home study area, and routines are set up to maximise your productivity and minimise distractions.

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CHECKLIST

- My study space has plenty of natural light and air
- My equipment is within easy reach
- I have a To Do list and Calendar
- My study area is quiet and free from all distractions
- The temperature is comfortable. Too warm will make you sleepy, too cold will be uncomfortably distracting
- The lighting is specific to the task – warm lighting is better for creativity and cooler lighting helps with concentration and focus
- I have small posters (or other reminders) of the most effective study skills that I can utilise each session. Download posters from the Learning Scientists
- My seat is ergonomic. I don't slouch, my feet are on the floor and my forearms sit comfortably on my desk
- I only have on my desk what I need for the immediate task I'm working on
- I know exactly what I need to do before I sit down
- My phone is in another room
- I do not eat in my workspace
- I have a timer on my desk (this is useful for implementing the *Pomodoro Technique*)
- I only have the computer on and in front of me if it's needed for the immediate task (e.g., research)
- I transfer relevant information from my diary to a calendar each afternoon
- I check Canvas/Schoology each afternoon, before beginning homework to ensure I haven't missed any information my teacher has posted
- I have a different coloured manilla folder for each subject. This is where I store study notes and notes I have made in class. Each topic is stapled or paperclipped together in chronological order
- I avoid attention switching or splitting
- I pack my bag the night before school
- I make my bed and tidy my room each morning before school
- I spend 15 minutes each Sunday night planning my week using my Outlook calendar

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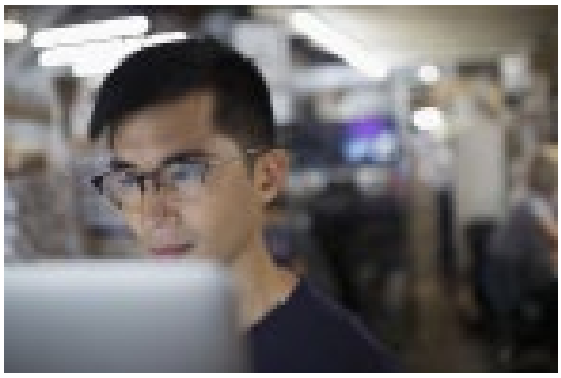
RESOURCES



The Case for Finally Clearing your Desk (Harvard Business Review)

The True Cost of Multi-Tasking (Psychology Today)

Study Space/Academic Success (Wendy Hargreaves)

How to Create an Organised, Productive, Study Space (YouTube)

What is the Importance of a Dedicated Study Area? (StuCred)

Tips for Creating a Study Space at Home (Joyce UNHS)

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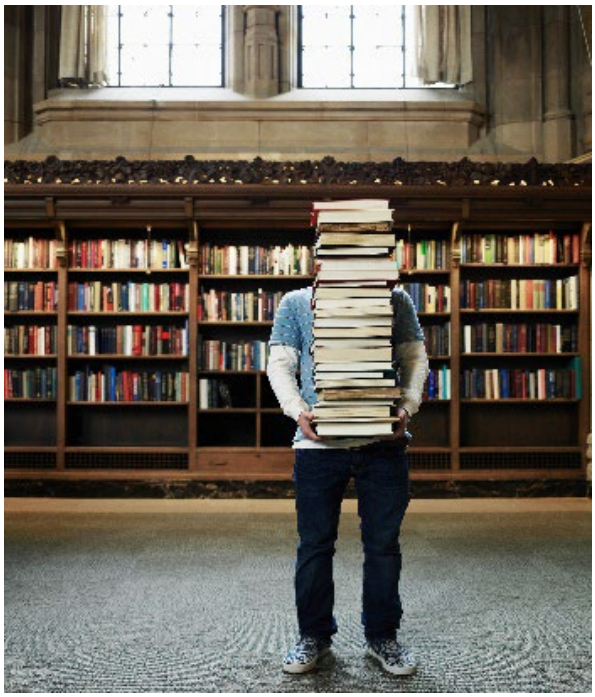
SCHOOL



Being organised at school is a critical part of the learning process. When you're organised, cognitive resources are freed up to focus on taking in and processing information in each lesson.

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CHECKLIST

- My locker is neat with no loose papers – I can find everything quickly
- I check my timetable each morning before school
- I have a second pencil case of spare equipment in my locker
- A copy of my timetable is stuck on the inside of my locker door
- I have a different coloured folder for each subject
- Topics within each folder are separated with a coloured divider
- When I walk into each room, I mentally review what was covered last lesson. Activating prior knowledge helps to store new information more accurately
- I get to class early and take out my equipment straight away, so I do not miss key instructions and information at the start of each lesson
- I sit in a spot that helps me to focus (usually away from a window, near the front and NOT next to my best friend
- I take notes, using the method that is most efficient for me e.g., The Outline Method
- I store notes carefully in my folder and take them home to file (and use for revision) on a regular basis
- I record all homework carefully in my diary at the end of each lesson.

RESOURCES

30 Organisational Tips for School (Daniel Wong)

The Best Notetaking Methods

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PLANNING AND ORGANISTAION

THE BRAIN

YOUR MENTAL ENVIRONMENT

Your mental environment is just as important as the physical. When your thinking is 'cluttered', it's harder to focus and retain information. When you have mental clarity about what you need to do and how you're going to do it, stress is reduced, and things feel easier. This frees up cognitive resources which can be allocated to the task at hand, rather than having to make multiple decisions 'in the moment'.

Use the checklist below to help ensure your mental environment is as organised as possible.

CHECKLIST

- I understand how my brain works, including the role of Pre-Frontal Cortex, Working Memory and Executive Functions
- I am aware of the role that brain modes play in learning
- I can consciously switch between both brain modes
- I am able to 'catch' and redirect myself when my attention begins to drift
- I am able to 'tune out' mental distraction effectively
- I practice 'emptying' my mind regularly – Meditation is particularly effective for this
- I take regular 'brain breaks' when working
- I understand how worry and anxiety can impact the learning process, and I have strategies to manage these issues if they occur – this includes telling an adult about how I'm feeling
- I avoid splitting my attention between 2 activities at the same time
- I use a range of effective study skills, including Retrieval Practice, Elaboration, Spaced Practice, Dual Coding, Concrete Examples, to move information to long term memory and free up cognitive resources.

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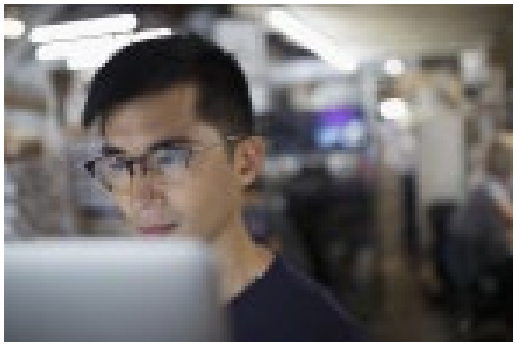
RESOURCES



Understanding Your Brain to Help you Learn Better (Frontiers for young Minds)

Learning Rewires the Brain (Science News for Students)

Brain Basics – How do I Learn (University of Washington

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PLANNING AND ORGANISTAION

PARENTS AND CARERS

OVERVIEW

Parents have an important role to play in helping to develop boys' organisational skills but finding the balance between 'nagging' and support can be challenging.

A helpful analogy, particularly for younger boys, can be to think of your role as a 'scaffolder' of Executive Functioning, or the 'default' Pre-Frontal Cortex. The amount of support needed will vary for each boy and be dependent on various factors including age and disabilities such as Attention Deficit Hyperactivity Disorder (ADHD). In cases where boys have an underlying issue that is impacting organisation, a collaborative home/school partnership is particularly important.

Effective parent support will usually fall into one or more of the 3 areas below.

- **Modelling** strategies such as task breakdown
- **Structuring** the environment
- Low key **prompting** and encouragement.

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PARENT CHECKLIST

- I have a working knowledge of the way that Executive Function skills develop in boys, and the various brain regions involved
- I model and monitor task breakdown, including backward mapping using Outlook Calendar or the SGS Planner
- As much as possible I try to ensure home routines are consistent and structured
- I encourage my son's 'functional' planning and organisational skills, e.g., following recipes, making dinner for the family, and household chores
- I check my son's diary each afternoon to ensure he has recorded homework etc.
- I am aware of my son's organisational strengths, and areas that need support – (see sample questions from Children's Organisational Skills Scales - Parent Feedback here.)
- I am in regular contact with my son's Tutor/Housemaster to monitor his organisational progress at school
- I am helping my son to develop positive routines and build automaticity. Examples include –
  - Start homework at the same time each evening
  - Pack school bag the night before school
  - Use calendar to note due dates of assessments and examinations.
- I have helped set up my son's work/study environment using the checklist in this guide
- I am aware of the 'symptoms' of poor organisation skills. These can include –
  - Procrastination
  - Problems with breaking down a task
  - Overwhelmed by multiple tasks
  - Frequently forgets or loses equipment
  - Avoidance

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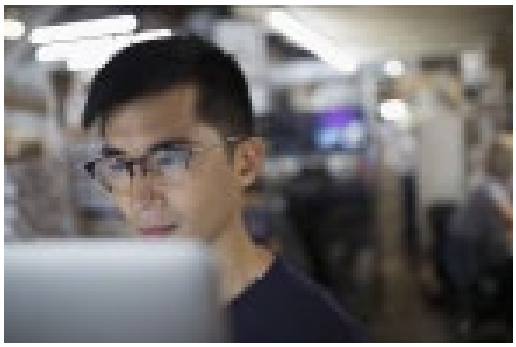
RESOURCES



Get in the Driver's Seat of your Teen's Executive Functioning Skills (Child Nexus Blog)

Executive Function Skills by Age (Life Advocate)

How to Develop your Child's EF Skills (Better Behaviour Show)

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PLANNING AND ORGANISTAION

ADDITIONAL RESOURCES

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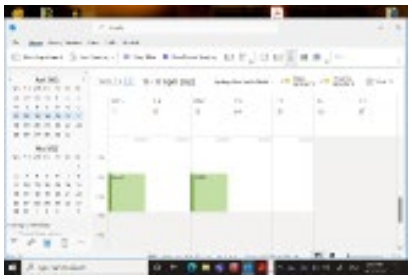
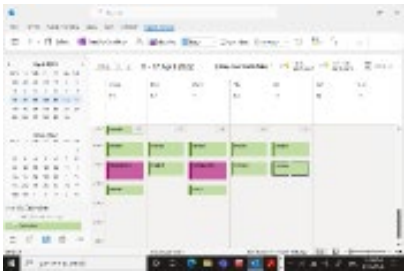
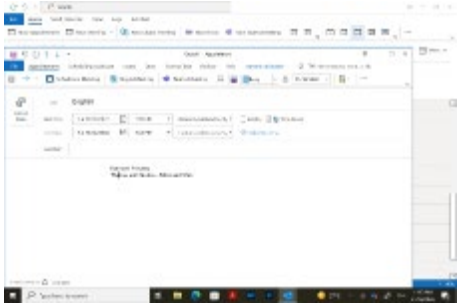
GETTING ORGANISED
USING YOUR OUTLOOK CALENDAR

1. Open your Outlook calendar
2. Create appointments for Sport afternoons – e.g., Mon and Wed 3-5pm
3. Add travel and dinner times
4. Create appointments for homework each evening.



5. List all your subjects
6. Create a 30-45 min appointment each day (after homework and a break)
7. Label each appointment with a subject.
8. Open each appointment and describe exactly which study skills you are going to use to revise exactly which content. e.g., ENGLISH: Retrieval Practice – Themes and quotes for Of Mice and Men.





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PROCRASTINATION

In simplest terms, procrastination means delaying or postponing something. In the online learning context, it also means additional stress and reduced academic performance. Like organisation (which is closely related) procrastination is not some genetic trait that others have, and you don't. Nor is it a mysterious 'entity' that is controlling your life and rendering you powerless. It is simply an unhelpful pattern of behaviour that can be reversed as easily as it was established.

The tips below provide some guidance.

- Get as much done as you can in class time. It's easier to procrastinate when working online because there is no one physically monitoring what you're actually doing in the lesson. Getting as much done during the lesson, just as you would on site, prevents the backlog of work that often causes procrastination.
- Catch the procrastination self-talk…and notice how it feels. The self-talk of procrastination usually sounds something like….'I'll do that tomorrow; I have plenty of time'. This brings an immediate sense of relief; your brain releases a shot of dopamine, and an unhelpful behavioural pattern begins to develop. Watch this self-talk arise without acting on it and it will quickly lose its potency. Giving yourself a reward after you've competed the task will help to establish a more helpful behavioural pattern.
- Work with a group of friends. Working with a small group of friends helps to 'share the load' of motivation. In other words, it's not all up to you. Encouraging each other with occasional, short 'build ups' just as you might on the sporting field also helps.
- Break tasks down…and do the 'easy' stuff to build behavioural momentum. Every school task has some components that can be done more easily than others: bullet points, topic sentences for each paragraph, title page etc. Doing these things on days when you feel like procrastinating helps build confidence that you're in control of the situation. Note: the 'easy' parts of each larger task do NOT include open ended tasks such as research. These can also be procrastination 'black holes'.
- Replace the 'Thrill'. Researchers have identified a subgroup of procrastinators who claim to enjoy the 'thrill 'of having to work at the last minute. Even for the most academically gifted boy, this is a mistake. You might get the adrenaline rush, but the quality of your work will be less than what you would have produced had you approached it in a more considered manner. You can still enjoy challenging yourself by doing timebound tasks, but not leaving them until the last minute provides opportunity for reviewing, refining, and editing your work.

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ROUTINES AND STRUCTURE

Creating a Study Schedule including Sleep, Diet and Exercise

An important part of effective study and exam preparation is organising your study/homework sessions into a regular schedule.

Having a study schedule helps to build a positive study habit and reduce 'decision fatigue'.

Procedural Memory and Decision Fatigue

When you break down what's involved a typical study session, there are several things that happen before you get to your destination of sitting down and beginning to work. These fall into two categories: physical behaviours and mental decisions.

Physical Behaviours	Mental Decisions
- Unpacking school bag	- What will I study?
- Having something to eat	- How will I study?
- Organising study area	- How long will I study for?
- Setting up study equipment	- What do I need to achieve in this session?

Physical Behaviour can be 'learned' by frequent repetition, this is called **Procedural Memory**. You can build your procedural memory as part of developing a study habit by;

- Unpacking your bag as soon as you get home each day.
- Always having a snack just before you begin a study session.
- Setting up your study area the same way (doing this in advance is a good idea) – this doesn't mean you need to study in the same spot each day, in fact research suggests that studying in various locations can help your brain to encode and retrieve information more accurately.

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Decision Fatigue

Having to make too many decisions before actually beginning a study session can deplete cognitive resources (particularly those that support motivation) this is called decision fatigue.

By deciding what, when, where and how you are going to study in advance, you'll have more cognitive resource at your disposal to focus and learn.

The SGS laminated study planner is ideal for this. Your Outlook Calendar is also a great tool that you can use to block out time in advance, enter specific details about what, where and how you'll study and set a reminder for each session.

Watch: How to Make a Study Schedule

Read: Make a Study Timetable

Read: Six Ways to Create the Ultimate Study Spot

Procrastination

You will have heard Professor Oakley discussing procrastination as part of the Learning How to Learn MOOC. Procrastination just means putting something off instead of doing it straight away (or when you had scheduled it) Usually this happens because your brain doesn't think of that activity as being as fun or rewarding as what you'd rather be doing instead, chatting to friends, gaming, watching Netflix etc. This requires self-regulation, a key life skill.

Watch: The Marshmallow Test

In addition to using the strategies above, Prof Oakley recommends The Pomodoro Technique (already discussed) with a big emphasis on rewarding yourself in each break.

Read: Top 10 Ways to Avoid Procrastination

Sleep, Diet and Exercise

Sleep is critically important for information storage, organisation and recall. When you sleep it's as if a housekeeper enters your mental room and tidies up, throwing away what isn't necessary and storing the important things neatly in their correct place. Sleep is when the consolidation phase of memory is, well, consolidated! Read some research on sleep and memory consolidation – here.

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Some tips for maintaining a good sleep regime –

- NO screens at least 60 min before bedtime.
- Go to bed at the same time each night.
- Avoid caffeinated or sugary food and drink, especially in the afternoon or evening.
- Keep a sleep diary for a week and note, how refreshed you feel on waking and how consistent your sleep patterns are.
- If you must make the occasional choice between going to bed at a 'normal' time or staying up to do homework, choose sleep. You'll do a better job with your homework the next morning. If this is an ongoing issue, you should tell your Tutor.

Diet and Exercise

Exercise literally increases the size of your Hippocampus, one of the most important brain regions involved in long-term memory storage. Diet is equally important for your brain to function optimally. Your brain runs on glycogen (glucose) and glycogen stores are needed for, and depleted by, hard cognitive effort.

Read more about sleep and memory – here.

Read more about glucose and the brain - here.

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One of the many benefits of being at school is regular participation in sport. You can help yourself by;

- Exercising immediately before a study session (or school) if time allows – make a note of how much more efficiently you're able to focus and take in information after doing an exercise session before school.
- Ensuring that much of your exercise is aerobic - your brain loves oxygen!
- Sticking with a regular exercise habit during holidays (and extended periods of online learning!)
- Eating regular meals, especially before study or learning.
- Avoiding sugary, processed foods that cause a brief sugar spike followed by a blood sugar 'crash' - (brain fog, irritability, poor self-regulation).

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ORGANISATION

Organisation is often used as an 'umbrella' term….'I'm totally disorganised……. he's very organised' etc. However, the trait of organisation is rarely this 'black and white'. Organisation is actually the result of several sub skills that (ideally) work fluently together.

One description of these subskills is outlined below and comes from a clinical tool called Children's Organisational Skills Scales (COSS).

These categories (and potential indicators of a deficit in each area) are described below;

Task Planning

Ability to meet deadlines and describe steps needed to complete tasks.

Sample questions/criteria –

- Has trouble knowing how to begin task
- Becomes overwhelmed with trying to manage multiple tasks
- Runs out of time before assignment or class task is complete
- Often does not get homework done on time

Organised Actions

Competent use of organisational supports such as calendars, diary and routines.

Sample questions/criteria –

- Homework is neat
- Desk is neat
- Makes drafts before completing written work
- Has separate folders for each subject

Memory and Materials Management

Ability to monitor progress of assignments, recall due dates, manage schoolbooks and other equipment.

Sample questions/criteria –

- Regularly forgets equipment
- Regularly loses things at school
- Forgets to return library books on time
- Often does not have writing or other materials for lesson

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How can I get more Organised?

- Think about which of these 2 areas you most need to work on, is it ***task planning*** or ***execution***? (Putting the plan into action), and focus accordingly
- Do all that you can to 'free up' cognitive resources – Pre-Frontal Cortex in particular.
- Build habits and routines
- Plan in advance to reduce decision fatigue

NOTES

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TIPS FOR STAYING ORGANISED

- **Backward Mapping** - Go to your calendar and, on the day before your assignment/essay is due, mark **SUBMIT**. Now work *backwards* and break the task down into small, manageable 'chunks' and create a calendar appointment for each sub task. E.g., *Submit. Final edit. Concluding paragraph. Paragraphs 2-4. Introduction. Rough Draft. Thesis. Research.*
- **Learn to Delay Reward** - Feeling tempted to do something is a normal human trait. Learning to recognise and actively resist a short-term reward (such as clicking onto YouTube during a study session) is an incredibly valuable life skill. You'll notice this process is like hitting the gym and getting physically stronger, it gets much easier with regular practice.
- **Develop (positive) Habits** - Doing the same thing at the same time, in the same place can help to build 'muscle memory'. Put simply, if you don't have to think about when, where, and how you're going to do a task, you can now devote all of your cognitive resources to the task itself. You'll also have extra cognitive 'fuel' to shut down any unhelpful internal dialogue about wanting to do something else instead.
- **Take regular breaks** - Working at home, without the structure that 'scaffolds' your school day, is more cognitively effortful. You need to recharge regularly by taking short, timed, breaks **AWAY FROM ALL SCREENS**.
- **Don't leave a small task, half done** - It's easier to put off doing a small task, telling yourself *'It won't take me long to do this later'*. The problem with this strategy is that a backlog of small tasks becomes as stressful as a big task. It's better to complete short tasks (30 min or less) as soon as possible.
- **When you feel like doing nothing, do something** - There will be times when the thought of starting work feels overwhelming. The danger of 'giving in' to this feeling and clicking onto YouTube is that this will quickly become an unhelpful behavioural pattern.

  There are elements of every work task that require less cognitive effort. Set a timer for 20 min and, make bullet points for your essay paragraphs, do a 'brain download' for Macbeth themes and quotes (**Retrieval Practice**), write the headings for each section of a science experiment.
- **Meditation** - There is nothing 'mysterious' or complicated about meditation. It simply means learning to sit quietly and watch your thoughts. As you become more proficient, you'll notice the different types of thoughts and how they come and go without you needing to respond to any of them. With practice, you'll find that the time between each thought increases, and this gap is an incredibly rejuvenating place to be. Procrastination, feeling overwhelmed, starting a task quickly, resisting the urge to look at YouTube are all behaviours that begin with a thought. Meditation is a great way of reminding yourself that you control your thoughts, they don't control you.

Science of Adolescent Learning:

How Body and Brain Development Affect Student Learning

ALLIANCE FOR EXCELLENT EDUCATION

August 2018

SCIENCE OF ADOLESCENT LEARNING REPORT SERIES

Acknowledgments

*This report was written by **Robyn Harper**, policy and research associate at the Alliance for Excellent Education (All4Ed). **Hans Hermann**, policy and research assistant at All4Ed, completed the literature review and contributed to the report. **Winsome Waite**, **PhD**, vice president of practice at All4Ed, leads All4Ed's Science of Adolescent Learning initiative and also contributed to this report. **Kristen Loschert**, editorial director at All4Ed, supported the development of this report and series. Cover photo by Allison Shelley/The Verbatim Agency for **American Education: Images of Teachers and Students in Action**.*

*All4Ed thanks the following individuals for their guidance and input during development of this report: **Richard Clark**, **PhD**, University of Southern California; **Ronald E. Dahl**, **MD**, University of California–Berkeley; **Simona Ghetti**, **PhD**, University of California–Davis; **Jay Giedd**, **MD**, University of California–San Diego; and **Mary Helen Immordino-Yang**, **EdD**, University of Southern California.*

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*The **Alliance for Excellent Education** (All4Ed) is a Washington, DC–based national policy, practice, and advocacy organization dedicated to ensuring that all students, particularly those underperforming and those historically underserved, graduate from high school ready for success in college, work, and citizenship. **all4ed.org***

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Table of Contents

Executive Summary

During adolescence, the body and brain experience a variety of biological changes that make this period of human development a time of learning opportunity and risk for students. As the human brain prepares for adulthood, its development depends strongly on the learning environment provided during adolescence. Events and activities experienced during this developmental period prepare the brain for situations and circumstances it presumes the adolescent will experience as an adult. Consequently, students in middle and high school need opportunities to develop deeper learning competencies, such as problem solving and critical thinking, and other higher-order thinking skills to support application of those skills later in life. Therefore, education leaders must ensure that learning opportunities support the development of adolescents' increasing cognitive capabilities and provide additional resources and services necessary to support learning and development of students during this period.

This report examines learning and development research that supports the Alliance for Excellent Education's (All4Ed's) Science of Adolescent Learning (SAL) Research Consensus Statements 1–5 (see page 3 for statements). The report highlights the following essential findings about adolescent learning and development:

1. While researchers once thought that early childhood was the only major period of brain plasticity, or adaptability, research now shows that adolescence is a second period of increased brain plasticity, making adolescence a critical period for students and educators.
2. The learning environment plays a significant role in brain development. As adolescents perform complex mental tasks, the neural networks that support those abilities strengthen, increasing their cognitive, emotion-regulation, and memory skills. Without opportunities to use these skills, those networks remain underdeveloped, making it challenging for individuals to engage in higher-order thinking as adults.
3. During adolescence, individuals face an increased risk for certain health issues that can affect their behavior and ability to learn.

This report also includes recommendations for how educators, policymakers, and advocates can apply adolescent learning and development research to policy and practice. By understanding the science behind student learning and development, education leaders can support adolescent learning and development throughout the entirety of the education system, closing achievement and opportunity gaps. Additionally, policymakers and educators can ensure that continuous improvement efforts at the secondary school level are comprehensive, developmentally appropriate, and support adolescents' academic, social, emotional, physical, and health needs.

About All4Ed's SAL Consensus Statement Report Series

In November 2017, All4Ed convened researchers, practitioners, and policy experts to examine advances in research and how recent findings from SAL can advance student learning and inform high school improvement strategies under the Every Student Succeeds Act (ESSA). During the event, an interdisciplinary group of researchers representing multiple scientific perspectives identified the most critical learning needs of adolescents.

After the convening, the researchers collaborated with All4Ed to develop a set of consensus statements about adolescent learning and development research, listed on pages 3–4. These statements, along with an accompanying series of reports, provide the foundation for All4Ed's SAL initiative. Each of the reports listed below translates supporting research on adolescent learning and development that informs the consensus statements, which are grouped by theme. The reports also offer key considerations for education practitioners and policymakers on how best to support adolescent learning, particularly for students from historically underserved populations:

1. *Science of Adolescent Learning: How Body and Brain Development Affect Student Learning*
2. *Science of Adolescent Learning: Risk Taking, Rewards, and Relationships*
3. *Science of Adolescent Learning: Valuing Culture, Experiences, and Environments*
4. *Science of Adolescent Learning: How Identity and Empowerment Influence Student Learning*

The following researchers, all members of All4Ed's Expert Advisory Group, endorse the consensus statements and continue to support All4Ed's SAL initiative and this report series in their respective areas of expertise:

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To learn more about All4Ed's SAL initiative, visit all4ed.org/SAL.

All4Ed's SAL Research Consensus Statements

Consensus statements featured in this report

1. In addition to body changes, the onset of puberty may trigger a second period of brain plasticity, increasing both the opportunity and vulnerability inherent in adolescence. Certain life conditions may cause the process of puberty to occur earlier or later, meaning that physical, cognitive, social-emotional, and other changes associated with puberty can begin at various ages.
2. Adolescents are in a stage of development during which the brain becomes more specialized and efficient. Learning experiences and environmental influences play key roles in this process. Learning and development are inextricably intertwined; these dual processes shape patterns of neural connections during adolescence.
3. As the brain becomes more interconnected during adolescence, young people are increasingly able to engage in adult levels of complex cognition, such as abstract reasoning, future thinking, and social cognition.
4. The ability to form memories and reflect on the accuracy of those memories continues to improve during adolescence. Adolescents become better able to assess their own learning, allowing for more time for additional information gathering and review.
5. Adolescents face an increased risk, compared to adults and younger children, for certain issues related to mental health, behavioral health, alcohol and substance use, accidents, trauma, sexual health, and nutrition due to physical, cognitive, and emotional changes they experience.

Consensus statements featured in report 2

6. During adolescence, biological and environmental changes affect motivation and mindset. Because adolescents have an increased sensitivity to social evaluation, praising their learning process and successful strategies, not effort alone, can support development of a positive mindset and motivate them to learn.
7. Adolescents are more sensitive to some types of rewards, such as social recognition, than adults and younger children. Adolescents are more likely to engage in both positive and negative forms of risk taking, especially if peers support that behavior.
8. The transition from childhood into adolescence is associated with an increased sensitivity to social evaluation, including feelings of belonging, acceptance, admiration, and respect.
9. Peer relationships strongly influence adolescents, even more so than younger children, in ways that contribute to opportunities as well as vulnerabilities.
10. Compared to younger children, adolescents are able to spend more time with peers without adult supervision. However, support, communication of consistent expectations, and monitoring of activities and emotional functioning by adults are essential as adolescents become more independent.

(continued)

Consensus statements featured in report 3

11. Culture constructs the nature of learning environments and ways adolescents experience them including their values, motivations, and beliefs related to learning.
12. Adolescents seek learning environments that are consistent with and meaningful within the social and cultural contexts of their lives.
13. Digital technologies, such as computers, the internet, social media, and smart phones, dramatically have changed the way individuals learn, play, and interact with each other. Their impacts may be greatest for adolescents who are young enough to embrace novelty and old enough to master the technologies.
14. Adolescence is marked by significant biological shifts, resulting in heightened stress-induced hormonal responses. Stress is a major modulator of human learning and memory processes. As pressures around school, work, and relationships increase, adolescents experience greater stress.
15. In addition to physical, social, and emotional impacts that economic disadvantage has on adolescents, poverty and socio-economic status are associated with a diverse set of neuroscientific structural and functional outcomes. Based on current evidence, the most sensitive systems are those related to executive functions, language, learning, and stress regulation.
16. Inequality, bias, and the persistence of structural discrimination constitute serious hazards to the positive development of all adolescents.

Consensus statements featured in report 4

17. While adolescents still are developing self-regulatory systems, under some circumstances they make more rational choices with the similar mental capacity of adults. However, the expression of self-regulatory skills depends on context and learning opportunities.
18. For adolescents, social and emotional development involves exploring meaning and finding purpose; sometimes this development is at odds with institutional structures and expectations.
19. Adolescents are developing their own adult identity, trying to understand their roles and contributions in social contexts and communities. This identity development continues into adulthood, as the individual has more diverse experiences.
20. Adolescents seek opportunities for agency where they can decide how they spend their time and influence policies and practices of institutions that shape their lives.

How the Body and Brain Affect Adolescent Learning

Several biological changes occur during adolescence, both in the body and brain, that make the adolescent years a time of great opportunity as well as one of increased vulnerability for students.[1] Furthermore, learning and development research describes how the environment plays a critical role in these biological changes, shaping even at the cellular level how students learn in ways that continue to affect their learning into adulthood.[2]

As students progress through this biological preparation for adulthood, education leaders play an essential role in ensuring that learning opportunities support the development of adolescents' increasing cognitive capabilities and providing additional resources and services necessary to support learning and development of this age group.

While adolescence often is associated with the teenage years, age is not the most accurate way of defining this important stage of development. The period of adolescence can be thought of as beginning with a biological change and ending with a social construct determined by factors like family, culture, and society.[3] This is an important distinction to make because most U.S. public schools expect students to achieve specific academic outcomes based on grade levels that, with few exceptions, largely are age based. As education leaders deepen their knowledge about how students learn and develop, they can shape the education system in ways that prepare students for postsecondary success by meeting students' specific developmental needs.

> **The period of adolescence can be thought of as beginning with a biological change and ending with a social construct determined by factors like family, culture, and society.**

The following sections examine learning and development research that supports All4Ed's SAL Research Consensus Statements 1–5 and recommend ways educators, policymakers, and advocates can apply adolescent learning and development research to policy and practice.

The Biological Beginning of Adolescence

SAL Research Consensus Statement 1: In addition to body changes, the onset of puberty may trigger a second period of brain plasticity, increasing both the opportunity and vulnerability inherent in adolescence. Certain life conditions may cause the process of puberty to occur earlier or later, meaning that physical, cognitive, social-emotional, and other changes associated with puberty can begin at various ages.

The biological change that begins the period of **adolescence** is **puberty**.[4] In addition to body changes, puberty begins a critical stage of brain development that affects adolescent learning; this is a key point for educators who work with these students to understand. The process begins when the **hypothalamus**, the part of the brain responsible for involuntary responses of the body, signals the release of **hormones**, including estrogens and testosterone.[5] While these hormones trigger biological changes in the body, studies show that some hormones associated with puberty also influence structural and functional brain development.[6] Further research still is needed, though, to investigate *how* these hormones cause these changes.

Too often, puberty is oversimplified, described as a period of quick, sporadic body changes and emotional disarray due to these "raging hormones."[7] This misinterpretation is one factor that creates a pervading view that adolescence is a time of deficit characterized by awkwardness or moodiness. But evidence for hormonally driven moodiness in adolescence is weaker than popular stereotypes suggest.[8] Some research finds little to no association of average mood or mood variability during puberty

Why the Science of Adolescent Learning Matters for Education

Adolescence is a time of transition characterized by rapid physical, neurological, cognitive, and socio-emotional development.[9] As students move toward adulthood, their bodies and minds change.[10] Those changes affect how they learn and, likewise, should influence how educators work.

A broad range of factors influence adolescent learning and development. These include *physiological* and *cognitive* factors, such as the maturation of neural pathways in the brain and the capacity to solve complex problems; *psychological* factors, such as the development of individual identity independent from parental figures; and even differing, sometimes conflicting, *cultural* and *societal* expectations.[11] Consequently, rather than being a time of deficit, adolescence is a period of immense learning and opportunity.

Research about adolescent learning and development draws from a variety of disciplines, including but not limited to neuroscience, cognitive sciences, psychology, sociology, cultural studies, and medicine. By drawing from these multiple disciplines, the science of adolescent learning (SAL) synthesizes what researchers know about adolescent learning and development and challenges traditional thinking about what it means to teach and learn during this developmental period. Furthermore, it offers a body of evidence that goes beyond simply observing students in the classroom and making assumptions about their learning and the strategies that support student needs. It provides a scientific understanding about how adolescents learn that can, and should, influence the approach to education reform.

Early childhood education benefitted dramatically from efforts to increase educator and public knowledge about the importance of the early years of life for brain development and learning.[12] Now educators, policymakers, and the public generally understand that quality education during early childhood can have lasting positive effects long into adulthood.[13] Similarly, recent evidence shows that adolescence represents a second critical window for human learning and development.[14] Consequently, education leaders have a responsibility to ensure that education systems align with research about adolescent learning and development.

among girls. Meanwhile, among boys, research finds that more advanced pubertal status is associated with positive, not negative, feelings.[15] Hormonal changes simply are one of several changing systems that emerge during puberty that may contribute to mood changes in adolescents, but research shows that hormones are not the sole causal reason for those changes.[16]

The timing and course of puberty also change based on a person's environment or experiences.[17] For example, the quality of family relationships can affect the onset and rate of puberty. Research shows that adolescents raised in homes characterized by less closeness and more conflict mature earlier and faster.[18] Meanwhile, puberty can be delayed in children who have not received proper nutrition, often due to long-term illnesses or food insecurity. Conversely, research shows that obesity can result in the earlier onset of puberty in girls, with insufficient evidence of its effect on boys.[19] Also, some young girls who undergo intense physical training for a sport, such as running or gymnastics, start puberty later than normal.[20] By contrast, such athletic activity does not appear to delay puberty in boys.[21] A delay in puberty also could occur simply because a child (male or female) matures more slowly than average, a trait that often is hereditary.[22]

Those with delayed puberty usually go through normal puberty, just at a later age. Compared to adolescents in the nineteenth century, today's adolescents, on average, start puberty at earlier ages.[23] Educators should be mindful that students develop at different rates and ages and their experiences influence how soon and how quickly their bodies and brains experience critical changes necessary for advanced learning.

The Second Critical Window of Brain Development

SAL Research Consensus Statement 2: Adolescents are in a stage of development during which the brain becomes more specialized and efficient. Learning experiences and environmental influences play key roles in this process. Learning and development are inextricably intertwined; these dual processes shape patterns of neural connections during adolescence.

Research indicates that brain changes associated with puberty trigger a second period of increased brain **plasticity**.[24] Plasticity refers to the ability of the brain to adapt and change based on experience and environment.[25] To use energy and resources efficiently, the brain prepares for an anticipated future based on an individual's current environment and needs. Experts once believed that the period of life between infancy and early childhood was the only stage of life associated with increased brain plasticity. But recent evidence shows that the brain goes through a second period of plasticity in the adolescent years, as the brain prepares for adulthood.[26] The dynamic brain development that occurs during adolescence manifests itself in several forms.

> **Experts once believed that the period of life between infancy and early childhood was the only stage of life associated with increased brain plasticity. But recent evidence shows that the brain goes through a second period of plasticity in the adolescent years, as the brain prepares for adulthood.**

In early adolescence, the human brain increases the rate at which it forms **synapses**, or connections between the brain's nerve cells. This burst of neural activity strengthens communication networks between brain regions and builds an individual's capacity to engage in complex mental tasks.[27]

Following this intense period of synaptic formation, the adolescent brain engages in high levels of **synaptic pruning**, a process that removes rarely used connections in the brain.[28] This process makes the brain more efficient by allowing it to change structurally in response to the demands, activity, and stimulation from an individual's environment, resulting in increased specialization of brain regions.[29]

Myelination, the process of wrapping neurons and their connections with fatty cells, also enhances the brain's functioning and makes it more efficient.[30] The additional fat facilitates faster electrical signals and communication between neurons, expediting completion of mental tasks. While synaptic pruning and myelination occur throughout different periods of life, during adolescence these processes occur in brain regions, such as the **prefrontal cortex**, that are involved in higher cognitive functions, such as controlling impulses and emotion regulation.[31]

Each of these processes is affected directly by an adolescent's individual needs and inputs from the environment he or she experiences. Evidence suggests that during puberty, the human brain is more sensitive to influences from an individual's environment and life experiences, making adolescence a time when quality learning opportunities and positive relationships with others can affect a student's developmental and academic trajectory significantly.[32]

Essentially, events and activities experienced during adolescence prepare the brain for environments it presumes the adolescent will experience as an adult. Consequently, when adolescents have opportunities to develop deeper learning competencies, such as problem solving and critical thinking, and other higher-order thinking skills, the neural pathways associated with those capacities are more likely to develop and mature.[33] Without these opportunities, adolescents could have more difficulty engaging in these types of higher-order thinking skills as adults, just as an athlete would need to exert more effort to win a game without prior practice.

Increased Capacity for Advanced Cognition

SAL Research Consensus Statement 3: As the brain becomes more interconnected during adolescence, young people are increasingly able to engage in adult levels of complex cognition, such as abstract reasoning, future thinking, and social cognition.

During adolescence, key brain regions involved in advanced **cognition** develop. As these regions, such as the prefrontal cortices, mature, adolescents become more capable of performing complex cognitive tasks, such as **executive functions**.[34] Executive functions are cognitive processes involving abstract thought, planning, decisionmaking, **perspective taking** (looking at a situation from a viewpoint that is different from one's usual viewpoint), and **future thinking** (visualizing, predicting, and planning for the future), among other higher-order processes. Development of these higher-order cognitive processes appears to be driven by changes in brain structure,

increased autonomy from parents, and importantly, societal contexts and expectations such as those in school settings.[35]

During adolescence, young people also further develop abilities to perceive, think about, interpret, categorize, and judge their own social behaviors and those of others—mental tasks collectively known as **social cognition**.[36] At the same time, adolescents face greater demands to regulate their emotions as they experience increased independence, hormonal changes, and a changing social environment. Evidence suggests that brain maturation and structural changes in the frontal and prefrontal cortices are linked to **emotion regulation** and plasticity of the adolescent period offers opportunities to help young people improve their abilities to process emotions. [37]

> **When adolescents have opportunities to develop deeper learning competencies, such as problem solving and critical thinking, and other higher-order thinking skills, the neural pathways associated with those capacities are more likely to develop and mature.**

Emotion regulation improves from childhood to adolescence and into adulthood, particularly an individual's ability to change the trajectory of an emotional response by reinterpreting the meaning of the emotional stimulus. This strategy is called **cognitive reappraisal** and it involves two parts: (1) recognizing a negative response and (2) reinterpreting the situation to either reduce the severity of the negative response or exchange the negative attitude for a more positive attitude.[38] For example, a student fails a series of tests and thinks negatively about his or her performance upon first receiving the results. But when the student later revisits his or her emotional response to the situation, he or she views the test results as a challenge to improve his or her performance. In research studies on cognitive reappraisal, younger adolescents show higher instances of negative **affect** (any experience of feeling, emotion, or mood) than older adolescents, suggesting that the ability to use this strategy of re-evaluating emotional responses develops during adolescence.[39]

Improved Ability for Complex Memory Tasks

SAL Research Consensus Statement 4: The ability to form memories and reflect on the accuracy of those memories continues to improve during adolescence. Adolescents become better able to assess their own learning, allowing for more time for additional information gathering and review.

Memory performance improves during adolescence in a variety of ways.[40] This improvement results largely from the increase of **white matter** in the brain, caused by myelination, and the reduction of **gray matter**, so named because this brain tissue contains only the cell bodies of neurons that are not wrapped in fatty cells giving the tissue a gray color.[41]

Studies suggest the increase in white matter within the frontal and parietal regions of the brain (as well as the networks that connect these regions) and the decrease in gray matter are associated with improvements in **working memory** performance during adolescence.[42] Working memory refers to the ability to remember accurately and manipulate information necessary for performing complex cognitive tasks, such as learning, reasoning, and comprehension, during a short period of time. For example, when students solve a problem, they must remember the original context of the problem as well as how the problem changed in response to the solutions they test mentally.

Research also suggests that as individuals transition into adolescence, they develop **episodic memory**, or the ability to remember personally experienced events associated with a particular time and place.[43] Similarly, **autobiographical memories** become more extensive in adolescence. Autobiographical memories have significant value to an individual, are the smallest unit of the life story, and are used to maintain a sense of continuity of self and identity over time. Additionally, memories (both episodic and autobiographical) created during adolescence are easier to recall later in life compared to memories created during other developmental stages.[44]

As individuals progress through adolescence, they experience improvements in the ability to reflect on the accuracy of their memories (known as **metamemory**) and the ability to remember to perform a planned action or recall a planned intention at

some future point in time (known as **prospective memory**).[45] Metamemory connects intimately with learning because it limits memory errors and promotes additional information gathering or review. Meanwhile, prospective memory tasks occur in daily life and range from the relatively simple, like remembering to turn in a homework assignment, to extreme life-or-death situations, such as remembering to take prescription medication. Prospective memory is critical for solving complex problems and planning to complete tasks necessary for academic success, such as making time to study or finish assignments.

While a few studies show a lack of improvement in prospective memory in children between ten and fourteen years of age, it is possible that the lack of improvement was related to the children's pubertal status.[46] Future studies are needed to ascertain the relationship between puberty and prospective memory performance to clarify at what stage in adolescence the ability for prospective memory develops.

A Time of Risk for Certain Health Issues

SAL Research Consensus Statement 5: Adolescents face an increased risk, compared to adults and younger children, for certain issues related to mental health, behavioral health, alcohol and substance use, accidents, trauma, sexual health, and nutrition due to physical, cognitive, and emotional changes they experience.

While the adolescent stage of development offers multiple opportunities to enhance student learning, the rapid brain and body changes that occur during this period also increase mental and physical health risks.[47] Moreover, research shows a relationship between various health concerns and poor academic performance.[48]

Several types of psychiatric disorders, including anxiety and mood disorders, psychosis, eating disorders, personality disorders, and substance abuse, first appear during this developmental stage.[49] Researchers still are studying reasons why this is the case. But an emerging consensus indicates that as the body and brain undergo multiple rapid changes, certain breakdowns or irregularities in development may cause the onset of these disorders.[50]

Furthermore, cultural beliefs about sexuality, gender roles, and attractiveness, combined with puberty, also increase the potential for certain health risks or disorders.[51] Recent research shows that during puberty, both girls and boys experience a peak in **sensation seeking**, or behaviors involving searching out and engaging in thrilling activities as a method of increasing stimulation and arousal. Boys and girls with more advanced pubertal development have higher rates of sensation seeking and greater drug use.[52] Young women entering puberty also may encounter a societal overemphasis on beauty concepts such as thinness, although such expectations can vary by demographic group.[53] This may lead to higher instances of anxiety, depression, or eating disorders among specific populations.[54]

In addition, adolescents' sleeping patterns affect their health and learning. Adolescents produce the hormone **melatonin**, which helps regulate the biological clock, about three hours later in the sleep cycle than do children or adults.[55] Consequently, adolescents find it harder to fall asleep at early hours, making it more difficult for them to get the recommended amount of sleep before having to wake for school or other responsibilities the next day. This lack of adequate sleep can increase potential health and developmental risks, such as obesity and substance use, for adolescents.[56] Additionally, poor sleep is among the most definitive health-related causes of poor academic performance.[57] By the end of puberty, the timing of melatonin production within the sleep cycle shifts back to what it used to be prior to adolescence.

Implications and Opportunities for Education Practice and Policy

Adolescence is a time when students experience multiple biological changes that create the cognitive and physiological framework necessary for advanced learning. More importantly, research shows that the environment surrounding an individual strongly influences how these biological processes take place and consequently, shape a person's learning and development. By understanding the science behind student learning and development, education leaders can support adolescent learning and development throughout the entirety of the education system, closing achievement and opportunity gaps.

Photo by Allison Shelley/The Verbatim Agency for **American Education: Images of Teachers and Students in Action**

What do these findings mean for educators?

- District and school leaders, educators, and counselors should design instructional programs and resources that increase and elevate opportunities for students to apply advanced cognitive strategies, such as metacognition and future thinking, to develop students' abilities to regulate and reflect upon their own thinking, increase their confidence, develop deeper learning skills, and improve their educational outcomes. These opportunities can occur through academic instruction as well as other school experiences. For example, educators and counselors can support students in developing future-thinking skills through college and career planning and disciplinary practices. District and school leaders should ensure equitable opportunities for all adolescents to access rigorous extended extracurricular learning opportunities that develop higher-order thinking skills, such as debate or robotics clubs.
- Educators should capitalize on adolescents' increased ability to remember personally relevant information by connecting academic learning to students' personal interests, prior knowledge, and current events. Teachers can develop students' working memory skills by designing assignments and assessments that require students to solve complex problems and connect information to their own experiences, rather than simply regurgitate memorized information.
- District and school leaders should provide teachers and counselors with support and professional learning necessary to provide students with guided opportunities to develop social and emotional skills and emotion-regulation strategies, such as cognitive reappraisal, as they navigate increasingly complex social environments. This might mean designating time during the school day, such as an advisory period, for adults in the school to discuss timely social issues with students.
- Health and physical education classes can improve students' knowledge about the body changes they experience during adolescence and how to care for themselves during this time of rapid development and as adults. In addition to offering formal opportunities for this type of learning, schools and districts should develop informal learning structures to engage parents, students, and communities to empower students to make healthy choices for themselves. These could include offering workshops or providing video clips on the importance of sleep and preparing healthy meals during parent-teacher-student association meetings or partnering with community public health organizations to provide resources and access to community clinics and other resources.

What do these findings mean for policymakers and advocates?

- Adolescence matters, yet evidence suggests that Title I funding, the federal government's primary source of financial support for underserved students, is allocated disproportionately to elementary schools.[58] School districts should use new flexibility provided under ESSA to target Title I funds toward high-poverty high schools.
- New research on brain science suggests that adolescents need opportunities to develop critical-thinking skills, otherwise the neural networks responsible for complex reasoning will remain underdeveloped, making it more challenging for individuals to engage in higher-order thinking as adults. Because assessments affect instruction significantly, states should encourage students to develop critical-thinking skills by using new flexibility provided under ESSA to embed complex performance tasks into statewide assessments.[59] (For more information about the opportunities ESSA offers states and districts to connect policy and practice to adolescent learning and development research, see All4Ed's report *Synapses, Students, and Synergies: Applying the Science of Adolescent Learning to Policy and Practice*.)
- The recent reauthorization of the Carl D. Perkins Career and Technical Education Act (Perkins) presents an important moment to support the science of adolescent learning.

States should use new opportunities in the law to develop partnerships among school districts, institutions of higher education, and employers to provide historically underserved students with opportunities to participate in college and career pathways that include work-based learning to develop students' higher-order thinking skills while preparing them for postsecondary education.

Photo by Allison Shelley/The Verbatim Agency for
American Education: Images of Teachers and Students in Action

Conclusion

Contrary to previous belief, early childhood is not the only period of significant brain development. Recent evidence shows that adolescence is a second period of brain plasticity and cognitive development, making those years a critical time for students and educators.

Education leaders should understand that adolescence presents a significant period for both learning opportunity and risk for students. As the brain prepares for adulthood, its development depends strongly on the learning environment and experiences provided during adolescence. Consequently, during middle and high school students must practice the types of complex cognitive and interpersonal skills necessary for postsecondary success.

> **[N]eurological and cognitive gains made through quality early childhood and elementary education may diminish if efforts to align policy and practice with learning and development research are not sustained in secondary school.**

If students do not have these opportunities, essential neural networks will remain underdeveloped, unnecessarily increasing the challenge of engaging in higher-order thinking as adults. In fact, neurological and cognitive gains made through quality early childhood and elementary education may diminish if efforts to align policy and practice with learning and development research are not sustained in secondary school.

Policymakers and educators should ensure that continuous improvement efforts at the secondary school level are comprehensive and developmentally appropriate. District and school leaders should design organizational structures, including academic support systems, school improvement efforts, structures that foster positive relationships, and wraparound services that respond to the learning and developmental needs of adolescent learners, supporting their academic, social, emotional, physical, and health needs.

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Glossary

abstract thinking. Thinking characterized by the use of general ideas or concepts. Compare to *concrete thinking*.

adolescence. The period of human development that starts with biological changes associated with puberty and ends once specific social expectations—determined by factors like family, culture, and society—are met.

affect. Any experience of feeling or emotion, ranging from suffering to elation, from the simplest to the most complex sensations of feeling, and from the most normal to the most pathological emotional reactions. Often described in terms of positive affect or negative affect, both mood and emotion are considered affective states.

autobiographical memory. A person's memory for episodes or experiences that occurred in his or her own life. Often the terms "autobiographical memory" and "episodic memory" are used interchangeably. However, autobiographical memory can consist of information stored in episodic memory (i.e., events experienced at a particular time and place), semantic memory (i.e., knowledge of general facts and concepts that give meaning to information), or a mix of the two. For example, the autobiographical memory of one's first day at school might contain episodic information, such as meeting the teacher, but it might also contain semantic information, such as knowledge that the teacher's name was Susan. Compare to *episodic memory*.

cognition. All forms of knowing and awareness, such as perceiving, conceiving, remembering, reasoning, judging, imagining, and problem solving.

cognitive reappraisal. The ability to change the trajectory of an emotional response by reinterpreting the meaning of the emotional stimulus. Cognitive reappraisal involves two parts: (1) recognizing a negative response and (2) reinterpreting the situation to either reduce the severity of the negative response or exchange the negative attitude for a more positive attitude.

concrete thinking. Thinking focused on immediate experiences and specific objects or events. Compare to *abstract thinking*.

dendrite. A branching, threadlike extension of the cell body that increases the receptive surface of a neuron.

emotion regulation. The ability of an individual to alter or adjust an emotion or set of emotions. *Explicit emotion regulation* requires conscious monitoring, using techniques such as learning to construe situations differently to manage them better, changing the target of an emotion in a way likely to produce a more positive outcome, and recognizing how different behaviors can be used in the service of a given emotional state. *Implicit emotion regulation* operates without deliberate monitoring; it modulates the intensity or duration of an emotional response without the need for awareness. Emotion regulation typically increases across the lifespan. Also called *emotional regulation*.

episodic memory. The ability to remember personally experienced events associated with a specific time and place. In addition to recalling facts of a past event, an individual must engage in "mental time travel" and remember that he or she was the one who lived the event. Compare to *autobiographical memory*.

executive functions. Basic cognitive processes, such as attentional control, cognitive inhibition, inhibitory control, working memory, and cognitive flexibility. Higher-order executive functions require simultaneous use of multiple basic executive functions and include planning, reasoning, and problem solving. These functions frequently are associated with neural networks that include the frontal lobe (see Glossary for definition), particularly the prefrontal cortex (see Glossary for definition).

fixed mindset. The belief that attributes and abilities inherently are established and unchanging. Compare to *growth mindset*.

frontal lobe. One of four main lobes of each cerebral hemisphere of the brain. It is concerned with motor and higher-order executive functions. Compare to *parietal lobe*.

future thinking. Thinking focused on visualizing, predicting, and planning for the future.

gray matter. Any area of neural tissue that is dominated by cell bodies and devoid of myelin (fatty cells), such as the cerebral cortex and the H-shaped periaqueductal gray of the spinal cord. Compare to *white matter*.

growth mindset. The belief that abilities and intelligence can be developed. Compare to *fixed mindset*.

hippocampus. A seahorse-shaped part of the forebrain—located in the region of the temporal lobe—that is important for declarative memory and learning.

hormone. A substance secreted into the bloodstream by an endocrine gland or other tissue or organ to regulate processes in target organs and tissues.

hypothalamus. Part of the brain with primary control of the autonomic (involuntary) functions of the body. It also integrates autonomic activity into appropriate responses to internal and external stimuli. Additionally, it is involved in appetite, thirst, sleep, and sexuality.

melatonin. A hormone that helps regulate seasonal changes in physiology and may influence puberty. It is implicated in the initiation of sleep and in the regulation of the sleep-wake cycle.

metacognition. Awareness of one's own cognitive processes, often involving a conscious attempt to control them.

metamemory. Awareness of one's own memory processes, often involving a conscious attempt to direct or control them. It is an aspect of metacognition.

myelin. The substance that forms the insulating sheath around the axons of many neurons. It consists mainly of fatty cells, with additional myelin proteins, and accounts for the whitish color of white matter.

myelination. The process of wrapping neurons and their connections with fatty cells.

neuron. The basic cellular unit of the nervous system. Each neuron consists of a cell body; fine, branching extensions (dendrites) that receive incoming nerve signals; and a single, long extension (axon) that conducts nerve impulses to its branching terminal. The axon terminal transmits impulses to other neurons or to effector organs (e.g., muscles and glands) via junctions called *synapses* or neuromuscular junctions. Axons of neurons are often surrounded by a myelin sheath (fatty cells). In contrast to other cell types, neurons possess the capacity to modify their structure and function based on receipt of information and stimuli from their immediate environment. Also called *nerve cell*.

parietal lobe. One of four main lobes of each cerebral hemisphere of the brain. It occupies the upper central area of each hemisphere, behind the frontal lobe, ahead of the occipital lobe, and above the temporal lobe. Parts of the parietal lobe participate in somatosensory activities, such as discrimination of size, shape, and texture of objects; visual activities, such as visually guided actions; auditory activities, such as speech perception; and episodic and working memory. Compare to *frontal lobe*.

perspective taking. Looking at a situation from a viewpoint that is different from one's usual viewpoint. This may involve adopting the perspective of another person or that associated with a particular social role.

plasticity. Flexibility and adaptability. Plasticity of the nervous or hormonal systems makes it possible to learn and register new experiences.

prefrontal cortex. The most anterior (forward) part of the cerebral cortex of each frontal lobe in the brain. The prefrontal cortex functions involve attention, planning, working memory, and the expression of emotions and appropriate social behaviors.

prospective memory. Remembering to do something in the future. Prospective memory contrasts with retrospective memory (remembering past events).

puberty. The stage of development when the genital organs reach maturity and secondary sex characteristics begin to appear, signaling the start of adolescence.

sensation seeking. The tendency to search out and engage in thrilling activities as a method of increasing stimulation and arousal. It typically takes the form of engaging in highly stimulating activities that have an element of danger, such as skydiving or race-car driving.

social cognition. Cognition in which people perceive, think about, interpret, categorize, and judge their own social behaviors and those of others.

synapse. The specialized junction through which neurons transmit signals from one to another.

synaptic pruning. A neurodevelopmental process, occurring both before birth and up to the second decade of life, during which the weakest synapses between neurons are eliminated.

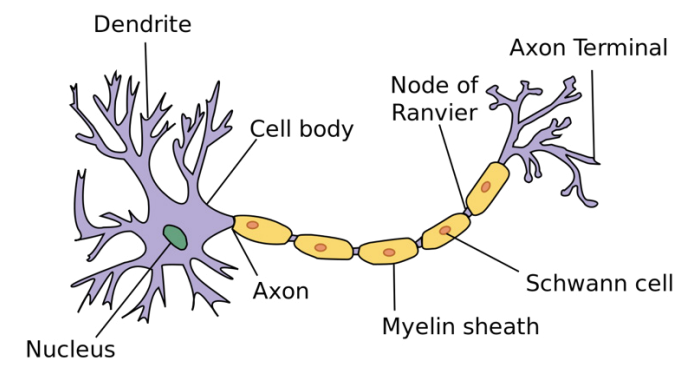
white matter. Parts of the nervous system composed of nerve fibers enclosed in a myelin sheath (fatty cells), which gives a white coloration to otherwise grayish neural structures. Compare to *gray matter*.

working memory. The short-term maintenance and manipulation of information necessary for performing complex cognitive tasks, such as learning, reasoning, and comprehension.

Sources: G. R. VandenBos, ed., *APA Dictionary of Psychology* (Washington, DC: American Psychological Association, 2007); S. Blakemore, *Inventing Ourselves: The Secret Life of the Teenage Brain* (New York: NY: PublicAffairs, Hachette Book Group, 2018); C. S. Dweck, *Mindset: The New Psychology of Success* (New York: NY: Random House, 2006); G. Oettingen, A. T. Sevincer, and P. M. Gollwitzer, *The Psychology of Thinking about the Future* (New York: NY: The Guilford Press, 2018).

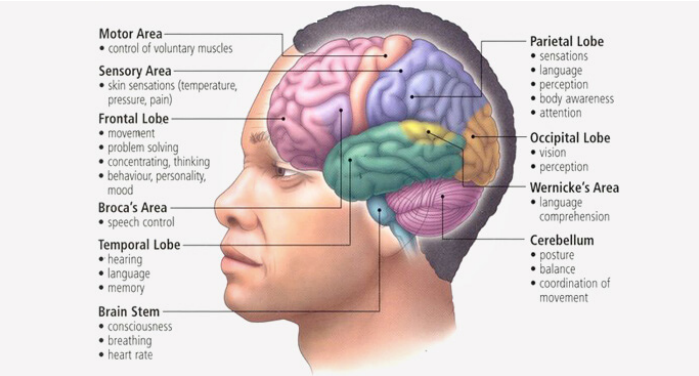
Appendix

FIGURE A1: Parts of a Neuron



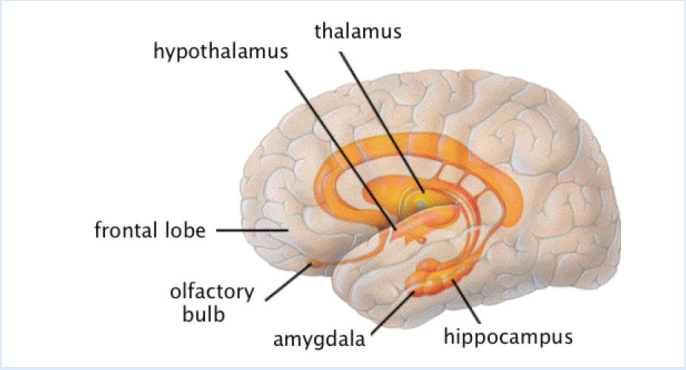
Source: U.S. National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program, "Anatomy and Physiology," https://commons.wikimedia.org/wiki/File:Neuron.svg (accessed June 1, 2018).

FIGURE A2: Areas of the Brain



Source: Human Brain Facts, "Human Brain Structure and Their Functions in Human Body," http://www.humanbrainfacts.org/basic-structure-and-function-of-human-brain.php (accessed June 1, 2018).

FIGURE A3: Limbic System



Source: C. G. Boeree, "General Psychology: The Emotional Nervous System," https://webspace.ship.edu/cgboer/limbicsystem.html (accessed June 1, 2018).

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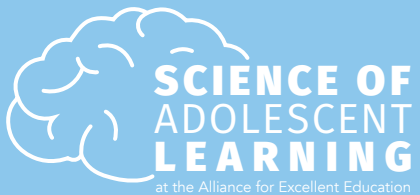

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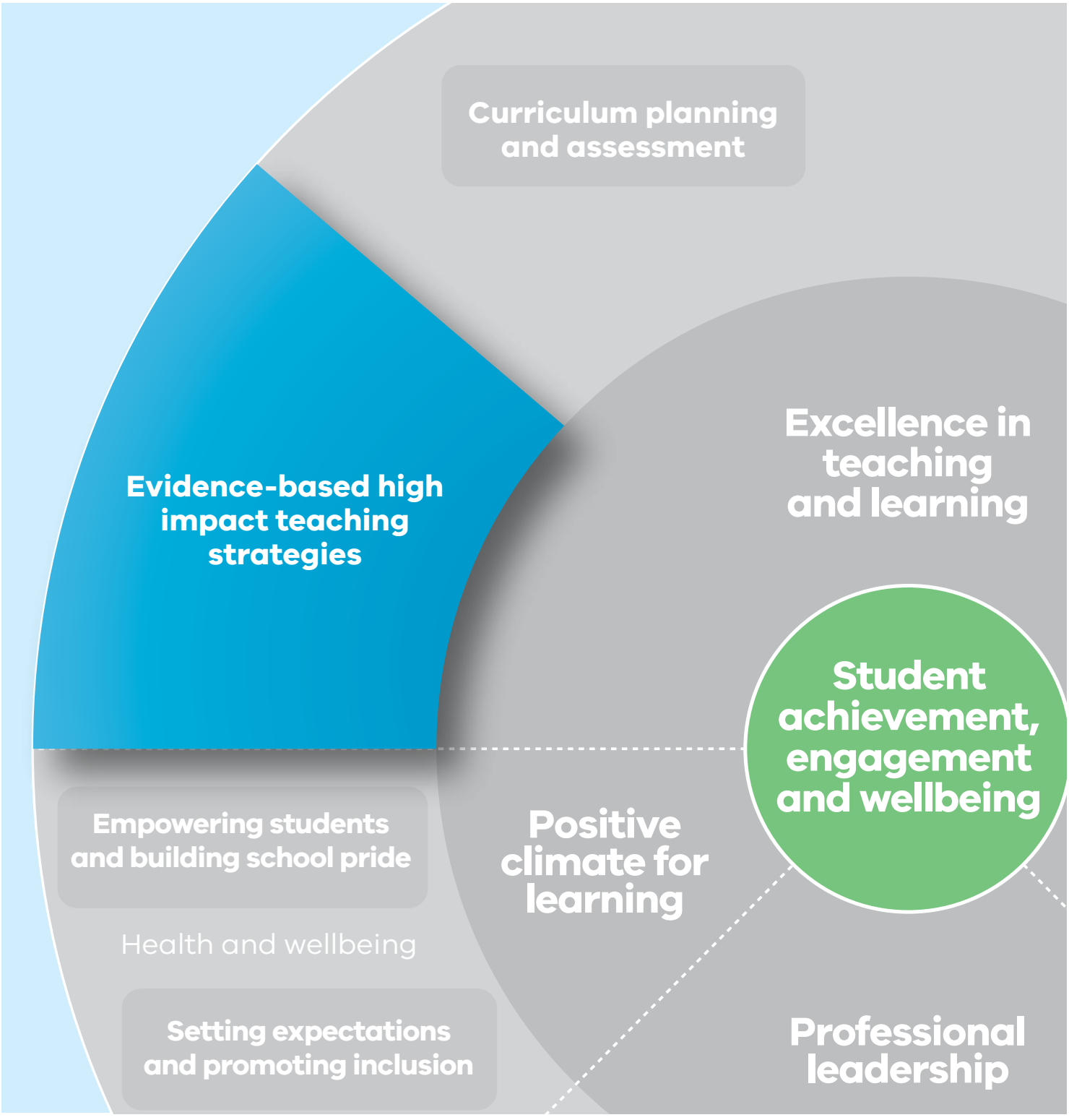

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Melbourne June 2017

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Contents

Deputy Secretary's Message

When teachers work together to improve their practice, students learn more. This simple yet powerful idea is at the heart of effective schools. Collaboration builds collective responsibility for constantly improving teaching practice and so student learning. The challenge for teachers and schools is to develop a shared understanding of what excellent practice looks like. While it will not look exactly the same in every classroom, there are some instructional practices that evidence suggests work well in most.

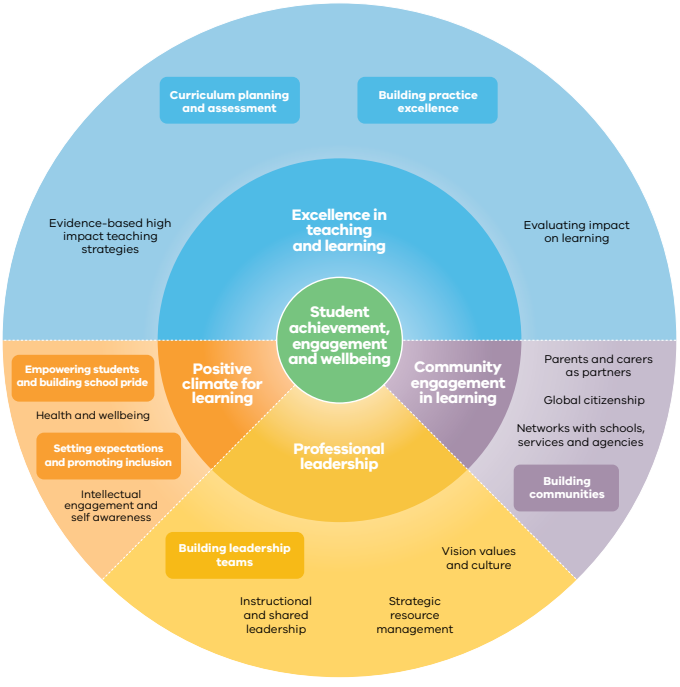
These High Impact Teaching Strategies (HITS) have been brought together here to support the thousands of increasingly collaborative and evidence-based conversations taking place between teachers in schools each day. These strategies provide teachers and teams with opportunities to observe, reflect on and improve a range of fundamental classroom practices.

The HITS are not intended to replace other teaching strategies teachers might already use with success. Instead, they will add to the repertoire of effective strategies that teachers can apply to the wide variety of learning needs that students present with each day.

Since 2016, school leadership teams have drawn on the Framework for Improving Student Outcomes (FISO) to drive strategic and annual planning at the whole school level. By clearly and insistently directing that planning toward student learning, FISO is helping to identify and address persistent challenges for individual teachers and to build collective teacher efficacy.

The HITS provide a clear link between the 'Evidence Based High Impact Teaching Strategies' dimension of FISO and classroom practice. Teachers can plan and adjust their practice in response to one or more of the HITS and monitor the impact on student engagement and learning outcomes. This resource provides a focus for the professional development efforts of individual teachers, which can be linked to the goals and feedback components of their own Performance and Development Plans.

I encourage teachers in all schools to use the HITS to challenge themselves and their colleagues as part of our collective and ongoing commitment to improving learning outcomes for every Victorian child.



Bruce Armstrong

Deputy Secretary, Regional Services Group

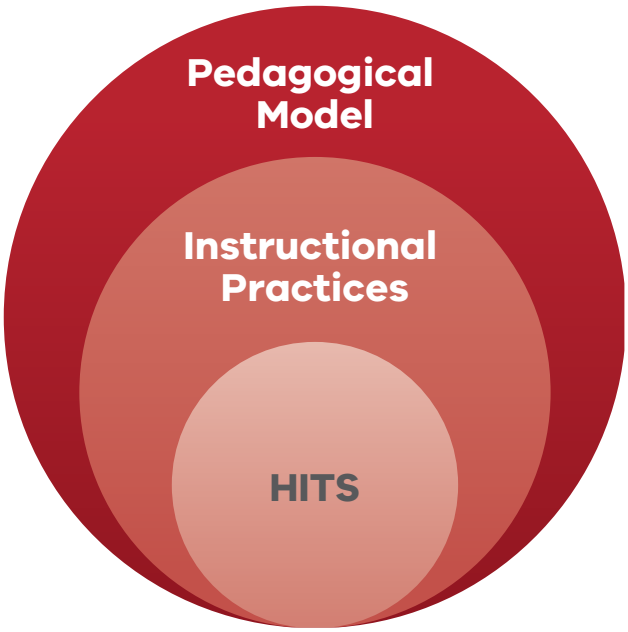
What are the High Impact Teaching Strategies (HITS)?

The HITS are 10 instructional practices that reliably increase student learning wherever they are applied. They emerge from the findings of tens of thousands of studies of what has worked in classrooms across Australia and the world. International experts such as John Hattie and Robert Marzano have synthesised these studies and ranked hundreds of teaching strategies by the contribution they make to student learning [see 'What is effect size?' box]. The HITS sit at the top of these rankings.

Some teachers will ask, "But will they work in my classroom, with my students?" Only the professional judgement of teachers, both individual and collective, can answer that question. For any concept or skill that students need to learn, using a HITS to teach it increases the chances that students will learn it, compared to using other strategies. But they are reliable, not infallible. Knowing their students and how they learn, teachers are well-placed to judge whether a HITS or another strategy is the best choice to teach that concept or skill.

The HITS will not be new to most teachers. The purpose of this resource is to bring them together in one place, along with practical examples of how other Victorian teachers are using them successfully.

The HITS alone do not constitute a complete framework for professional practice. They are part of the full set of instructional practices that contribute to a comprehensive pedagogical model [see diagram below].



This resource offers:

- **accessible, succinct guidance on using high impact, evidence-based strategies**
- **bite sized insights that enable you to focus on one or more HITS, and to progressively build expertise, and**
- **scalable possibilities, allowing individual teachers, Professional Learning Communities, and whole schools, to set goals and actions centred on the HITS.**

What is effect size?

Effect size is a measure of the contribution an education intervention makes to student learning. It allows us to move beyond questions about whether an intervention worked or not, to questions about how well an intervention worked in varying contexts. This evidence supports a more scientific and rigorous approach to building professional knowledge. Effect size is an important tool for reporting and interpreting the effectiveness of specific teaching practices and interventions*.

Highly regarded educational researchers and resources, including Hattie, Lemov, Marzano, and the Teaching and Learning Toolkit**, have used slightly different methodologies to measure effect size and identify HITS. Despite their varied approaches and terminology, all agree on a number of powerful strategies. These strategies are reflected in this HITS resource and the AITSL Standards and the Classroom Practice Continuum.

* Education Endowment Foundation (2012) *Teaching and Learning Toolkit: Technical appendices.* https://v1.educationendowmentfoundation.org.uk/uploads/pdf/Technical_Appendices_(July_2012).pdf

** Evidence for Learning (2017) *Teaching and Learning Toolkit - Australia.* http://evidenceforlearning.org.au/the-toolkit/

Who are the HITS for?

Teachers

The HITS will support teachers at every career stage. Each strategy is accompanied by two examples. The examples show teachers how to adapt the HITS to different learning goals and needs, and to respond to different school contexts.

For beginning teachers, the HITS are a bank of reliable instructional practices they can use with confidence.

For experienced teachers, this resource can add to their understanding of the HITS they are already using, and suggest new ways to use them in the classroom.

Even teachers highly familiar with the HITS will benefit from this resource as they pursue mastery of these valuable instructional practices through practice, reflection, shared observation and feedback.

Professional Learning Communities

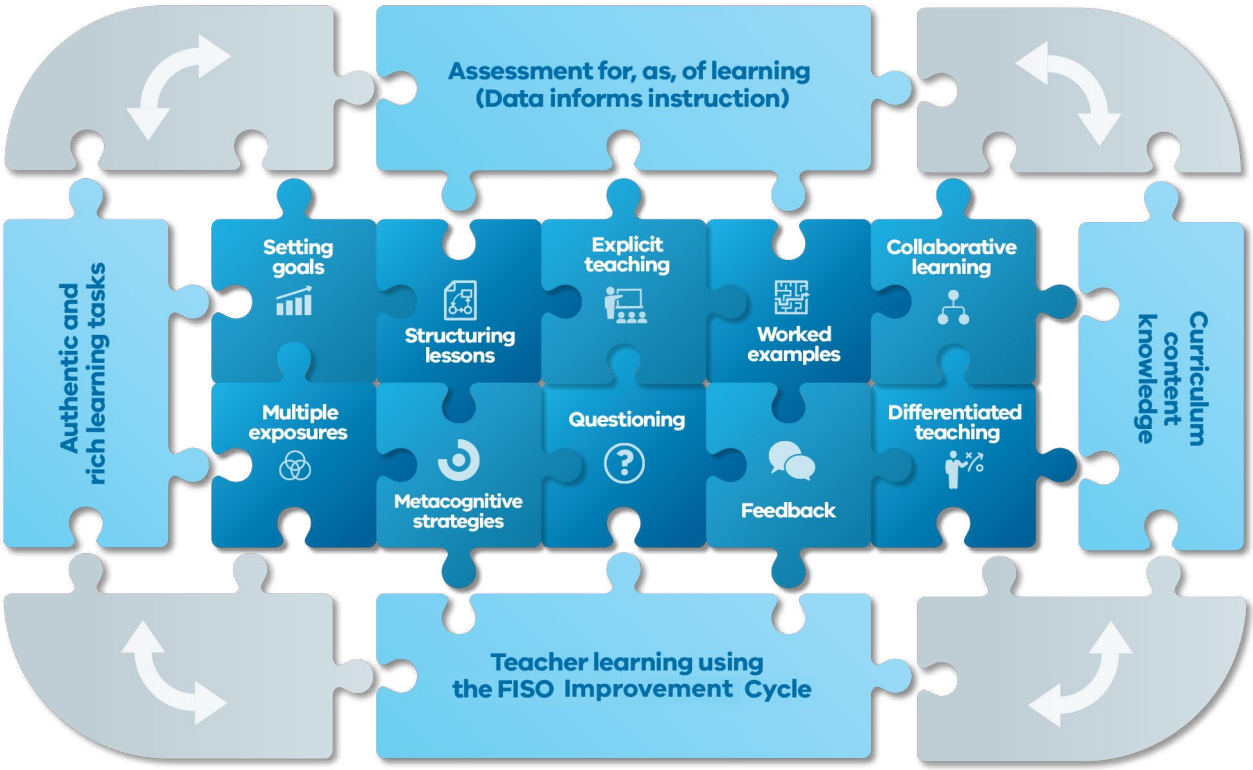
Confined to individual teachers and classrooms, the HITS will not contribute to the collective efficacy that marks out high-performing schools. In these schools, teachers come together to pool their knowledge of effective teaching into a collaborative approach to planning, implementing and monitoring teaching interventions.

By using the HITS to build their pool of knowledge, these professional learning communities can anchor their interventions in evidence-based practices and so increase the likelihood of those interventions being effective.

School leaders

For school leaders the HITS are a professional learning opportunity. The HITS are linked to each other, and connected to a broader repertoire of teacher skills and knowledge. They can be connected to collaboration between teachers in professional learning communities and integrated into classroom and school planning around curriculum, instruction and assessment.

Understanding the interdependencies and developing a whole of practice approach is complex work for teachers which requires classroom embedded professional learning and a supportive high performance learning culture in a school. A sustained focus on HITS can be supported by coaching, modeling, observation and feedback to ensure widespread use of successful teaching practices.



Using the HITS

This resource offers teachers and school leaders an opportunity to embed and share the use of successful instructional practices by providing:

- a common language to use in planning, monitoring and reflecting on classroom practice
- a developmental continuum to measure proficiency across ten high-impact teaching strategies, and
- initial resources to guide a practice improvement journey.

The HITS will have the strongest impact on student learning when used as part of an ongoing improvement cycle embedded in professional learning communities.

Effective teams use the improvement cycle to:

- diagnose a classroom need
- investigate a problem of practice
- identify one or more of the HITS as a possible intervention
- unpack, discuss and model the strategies
- collectively review them as part of observation rounds.

The review and evaluation phase of the improvement cycle is critical to using the HITS for maximum impact on student learning. While the strategies are reliable, their effectiveness in any particular school context can only be determined by applying a HITS to an individual or group of students and measuring its impact on student learning.

Mastery of the HITS requires you to draw on both your deep curriculum knowledge and your skills in assessment for, as and of learning. Applying the HITS effectively relies on tapping into your expertise to develop and implement rich, authentic learning tasks. Importantly, adept application of the HITS will stimulate your students to take agency for, and reflect on, their own learning.

The continuum of practice included with each HITS will support you to reflect on your practice, assess proficiency levels and set improvement goals, which can be linked to the performance and development cycle. The broader FISO continua for the 'Evidence Based High Impact Teaching Strategies' dimension will also assist leaders and teachers to maintain a whole of practice focus.

Deliberate practice and feedback on HITS in a trusted and collaborative environment will help you to develop new skills and extend existing ones, impacting both teacher and student learning over time.

Providing feedback

This resource is the result of the generous collaboration of numerous teachers from across Victoria. Their input and feedback was essential in tailoring the HITS to meet teachers' needs. However, this is the first version of the resource and your feedback will assist the Department in further improving the HITS. You can provide input into the development of future versions using the following survey tool:
https://www.surveymonkey.com/r/PT26S65

1. Setting Goals

Overview

Lessons have clear learning intentions with goals that clarify what success looks like.

Lesson goals always explain what students need to understand, and what they must be able to do. This helps the teacher to plan learning activities, and helps students understand what is required.

Key elements

- Based on assessed student needs
- Goals are presented clearly so students know what they are intended to learn
- Can focus on surface and/or deep learning
- Challenges students relative to their current mastery of the topic
- Links to explicit assessment criteria

Related effect sizes*

- Goals – 0.56
- Teacher clarity – 0.75

2. Structuring Lessons

Overview

A lesson structure maps teaching and learning that occurs in class.

Sound lesson structures reinforce routines, scaffold learning via specific steps/activities. They optimise time on task and classroom climate by using smooth transitions. Planned sequencing of teaching and learning activities stimulates and maintains engagement by linking lesson and unit learning.

Key elements

- Clear expectations
- Sequencing and linking learning
- Clear instructions
- Clear transitions
- Scaffolding
- Questioning/feedback
- Formative assessment
- Exit cards

Related effect sizes*

- Scaffolding – 0.53
- Formative evaluation – 0.68
- Teacher clarity – 0.75

3. Explicit Teaching

Overview

When teachers adopt explicit teaching practices they clearly show students what to do and how to do it.

The teacher decides on learning intentions and success criteria, makes them transparent to students, and demonstrates them by modelling. The teacher checks for understanding, and at the end of each lesson revisits what was covered and ties it all together (Hattie, 2009).

Key elements

- Shared learning intentions
- Relevant content and activities
- New content is explicitly introduced and explored
- Teacher models application of knowledge and skills
- Worked examples support independent practice
- Practice and feedback loops uncover and address misunderstandings

Related effect sizes*

- Goals – 0.56
- Worked examples – 0.57
- Time on task – 0.62
- Spaced practice – 0.60
- Direct instruction – 0.59
- Teacher clarity – 0.75

4. Worked Examples

Overview

A worked example demonstrates the steps required to complete a task or solve a problem.

By scaffolding the learning, worked examples support skill acquisition and reduce a learner's cognitive load.

The teacher presents a worked example and explains each step. Later, students can use worked examples during independent practice, and to review and embed new knowledge.

Key elements

- Teacher clarifies the learning objective, then demonstrates what students need to do to acquire new knowledge and master new skills
- Teacher presents steps required to arrive at the solution so students' cognitive load is reduced and they can focus on the process
- Students practice independently using the worked example as a model

Related effect sizes*

- Worked examples – 0.57
- Spaced practice – 0.60

5. Collaborative Learning

Overview

Collaborative learning occurs when students work in small groups and everyone participates in a learning task.

There are many collaborative learning approaches. Each uses varying forms of organisation and tasks.

Collaborative learning is supported by designing meaningful tasks. It involves students actively participating in negotiating roles, responsibilities and outcomes.

Key elements

- Students work together to apply previously acquired knowledge
- Students cooperatively solve problems using previously acquired knowledge and skills
- Students work in groups that foster peer learning
- Groups of students compete against each other

Related effect sizes*

- Peer tutoring – 0.55
- Reciprocal teaching – 0.74
- Small group learning – 0.49
- Cooperative learning vs whole class instruction – 0.41
- Cooperative learning vs individual work – 0.59
- Cooperative learning vs competitive learning – 0.54

Months of progress**

- Collaborative learning +5
- Peer tutoring +5

* As reported in: Hattie, J. (2009). *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement.* Milton Park, UK: Routledge.

** As reported in: Evidence for Learning (2017) *Teaching and Learning Toolkit - Australia.* http://evidenceforlearning.org.au/the-toolkit/

6. Multiple Exposures

Overview

Multiple exposures provide students with multiple opportunities to encounter, engage with, and elaborate on new knowledge and skills.

Research demonstrates deep learning develops over time via multiple, spaced interactions with new knowledge and concepts. This may require spacing practice over several days, and using different activities to vary the interactions learners have with new knowledge.

Key elements

- Students have time to practice what they have learnt
- Timely feedback provides opportunities for immediate correction and improvement

Related effect sizes*

- Time on task – 0.62
- Spaced practice – 0.71
- Feedback – 0.73

Months of progress**

- Mastery learning +5

7. Questioning

Overview

Questioning is a powerful tool and effective teachers regularly use it for a range of purposes. It engages students, stimulates interest and curiosity in the learning, and makes links to students' lives.

Questioning opens up opportunities for students to discuss, argue, and express opinions and alternative points of view.

Effective questioning yields immediate feedback on student understanding, supports informal and formative assessment, and captures feedback on effectiveness of teaching strategies.

Key elements

- Plan questions in advance for probing, extending, revising and reflecting
- Teachers use open questions
- Questions used as an immediate source of feedback to track progress/understanding
- Cold call and strategic sampling are commonly used questioning strategies

Related effect sizes*

- Questioning – 0.46

8. Feedback

Overview

Feedback informs a student and/or teacher about the student's performance relative to learning goals.

Feedback redirects or refocuses teacher and student actions so the student can align effort and activity with a clear outcome that leads to achieving a learning goal.

Teachers and peers can provide formal or informal feedback. It can be oral, written, formative or summative. Whatever its form, it comprises specific advice a student can use to improve performance.

Key elements

- Precise, timely, specific, accurate and actionable
- Questioning and assessment is feedback on teaching practice
- Use student voice to enable student feedback about teaching

Related effect sizes*

- Feedback – 0.73

Months of progress**

- Feedback +8

9. Metacognitive Strategies

Overview

Metacognitive strategies teach students to think about their own thinking.

When students become aware of the learning process, they gain control over their learning.

Metacognition extends to self-regulation, or managing one's own motivation toward learning. Metacognitive activities can include planning how to approach learning tasks, evaluating progress, and monitoring comprehension.

Key elements

- Teaching problem solving
- Teaching study skills
- Promotes self-questioning
- Classroom discussion is an essential feature
- Uses concept mapping

Related effect sizes*

- Teaching problem solving – 0.63
- Study skills – 0.60
- Self-questioning – 0.64
- Classroom discussion – 0.82
- Concept mapping – 0.64

Months of progress**

- Metacognition and self-regulation +8

10. Differentiated teaching

Overview

Differentiated teaching are methods teachers use to extend the knowledge and skills of every student in every class, regardless of their starting point.

The objective is to lift the performance of all students, including those who are falling behind and those ahead of year level expectations.

To ensure all students master objectives, effective teachers plan lessons that incorporate adjustments for content, process, and product.

Key elements

- High quality, evidence based group instruction
- Regular supplemental instruction
- Individualised interventions

Related effect sizes*

- RTI - 1.07
- Piagetian programs - 1.28
- Second and third chance programs - 0.5

Months of progress**

- Individualised instruction +2
- Mastery learning +5

High Impact Teaching Strategy
Setting Goals

Effective teachers set and communicate clear lesson goals to help students understand the success criteria, commit to the learning, and provide the appropriate mix of success and challenge.

Strategy overview

Hattie found an effect size of 0.56 for setting goals (Hattie, 2009).

What is it?

Lessons need clear learning intentions with goals that clarify what success looks like. Lesson goals always explain what students need to understand, and what they must be able to do. This helps the teacher to plan learning activities, and helps students understand what is required.

How effective is it?

Research shows goals are important for enhancing performance. It is important to set challenging goals, rather than 'do your best' goals relative to student starting places (Hattie, 2009).

Considerations

Learning goals must provide challenge for all students. By setting challenging goals, the teacher develops and maintains a culture of high expectations.

Learning goals should be achievable for students of varying abilities and characteristics. They must also have a firm base in assessed student needs. Assessment provides teachers with evidence of prior learning, and the information they need to set goals that offer each student the appropriate level of stretch/challenge.

Effective teachers design assessment tasks that require students to demonstrate knowledge and skills at many levels. Tasks will include lower order processes like comprehension, and higher order processes like synthesis and evaluation.

When teachers explain the connections between learning goals, learning activities and assessment tasks, then students can use learning goals to monitor and progress their learning.

This strategy is demonstrated when the teacher:

- assesses students' prior knowledge
- uses evidence to differentiate learning goals for groups of students based on need
- demonstrates a purpose for learning by linking a specific activity to the learning goals
- provides realistic but challenging goals, and recognises effort towards achieving them.

This strategy is not demonstrated when the teacher:

- implies by words or actions that some students are not expected to achieve the learning goal
- praises all work regardless of quality and effort
- assesses student work against other students' work, rather than against prior achievement and individual learning goals.

This strategy is demonstrated when students:

- actively engage with the learning goals to plan their own learning
- self-monitor their progress, and provide evidence they believe demonstrates they have achieved their goals
- frame future learning goals based on identified strengths and areas for improvement.

Resources:

- AITSL videos:
  Setting challenging and achievable learning goals:
  https://www.youtube.com/watch?v=uXx8Szy7lZE

  Sound routines:
  https://www.youtube.com/watch?v=N0r1SLXIoAo

  High expectations:
  https://www.youtube.com/watch?v=6GZqusdspPM

  Flash dance:
  https://www.youtube.com/watch?v=kvaKvgXut0Q

  Circle time:
  https://youtu.be/wOlKoXz_5t0
- Learning intentions:
  http://www.assessmentforlearning.edu.au/professional_learning/learning_intentions/learning_examples_intentions.html#3
- Insight Assess Platform:
  http://www.insight.vic.edu.au/
- Proficiency scales
  http://www.marzanoresearch.com/resources/proficiency-scale-bank

Examples that illustrate the strategy

Example 1: Secondary – Health and Physical Education

The Health and Physical Education (HPE) Team at a Melbourne secondary school invited the Professional Learning Coordinator to their Team meeting to discuss using goal setting and success criteria for the upcoming Year 8 Dance Unit. The Team wanted to ensure students developed the required knowledge, understanding and skills identified in the achievement standard. Discussion during the meeting underlined the importance of providing students with clear learning intentions, success criteria and a common assessment language. The Team decided to create a unit plan that included a proficiency scale for the unit, with clear learning intentions and success criteria for each lesson in the unit.

At the start of the dance unit teachers presented their students with a unit overview, and provided them with opportunities to demonstrate their current knowledge and skills on a proficiency scale. Students were also introduced to the unit's learning intentions and success criteria so they could self-monitor their progress throughout the unit.

At the end of the dance unit, students reviewed the proficiency scales, and self and peer-assessed their gains in knowledge and skills. Teachers supported individual students to identify their strengths and areas for improvement, and to set new learning goals. HPE teachers collected the data and used it for overall student assessment, and to support reflection on the impact of their teaching practice.

Using proficiency scales allowed students and teachers to recognise prior learning levels, and created opportunities to reflect on student growth in engagement and academic outcomes. Consistently articulating learning intentions and success criteria allowed teachers to set challenges that fostered student commitment to learning, and built their confidence in attaining the learning intentions.

Example 2: Secondary – Whole school approach

At an outer suburban secondary college, the Attitudes to School Survey results revealed a high level of student disengagement. Students reported learning was not engaging. Parents complained their children were often unable to articulate what they learnt at school. The school leadership team decided to respond with a suite of whole school initiatives that would roll out progressively through the year. The interventions focused on making learning visible to students. The first step was to implement a consistent approach in every lesson to setting goals and success criteria.

Resources were allocated to support the initiative. Over the summer holidays all classrooms were fitted with small whiteboards with pre-set sections for learning outcomes, success criteria, activities and review questions. During the professional development and planning day at the start of Term 1, all teachers were trained to use the mini-whiteboards, and to develop learning outcomes clearly linked to lesson activities and success criteria. During Term 1, Professional Learning Communities focused on supporting implementation of the strategy and monitoring its impact on student learning.

By the end of Term 2, after achieving a high level of consistency and precision in using the mini-whiteboards, teachers reported an increase in student engagement. The results of a student survey were even more promising, showing a sharp increase in engagement with learning, even when teachers had not yet noticed shifts in performance.

In Term 3, teachers continued to evaluate the effectiveness of their practice, monitor student engagement and learning, and seek feedback from colleagues and students to gauge the impact of changed practices.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
Teachers set learning goals that explain what students need to understand, and what they must be able to do. Teachers use student assessment data and prior learning to set learning goals. Teachers design learning activities and assessment tasks that reflect the learning goals.	Teachers set explicit, challenging and achievable learning goals for all students, drawing on students' backgrounds, interests and prior knowledge. Teachers work together to design learning activities and assessment tasks that require students to demonstrate knowledge and skills at many levels. Teachers make explicit the connections between learning goals, learning activities, and assessment tasks.	Teachers develop and maintain a culture of high expectations for all students by setting challenging learning goals. Teachers use moderation of student assessment tasks to refine learning goals, and to provide appropriate levels of challenge for each student. Teachers support students to use learning goals to monitor and progress their learning. They encourage students to review and set their own learning goals.	A culture of high expectations for all students is embedded. Students regularly set their own learning goals, self-reflect and evaluate, and share feedback with peers. Teachers support students to use evidence to personalise and revise their learning goals, based on identified strengths and areas for improvement. Teachers use data to evaluate the impact of setting goals to raise achievement and engagement levels.

Evidence base

- Evidence for Learning: *Teaching and Learning Toolkit – Australia*. http://evidenceforlearning.org.au/the-toolkit/
- Hattie, J. (2009). *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement*. Milton Park, UK: Routledge.
- Lemov, D. (2015). *Teach like a champion 2.0: 62 techniques that put students on the path to college*. San Francisco, USA: Jossey-Bass.
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2

High Impact Teaching Strategy
Structuring Lessons

Effective teachers plan and deliver structured lessons which incorporate a series of clear steps and transitions between them, and scaffold learning to build students' knowledge and skills.

Strategy overview

Hattie (2009) found an effect size of 0.53 for scaffolding.

What is it?

A lesson structure maps teaching and learning that occurs in class. Sound lesson structures reinforce routines, scaffold learning via specific steps/activities, and optimise time on task and classroom climate using smooth transitions. Planned sequencing of teaching and learning activities stimulates and maintains engagement by linking lesson and unit learning.

How effective is it?

The way teachers structure lessons can have a large impact on student learning. Some research shows student achievement is maximised when teachers structure lessons so that they:

- begin with overviews and/or review objectives;
- outline the content to be covered and signal transitions between lesson parts;
- call attention to main ideas; and
- review main ideas at the end (Kyriakides et al, 2013).

A 2013 meta-analysis found an effect size of 0.36 when lessons are structured by summarising main points, gradually increasing the difficulty level, and connecting to previous lessons (Kyriakides et al, 2013).

There is no specific measure of the effect size of structuring lessons. However, a sound lesson structure contributes to effective scaffolding of student learning, which has an effect size of 0.53.

Considerations

It is useful to integrate structuring lessons with other High Impact Teaching Strategies. By coherently organising teaching and learning, sound lesson structures create synergies between the strategies, cumulatively enhancing their effectiveness.

Teachers must also consider sequencing and the pace of the curriculum.

This strategy is demonstrated when the teacher:

- explains to students the steps in the lesson, including presenting learning intentions, explicitly presenting new knowledge, identifying planned opportunities for practice, outlining questioning techniques the class will use, and describing the assessment formats
- makes clear connections between the learning goals, activities and assessment tasks
- creates transparent, predictable and purposeful routines for students
- identifies clear transitions between each step in the lesson
- plans the sequence of steps to scaffold student learning
- monitors student understanding and provides feedback.

This strategy is not demonstrated when:

- lesson structures keep changing, producing unhelpful unpredictability in the classroom environment.

This strategy is demonstrated when the students:

- understand the learning goals and success criteria
- understand the lesson routine and confidently negotiate the sequence of steps/activities.

Resources:

- AITSL videos:

  Multiple activities to engage students: https://www.youtube.com/watch?v=lyYrAgnKe1A

  Deep questioning to support research: https://www.youtube.com/watch?v=0-Au253dMS4

  Transformative classrooms: https://youtu.be/BDCyNlmmxlo

  Making money amounts: https://www.youtube.com/watch?v=-Sc8RqZw-0o

  Well-sequenced mathematics teaching: https://www.youtube.com/watch?v=gijBHH0Z8M0

  Humpty Do Primary School, NT: https://www.youtube.com/watch?v=zWDny7Nk7Xk&feature=youtu.be

  and

  https://www.youtube.com/watch?v=zWDny7Nk7Xk

Examples that illustrate the strategy

Example 1: P-9 – Science

A graduate Science teacher in a P-9 metropolitan school is working with a mentor teacher to ensure their Plate Tectonics lessons are structured, succinct and aligned to the Science Understanding and Inquiry Skills standards. The teachers devise a lesson structure that ensures each lesson links to previous student learning, has clear learning intentions, details specific activities, and provides opportunities for assessment of learning.

After gauging student prior knowledge through questioning, the teachers collaboratively set appropriate learning objectives and success criteria. They are presented as the lesson begins using acronyms: WALT (We Are Learning To) refers to learning objectives, and WILF (What I'm Looking For) refers to success criteria.

The teacher sets clear expectations by defining WALT and WILF at the start of the lesson, ensuring students understand the lesson's objectives and content. As the class moves through the activities, the teacher provides opportunities to measure student learning. Using Traffic Light questioning, students indicate their level of content understanding. The teacher has structured the lesson to allow time to work with the students requiring additional support. At the same time, those who indicate they have understood the concept are working on an extension activity. When students demonstrate a clear understanding of the concept they can transition to the next activity.

At the end of the lesson, the teacher summarises and reinforces the main ideas, then poses a question to students in the form of an Exit Card. The teacher analyses their answers to assess whether they have grasped concepts well enough to progress in the unit.

The lesson design reinforces routine through a scaffolded approach to learning informed by clearly identified goals and formative assessment. Time on task is optimised and student engagement maintained.

Example 2: P-12 – Performing arts

A Performing Arts teacher at a regional P – 12 school emphasises lesson designs with clear learning intentions and success criteria. This approach embeds a sequential structure students can rely on as they build skills and content knowledge. The scaffolded approach provides smooth transitions between activities, ensuring students build on prior knowledge, identify links between lesson activities, and can discern the relevance of the activities.

In a Miming unit, lesson and unit structures are designed to scaffold student learning. Opportunities are created to build their improvisation skills, and to demonstrate competence against the achievement standards in the level 5/6 band.

To begin, the teacher identifies students' prior knowledge through questioning and a short performance. Students perform a short mime in front of a small audience so the teacher can gauge individual skill levels. The teacher then provides a brief overview of miming with worked examples.

The unit's focus then turns to skill development. Each lesson has clearly articulated success criteria – a set of activities scaffold the learning and explicitly address the learning intentions, with clear transitions linking to skills developed in previous lessons. Lessons are designed so students can participate in mime games and activities that furnish opportunities for self-assessment, peer feedback and teacher feedback. The teacher's clear instructions assist all students to build skills. This scaffolding approach is intended to make learning visible and predictable, helping students to feel comfortable, prepared and capable of presenting a short mime by the end of the unit.

The unit concludes with a summative assessment. Students perform a short mime in front of an audience, similar in design to the initial assessment activity. By comparing both performances, the teacher can assess and provide feedback on individual student growth and skill development.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
The teacher identifies the learning goals, sets learning activities, and assesses student understanding. The teacher explains the lesson structure, including timeframes for learning activities.	The teacher plans and delivers structured lessons that include reviewing previous lessons, signposting new content to be covered, explaining learning activities, and checking for understanding at the end of the lesson. The teacher ensures the lesson's steps are clear transparent and predictable for students.	The teacher assesses prior knowledge, signposts new content, and clearly explains the learning goals of the current lesson. The teacher designs sequenced learning activities that scaffold the learning. Teaching is adapted during the lesson in response to students' understanding.	The teacher ensures all students understand the learning intentions and success criteria. The teacher reinforces routines, scaffolds new learning via specifically selected steps/activities, and uses smooth transitions to optimise time on task and classroom climate. The teacher spontaneously adjusts instructions during a lesson to increase learning opportunities and improve students' understanding. In closing the lesson, the teacher reviews, clarifies and reinforces key points, and assesses student understanding.

Evidence base

- Hattie, J. (2009). *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement.* Milton Park, UK: Routledge.
- Kyriakides, L., Christoforou, C. and Charalambous, C. (2013). 'What matters for student learning outcomes: A meta-analysis of studies exploring factors of effective teaching,' *Teaching and Teacher Education*, 36, 143-52.
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3

High Impact Teaching Strategy
Explicit Teaching

Effective teachers use explicit teaching to provide instruction, demonstrate concepts and build student knowledge and skills. In explicit teaching practice, teachers show students what to do and how to do it, and create opportunities in lessons for students to demonstrate understanding and apply the learning.

Strategy overview

Hattie (2009) found an effect size of 0.59 for direct instruction.

What is it?

When teachers adopt explicit teaching practices they clearly show students what to do and how to do it. Students are not left to construct this information for themselves. The teacher decides on learning intentions and success criteria, makes them transparent to students, and demonstrates them by modelling. In addition, the teacher checks for understanding, and at the end of each lesson revisits what the lesson has covered and ties it all together (Hattie, 2009).

How effective is it?

Explicit teaching is effective in accelerating student performance. The aim is to teach generalisations beyond rote learning, and to sequence learning. In explicit teaching practice, teachers constantly monitor students' progress towards challenging goals.

The effects of explicit teaching are similar for students in all school settings. It also has the highest effect size for reading among students at every year level. It supports both low-level word-attack and high level comprehension.

Considerations

Explicit teaching is systematic and sequential. It directly supports guided practice using a series of steps. First, teachers are explicit about the learning goals and the success criteria. Teachers then demonstrate how to achieve them by modelling and providing examples. The final step is to provide students with opportunities to practice and to demonstrate their grasp of new learning.

A high level of teacher-student interaction characterises explicit teaching. Teachers actively support students to achieve success as they move through the learning process. Teacher feedback is critical. Teachers closely monitor student understanding and target further individual support when it is needed.

This strategy is demonstrated when the teacher:

- explains what students need to know and be able to do by the end of the lesson or unit
- uses worked examples to show students how to do something
- allows students sufficient time to practice what they have learned
- guides student practice by monitoring their work and providing help when it is needed
- reinforces the main points at the end of the lesson.

This strategy is not demonstrated when the teacher:

- is didactic, using teacher-centred, uninterrupted monologue with few opportunities for students to be active in the learning
- restricts class discussions and student input is discouraged
- responds judgmentally to students' attempts at problem solving activities rather than treating each attempt as an opportunity for further learning.

This strategy is demonstrated when students:

- understand the learning goals and success criteria
- have access to multiple examples before undertaking the learning task
- master the new knowledge and skills before moving on
- receive feedback as needed.

Resources:

- AITSL videos:
  Explicit instruction: https://www.youtube.com/watch?v=t4zuYXLodRA
  Transformative classrooms: https://youtu.be/BDCyNlmmxlo
  Literacy teaching strategies: https://www.youtube.com/watch?v=_jWXL_fmhTw
- Allen Luke, 'On explicit and direct instruction,' Australian Literacy Educators' Association (2014): https://www.alea.edu.au/documents/item/861

Examples that illustrate the strategy

Example 1: Primary – English

An inner city primary school has endorsed a whole school approach that encourages teachers to target writing mechanics. This emphasis encouraged a group of teachers in an English Professional Learning Community to interrogate their student achievement data on writing. Developing explicit teaching lesson segments quickly became the focus of PLC meetings. They decided to use an explicit teaching framework for a collaboratively designed model lesson plan – an approach that assisted all PLC members to learn more about explicit teaching techniques.

The broad learning intention they adopted was that students will know how, and be able to, write an introduction. Their planning first focused on how to clearly demonstrate to students what they need to know and how to do it. They collaborated on designing a persuasive writing lesson plan that explicitly taught and modelled how to write an introduction.

The model lesson plan opened with explanations of the learning goals and success criteria. It moved on to explicitly teach the structure of an introduction, clearly naming and explaining all the components. The next step was for the teacher to present varied exemplars demonstrating what a good introduction looks like. The model plan's next step was to check students' understanding, and clarify misunderstandings before students embarked on guided practice.

The plan built in time to closely monitor individual student performance in guided practice activities, and to provide feedback. The plan noted possible support strategies that may assist students. The model plan then progressed to whole group practice and individual practice, again with close performance monitoring.

Drawing on their learning from working together to fashion a model lesson plan, PLC members constructed lesson plans appropriate to the year levels they teach. Teachers collected student feedback about the lessons based on explicit teaching practice. At PLC meetings they discussed the feedback, which was very positive. Students said they were able to focus on a specific goal for the lesson, they felt assured they had the knowledge and skills required to achieve the goal, and they felt confident about independently completing the task.

Example 2: Year 8 – Humanities

After introducing a History research project to a Year 8 Humanities class, the teacher recognised most students were struggling with bibliography writing skills which had been addressed in Year 7 but obviously needed revision.

In response, the teacher planned a lesson that used explicit teaching to scaffold students' knowledge and competence in how to reference sources consulted during their research.

The teacher commenced the review lesson by presenting the learning goals and success criteria, taking time to establish students' prior knowledge and connecting that knowledge to the new project. A class discussion followed about how students can find information for their research projects from many sources, such as the internet, books and television programs. The teacher then explained the importance and function of taking notes from each source during the research phase. She used explicit teaching to show students how to reference various information sources.

The teacher modelled notetaking and bibliography writing, pointing out key features of each and how they related to achieving the learning goals and success criteria. She then provided students with source material examples so they could practice creating their own references. As the teacher monitored students' progress, she ensured they had opportunities to seek feedback. The review lesson was concluded by checking for understanding, again modelling aspects of referencing as required, and asking her students to provide further examples necessary.

In the next History lesson students returned to the research project. They applied their knowledge from the review lesson, along with the skills they had worked on. The teacher checked students' progress as they worked in class, making sure they recorded source information correctly.

For this Year 8 class, explicit teaching was effective in scaffolding student learning, and ensuring all students had the skills necessary to complete the research project in line with the learning goals and success criteria.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
Teachers know what students should know and be able to do by the end of the lesson. Teachers explain new knowledge and skills. Teachers plan learning activities that enable students to demonstrate their understanding.	Teachers make the learning intentions clear before students undertake the learning task. Teachers explain new knowledge and skills, and model how to apply them in practice. Teachers plan learning activities and assessment tasks that enable students to practise their skills and demonstrate their understanding.	Teachers clearly explain the learning intentions and success criteria before students undertake the learning task. Teachers provide worked examples and assess student understanding before students independently practice their skills and demonstrate their understanding. Teachers monitor individual students and provide feedback.	Students can articulate the learning intentions and success criteria. Teachers provide worked examples and opportunities for guided practice. They check for understanding before students engage in independent practice. Teachers closely monitor individual students' progress and offer targeted feedback as needed. Teachers conclude the lesson by reinforcing the main points to consolidate the learning, and to support students to apply their learning in new contexts.

Evidence base

- Archer, A. L. & Hughes, C. A. (2011). *Explicit Instruction: Effective and efficient teaching*. New York, USA: Guilford Press.
- Evidence for Learning: *Teaching and Learning Toolkit – Australia*. http://evidenceforlearning.org.au/the-toolkit/
- Hattie, J. (2009). *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement*. Milton Park, UK: Routledge.
- Liem, G. & Martin, A. (2013). 'Direct instruction.' In J. Hattie and E. Anderman (Eds.), *International guide to student achievement* (pp. 354-356). New York, USA: Routledge.
- Moss, C. and Brookhart, S. (2012). *Learning targets: Helping students aim for understanding in today's lesson*. Alexandria, USA: ASCD.

4

High Impact Teaching Strategy
Worked Examples

Effective teachers use worked examples to reduce student cognitive load, enabling them to focus on understanding a process which leads to an answer, not the answer itself.

Strategy overview

Hattie (2009) found an effect size of 0.57 for worked examples.

What is it?

A worked example is a demonstration of the steps required to complete a task or solve a problem. By scaffolding the learning, worked examples support skill acquisition and reduce the cognitive load for learners.

Usually, the teacher presents a worked example to students and explains each step. Later, students can use worked examples during independent practice, and to review and embed new knowledge.

How effective is it?

Worked examples are effective in demonstrating what success looks like, and how to achieve success. This reduces the cognitive load for students by helping them to focus on the process required to complete a task or find the solution to a problem.

Research demonstrates that worked examples are most effective when the teacher explicitly teaches the steps taken to complete the worked example, and when learners use self-explanations to describe the steps to themselves and others. The overall impact on student learning is high, measured at 0.57 in Hattie's research.

Considerations

Using a series of worked examples can assist teachers to scaffold student knowledge and skill acquisition. However, when progressively incorporating additional stretch, each new example needs to be adequate to challenge the learner – not too great, not too little. Formative assessment is used to monitor student understanding and target teaching to the appropriate level of challenge.

Gradually omitting steps from worked examples can be effective too. This approach supports the students' transition from learning by using worked examples as references, to using problem solving and metacognition (for example, self-verbalisation and self-questioning).

The effectiveness of worked examples is related to the learners' relative expertise. Reliance on worked examples decreases as learners' proficiency increases.

This strategy is demonstrated when the teacher:

- scaffolds the acquisition of new knowledge and skills by presenting students with a clear, step-by-step example
- designs worked examples that are accessible to students (self-explanatory) and unpacks the learning process, highlighting options available to arrive at the correct solution
- monitors student learning and supports students to move towards more independent practice.

This strategy is not demonstrated when the teacher:

- introduces new knowledge and skills with worked examples that are too complex and inaccessible to learners
- uses the same worked examples for all learners, including those with an already advanced knowledge of the topic or subject matter.

This strategy is demonstrated when students:

- are engaged and on task because the worked example is pitched at the right level of challenge
- understand that the focus is on understanding the process required to complete the task
- can move with confidence from using worked examples to independent practice.

Resources:

- AITSL videos:
  Motivating Learning:
  https://www.youtube.com/watch?v=29u938fYS-o
  Well-sequenced mathematics teaching:
  https://www.youtube.com/watch?v=gijBHH0Z8M0
  Why do objects sink or float:
  https://www.youtube.com/watch?v=6ilWMRY_FNg

Examples that illustrate the strategy

Example 1: Year 6 – Mathematics

At the beginning of a unit of work on Financial Literacy, a Year 6 Mathematics teacher planned to use worked examples as a foundation for building her students' skills. She applied this high impact teaching strategy to demonstrate a method of calculating percentage discounts of 10%.

After presenting a video of discount sales and linking the learning intentions and success criteria to real-life problems, the teacher demonstrated the method on the board. She emphasised each step of the process, clearly articulating the method and the links between the steps. With this strategy the teacher was able to demonstrate the complete process and provide a worked example that would assist students to find solutions to like problems.

She built upon this knowledge by tasking students to use the worked example to apply the process learnt. In small groups, students worked through the steps using the processes that were clearly articulated at the start of the lesson and annotated on the board. Once they had mastered using the method for calculating 10% discounts, the teacher provided additional worked examples demonstrating how to apply the knowledge to percentage discounts of 25% and 50%. Students used the new worked examples as a guide for their independent practice.

Working in groups and using the worked examples opened up opportunities for students to discuss any step they needed further clarification on, prior to a period of independent practice.

Using worked examples enabled the teacher to scaffold the learning which reduced the cognitive load for the learners and supported their skill acquisition.

Example 2: Secondary – Writing in an EAL class

At a secondary school in central Victoria, worked examples were used to develop simple essay writing skills among English as an Additional Language (EAL) students. The teacher had been using the hamburger structure and co-construction in the classroom to scaffold student learning. However, many of his students were finding it hard to become independent writers. To support the transition from guided competence to independent confidence, the teacher decided to structure a recurrent activity around worked examples.

The first EAL lesson every week was dedicated to writing a short essay that recounted the three most important events of the weekend. To scaffold student learning, the teacher initially modelled the steps involved in planning and writing the essay. The steps included writing a list of activities, ranking the activities from most to least important, identifying two fun facts about each of the most important ones, and using this information to write short sentences that were then assembled into a brief essay. The resulting planning notes and sample essay were shared with the students as a fully annotated worked example. The students used this worked example as model for their own writing.

Each Monday lesson started with sharing a new worked example, followed by discussion about the process the teacher used. As students became more familiar with the process, the annotations on worked examples became progressively less comprehensive, encouraging students to own the writing process. Students who were still struggling had access to a bank of worked examples. They could refer to the more comprehensive annotations made on worked examples completed earlier in the term.

The scaffolding provided through worked examples enabled students to become more independent and their writing skills improved. When the teacher asked students whether worked examples were helpful, their responses were positive. They reported that worked examples enabled them to engage with increasing confidence in what they considered a complex task, and to focus more closely on their spelling and grammar.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
Teachers access professional learning to build teacher knowledge and skills in using worked examples. Teachers sometimes use worked examples to introduce new knowledge and skills.	Teachers identify worked examples as a focus for learning and development in Performance and Development Plans. Teachers regularly use worked examples to present new knowledge and skills, and to scaffold student learning. Teachers collaboratively develop and share worked examples in Professional Learning Communities. They monitor the impact on student learning outcomes to evaluate their effectiveness.	Professional Learning Communities support building knowledge and skills in effectively using worked examples, as referenced in teachers' Performance and Development Plans. Teachers collaboratively develop and share worked examples. They use them to scaffold student learning and to foster metacognition. Teachers analyse a range of data, including student feedback, to measure the impact on student learning and to evaluate the effectiveness of worked examples.	Worked examples are used deliberately and systematically, and embedded in lesson and unit structures. They are used consistently across learning areas. As part of the school improvement focus on evidence-based high impact teaching strategies, the school monitors the use of worked examples, and evaluates their effectiveness in improving the quality of learning.

Evidence base

- Atkinson, R.K., Derry, S.J., Renkl, A. and Wortham, D.W. (2000). 'Learning from examples: Instructional principles from the worked examples research.' *Review of Educational Research*, 70, 181-214.
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5

High Impact Teaching Strategy
Collaborative Learning

Effective teachers provide opportunities for students to participate in flexible groups that collaborate on meaningful tasks, and respond to questions that support achievement of learning goals.

Strategy overview

Hattie (2009) found:

- **an effect size of 0.59 for cooperative learning when compared to individual work**
- **an effect size of 0.54 for cooperative learning when compared to competitive learning.**

What is it?

Collaborative (or cooperative) learning occurs when students work together in small groups and everyone participates in a learning task. There is a range of collaborative learning approaches, each involving different kinds of organisation and tasks (Education Endowment Foundation, 2015).

With a focus on meaningful learning, the teacher uses strategies (such as cooperative learning strategies and strategic selection of groups) to establish an atmosphere of cooperation and collaboration. Collaborative learning is supported by designing meaningful tasks and inviting group responses to questions.

Collaborative learning relies on students actively participating in negotiating roles, responsibilities and outcomes. Their collaboration may involve projects undertaken by the whole class, such as an environmental project in the school or a community survey.

How effective is it?

Hattie (2009) found an effect size of 0.59 for cooperative learning. A 2013 meta-study found an effect size of 0.54 (Kyndt et al, 2013). The Australian Teaching and Learning Toolkit cites an average effect size of 0.41 (Education Endowment Foundation, 2015). Studies show that variations in effect size for collaborative learning are associated with the learning area, students' ages and their cultural backgrounds (Kyndt et al, 2013).

Some analyses indicate cooperative learning has a much stronger effect on achievement for adolescent children than for younger children (Nunnery et al, 2013).

Considerations

Group selection and composition is an important consideration.

Group membership should vary according to the activity's purpose and individual learning goals.

Team building skills are taught explicitly so students learn to collaborate, negotiate and contribute to joint assignments. Group members experience sharing roles, responsibilities and ownership of outcomes.

Group learning activities are specifically designed so that student collaboration is necessary to accomplish the task.

This strategy is demonstrated when the teacher:

- regularly sets group tasks and establishes ground rules about how groups operate
- explicitly teaches students to work as a team by assigning different roles within groups so that students take responsibility for particular aspects of tasks
- differentiates learning by assigning group content based on student readiness
- designs tasks that require sharing expertise and ensuring each student's contribution is valued by other students
- promotes interactions by organising students in flexible groupings in which group membership varies and may be based, for example, on friendship, mixed academic ability or common interests.

This strategy is not demonstrated when the teacher:

- dominates class discussion
- allows a few students to dominate discussion
- gives students few opportunities to interact with, and support, each other.

This strategy is demonstrated when students:

- understand the protocols for working collaboratively
- accept individual responsibility for participating and contributing to group tasks
- are skilled at providing feedback to each other.

Resources:

- AITSL videos:
  A collaborative learning space:
  https://www.youtube.com/watch?v=X58leKRgi3A
  Managing student learning:
  https://www.youtube.com/watch?v=T-XIdeotfq8
- Jigsaw cooperative learning:
  http://www.readwritethink.org/professional-development/strategy-guides/using-jigsaw-cooperative-learning-30599.htm

Examples that illustrate the strategy

Example 1: Primary – Years 5/6

Senior school teachers at a primary school in Melbourne's outer east wished to encourage and develop collaborative learning in their Year 5/6 classes. After consulting their students the teachers decided to participate in the Victorian Solar Boats Challenge. The Solar Boats Inquiry Unit provides opportunities for all students to collaborate, negotiate and contribute to a real life assignment.

Teachers structured participation around achieving clear goals and success criteria which included working collaboratively in groups. They used explicit teaching to teach collaborative learning skills, including negotiating and jointly contributing to the assignment. Expert mentors, including engineers and electricians from the school community, were invited to participate in the project and share their expertise, knowledge and skills. Thanks to these practices, students were supported to work collaboratively, and with success in mind.

Throughout the unit, teachers continually monitored their students' learning and progress. They modified practice when necessary and evaluated success of the unit by reference to data which showed improved quality of student learning. As a result of the scaffolding and guidance, the students organised themselves into small groups that functioned effectively, and they experienced sharing roles, responsibilities and project ownership.

At the end of the unit all students had contributed to designing and constructing their team's solar powered boat, with each group approaching the task by negotiating roles, responsibilities and outcomes. Students reported they learned to value the contributions of all group members, as everyone contributed to achieving their common goal.

Example 2: Secondary – Year 10 History

A Year 10 History teacher introduced a unit on the Chinese Revolution. To engage students, the teacher used questioning to elicit prior knowledge, stimulate interest, and connect learning to real world experiences. She set challenging goals, including understanding the causes of the revolution, and developing cooperative learning skills. The assessment and performance requirements were made clear.

The teacher had tried group work in the past but students were resistant and groups did not function effectively. Reflecting on those circumstances, this time the teacher decided to use the explicit teaching model. She explicitly taught her students to work as a team on an activity specifically designed to require each student to contribute, share their expertise and collaborate to successfully achieve the learning goals.

Using the Jigsaw Strategy, she organised students into 'home' groups, and each home group member was assigned a different text. Students then reformed into 'expert' groups to work with other students allocated the same text. Together they researched and discussed until they became experts on one issue. Finally, students returned to their home groups where they shared their knowledge with other group members.

Students were responsible for learning their own parts and for teaching it to other group members. Learning goals of independence and interdependence became clear as students synthesised information from multiple sources and built their collective knowledge of the topic.

The Jigsaw Strategy allowed the teacher to scaffold a large task into smaller chunks. It also provided for differentiation of content as the teacher allocated different texts to each home group member. Peer tutoring provided opportunities for students to become content experts, creating positive interdependence and mutual respect.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
During lessons, teachers allow students to share and reflect on their ideas with their peers. Occasionally, teachers structure learning activities in small groups. Teachers engage in professional conversations to investigate the evidence base for collaborative learning and share examples of their practice.	Teachers work together in PLCs to build their knowledge of, and skills in, collaborative learning. Teachers collaborate to design group tasks that help students work and learn together on specific learning goals. Teachers collaboratively develop and implement protocols for group work that build student understanding of how effective groups operate.	Teachers consistently structure learning around differentiated group tasks that require students to work collaboratively. Teachers support students to provide feedback to each other using feedback protocols. Teachers observe experienced colleagues, trial new strategies, and seek feedback to support changes to their practice.	Cooperative learning is embedded in classroom practice. Students understand the protocols for working collaboratively and they are skilled at providing considered feedback to each other. Students design challenging and differentiated individual or group tasks to achieve identified learning goals. Teachers collect data, including feedback from students, to monitor and evaluate the impact of collaborative learning strategies.

Evidence base

- Evidence for Learning: *Teaching and Learning Toolkit – Australia*. http://evidenceforlearning.org.au/the-toolkit/
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6

High Impact Teaching Strategy
Multiple Exposures

It takes 'three or four experiences involving interaction with relevant information for a new knowledge construct to be created in working memory and then transferred to long-term memory' (Nuthall, 2000, p.93).

Strategy overview

Hattie (2009) found an effect size of 0.71 for spaced practice.

What is it?

Multiple exposures provide students with multiple opportunities to encounter, engage with, and elaborate on new knowledge and skills. It is not simple repetition or drill work. Research demonstrates that deep learning is developed over time via multiple and spaced interactions with new knowledge and concepts. This may require distributing practice across several days, and using different activities to vary the interactions learners have with the new knowledge.

How effective is it?

Research demonstrates that multiple exposures greatly improve learner retention of new knowledge. It is most effective when exposures are used deliberately to assist learners to master new knowledge and skills, and when the exposures are spaced over time. Massed practice is less effective with an effect size of 0.41.

Considerations

Multiple exposures are most effective when strategically spread over time, as part of a unit and/or lesson structure.

To make the repetition meaningful, it is essential to clearly state the link between the learning intentions and the work being done.

Multiple exposures require planning and structure. They provide opportunities to engage, and re-engage, with concepts and ideas, and to practice new skills in different contexts. Planned, intentional repetition supports transfer of learning from earlier exposures to later exposures.

It is vital to offer feedback on how well a student is achieving the learning goals. Timely feedback on practice remediates student misunderstandings and prevents them repeating mistakes in multiple exposures. Feedback also informs teacher practice and pinpoints where teaching strategies need be adapted.

This strategy is demonstrated when the teacher:

- links multiple exposures to the learning goals
- plans units of work that clearly identify new knowledge and skills that will benefit from multiple exposures
- uses a variety of learning and assessment tasks that vary students' interactions with the knowledge and/or skills, and support transfer of learning.

This strategy is not demonstrated when the teacher:

- repeats the same activity many times with no variation in context, resulting in dull repetition
- does not provide timely feedback, resulting in students repeating mistakes multiple times.

This strategy is demonstrated when students:

- consolidate their learning through opportunities that engage and re-engage them with new content over a period of time
- feel supported and confident about new learning.

Resources:

- AITSL videos:

  Multiple activities to engage; students: https://www.youtube.com/watch?v=lyYrAgnKe1A

  Making money amounts: https://www.youtube.com/watch?v=-Sc8RqZw-0o

  Engaging through ICT: https://www.youtube.com/watch?v=S3AEvPZJLFY

Examples that illustrate the strategy

Example 1: Years 7/8 – Humanities

The Humanities teachers of a secondary school in regional Victoria identified the need to actively and consistently address literacy skills as part of their everyday teaching. By building the core vocabulary of their students, they aimed to support them to engage more deeply with complex issues and ideas. Working with a literacy coach, they planned and trialled a yearlong intervention designed to expose students to carefully selected 'target words' linked with the learning area content. The intervention sought to reinforce the use and meaning of target words via multiple exposures over a period of time.

Working in Professional Learning Communities (PLCs), teachers reviewed the unit topics to identify a list of content specific vocabulary all students need to understand and be able to use. They then pre-tested students to identify levels of understanding. The teachers collaborated to design learning activities that incorporated multiple exposures in different contexts over the year. Their intent was to teach and reinforce specific vocabulary and support transfer of learning across the planned units of work.

Students initially encountered the words when reading a text or watching a video. From the moment a new word was introduced, students were exposed to it repeatedly via 'friendly descriptions' of what the word meant. Other strategies included using a vocabulary log, drawing a picture of the word, peer discussion on how and when to use the word, and consolidation activities at the end of each lesson. Over time, the use of the words was reinforced via 'Do Now' activities at the start of each lesson. These activities included games such as Pictionary, traffic light cups, homework activities, self-assessment and vocabulary walls.

The PLC monitored the intervention's implementation and at the end of the year teachers measured the impact of multiple exposures on student learning. The initiative was particularly successful because at the end of each unit students were able to track their progress by comparing their pre-test scores to the final vocabulary test scores.

Example 2: Multiple exposures in the VCE

A VCE teacher in south-west Victoria planned structured multiple exposures to strategically support knowledge acquisition, transfer and deep understanding. The VCE unit plan calendar was set up to ensure key knowledge areas were addressed over a series of lessons rather than a single lesson, and that earlier Areas of Study were revisited halfway through the year and again before the exam. When relevant, the class discussed links between current and previous topics.

Students encountered and revisited content and skills on multiple occasions and in different settings – initially through pre-reading, then being explicitly taught the concepts in class, and by completing 'Do Now' activities and exit slips that addressed content from previous and current lessons. Additional reinforcement strategies included watching short, relevant video clips in their own time, completing practice questions, receiving feedback on practice questions, completing and receiving feedback on practice SACs, being taught active revision strategies, and ultimately completing and receiving feedback on the SACs.

Over the longer term, students completed Unit 3 practice exams halfway through the year to revise content from earlier in the year. They revisited the content prior to the end-of-year exam.

Thanks to clear structuring of the units, spaced practice, and multiple exposures to the content and vocabulary, students deepened their understanding of the subject. They were able to draw links between classroom learning and everyday life. This ensured students were ready for their exams, and prepared both to apply their knowledge and become active citizens.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
The teacher uses repetition to review and reinforce new learning, particularly when introducing new concepts and skills. Professional learning activities focus on building teachers' understanding of evidence based high impact teaching strategies.	The teacher plans the use of repetition to review and reinforce new concepts and skills, explicitly linking each exposure to the learning goals. The teacher assesses student competence at each stage and provides timely feedback to remediate student misunderstandings and/or mistakes. Teachers work in Professional Learning Communities to develop multiple exposures learning activities in different contexts which support transfer of learning.	Across learning areas, teachers are skilled in planning and structuring multiple exposures. Teachers collaboratively plan and develop learning and assessment activities that incorporate multiple exposures. Teachers analyse a range of data, including student feedback, to measure the impact of multiple exposures on student learning and to evaluate their effectiveness.	Use of multiple exposures is deliberate, systematic and embedded in lesson and unit structures, and applied strategically to support knowledge acquisition, transfer of knowledge and deep understanding. An integrated, whole-school approach to using high impact teaching strategies is implemented, and regular monitoring and evaluation processes ensure teacher accountability.

Evidence base

- Hattie, J. (2009). *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement.* Milton Park, UK: Routledge.
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7

High Impact Teaching Strategy
Questioning

Effective teachers regularly use questioning as an interactive means to engage and challenge students, and use it as a tool to check student understanding and evaluate the effectiveness of their teaching.

Strategy overview

Hattie (2009) found an effect size of 0.46 for questioning.

What is it?

Questioning is a powerful tool. Effective teachers deploy it regularly for many purposes. It engages students, stimulates interest and curiosity in the learning, and makes links to students' lives. It unfolds opportunities for students to talk together, discuss, argue, and express opinions and alternative views. Used effectively, questioning yields immediate feedback on student understanding, supports informal and formative assessment, and captures feedback on the impact of teaching strategies.

How effective is it?

Questioning by teachers of students is one of the most widely studied aspects of teaching. Effective questions have varied levels – they focus on both product and process, and elicit more information if a student gives a partial (or partially correct) answer (Kyriakides et al, 2013; Muijs et al, 2014). Hattie measures the general effect size of questioning as 0.46, which is above average and within the zone of desired effects on student learning. Questioning is a flexible tool. It is used to provide feedback to students, to check for understanding, and to quickly assess student progress. Feedback to students and teachers has an effect size of 0.73 (Hattie, 2009).

Considerations

Teachers use questioning for many purposes. Effective teachers understand that specific types of questions are appropriate for particular learning goals and activities. As the types of questions used vary according to the learning goals, questions need to be planned. Is the purpose to engage, revise, challenge, encourage reflection and deep understanding, or provide the teacher with feedback?

Questioning is most successful when teachers maintain a respectful, trusting learning environment in which students feel confident to contribute. So that students understand how to conduct discussions, teachers introduce protocols which are framed in ways that encourage students to respect the rights of others to hold differing views.

Providing appropriate feedback is critical in encouraging all students to contribute, to extend and deepen their thinking, to correct misunderstandings, to acknowledge their learning, and to support students to generate their own questions that lead to further inquiry.

This strategy is demonstrated when the teacher:

- negotiates conversational protocols which support all students to make meaningful contributions
- targets questions, or responds to answers, in ways that acknowledge individual needs and potential contributions
- models acceptance and valuing of unusual ideas
- provides stimulus materials that challenge students' ideas and encourage discussion
- engages students in dialogue, continuously extending their thinking and refining students' understanding
- asks questions that probe student thinking and prompt them to justify their responses
- provides feedback and structures opportunities for students to give feedback to one another.

This strategy is not demonstrated when the teacher:

- mainly asks questions that are closed, focuses on recall of information, and having one 'right' answer
- allows insufficient wait time for students to think about the question and their possible responses
- consistently relies on a few students to respond and does not engage all students in discussion
- allows the class discussion to wander without focus
- dominates the discussion and does not allow students to interact, challenge viewpoints and speculate.

This strategy is demonstrated when students:

- feel confident to ask questions, speculate and hypothesise, and when they respect others' views
- understand how different types of questions are used to identify and clarify information
- give feedback to one another, and when they build on and challenge one another's ideas.

Resources:

- AITSL videos:
  Deep questioning to support research: https://www.youtube.com/watch?v=0-Au253dMS4
  Engaging every learner: https://www.youtube.com/watch?v=AyDA12mOaSs
  Supporting children's development: https://www.youtube.com/watch?v=93KpPrcM1F4

Examples that illustrate the strategy

Example 1: Primary – Science

Over several meetings of their Professional Learning Community (PLC), a group of primary school science teachers discussed alternative approaches to fostering more active student participation in science lessons. After referring to the evidence base, they concluded strategic use of questioning held particular benefits. They agreed to collaborate on selecting productive questioning strategies and building their knowledge and skills in using them.

To create a learning environment where students were confident to make contributions, their first step was to write agreed protocols that emphasised the importance of trust and respect among students. The teachers then decided to concentrate on three aspects of questioning practice: asking open-ended questions, using wait time, and supporting students to question each other. They backed up these priorities with jointly composed classroom norms, including a strict five seconds wait time after either the teacher or students posed questions.

A more challenging norm to embed was an expectation that all students would be 'active sceptics'. They made this tangible by designing tasks with many possible solutions. One student would present their favoured solution to the class. The whole class would be invited to offer a view on that solution. Those who offered a view different to the presenter would be required to formulate a follow-up question to put to the presenter.

To support implementation of the intervention, the PLC members agreed that every lesson would incorporate time for open-ended questions that generated discussion. They also agreed to schedule regular peer observations focused on question quality and student responses.

The shared goal was increased student participation. With that in mind, PLC members monitored and evaluated the effect of wait time by observing its impact on the receiver of a question, and the extent to which wait time encouraged deeper thinking. They used peer observation to build a shared bank of practices that cultivate students' skills in framing open-ended questions so they could better question each other.

Data collected from peer observation indicated greater teacher attention to quality, open-ended discussion from which questions emerged, as well as increased depth of student articulation. They found that when their protocols were consistently implemented, over time there was more student-led discussion. This effectively reduced the amount of teacher talk time in science lessons.

Example 2: Year 9 – History

Year 9 and 10 History teachers at a recently opened school in a suburban growth corridor expressed their concern that many students in their classes were making limited progress. In a regular PLC meeting, they analysed assessment data for Years 9 and 10 students and were struck by the consistent absence of higher order thinking skills. This led PLC members to consider how they could use higher order questioning to encourage deeper learning. They agreed to research and trial effective questioning techniques that would promote high order thinking and ensure all students felt engaged, challenged and extended.

To encourage deeper student learning, the teachers agreed to structure their lessons around strategic use of effective questions, particularly at higher cognitive levels.

Two PLC members, responsible for teaching a Year 9 History unit, designed questions for every class that asked for evidence and/or clarification. In addition, they framed different kinds of questions for selected topics, including linking or extension questions, hypothetical questions, cause and effect questions, and summary and synthesis questions.

They devoted attention to establishing explicit links to the learning goal of developing deeper understanding of the lesson content. During Terms two and three, they provided explicit instruction in various types of questions and their uses, modelled effective questioning, and encouraged students to ask questions of themselves.

Their lesson plans incorporated learning activities that revolved around peer questioning, reciprocal teaching and student self-questioning. These approaches served to engage students in discussion, continuously extend their thinking and refine their understanding. The Year 9 teachers provided explicit instruction in each strategy, modelled its use, allowed students time for practice, provided feedback, and structured opportunities for students to give feedback to one another.

The teachers monitored implementation of changes to their practice. They and other PLC members undertook peer observations which enabled sharing and debriefing about how well questioning techniques were supporting deeper learning. The Year 9 teachers regularly sought student feedback and were confident that by the end of Term 3 their students were more engaged, motivated and independent learners. Their confidence was reinforced when they analysed student achievement data in Term 4 to evaluate the impact of the changes to their practice.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
Teachers use questioning to identify prior learning and gauge levels of understanding. Teachers provide positive feedback on responses to encourage student participation and to engage students in higher order thinking and learning.	Teachers work in teams to develop their questioning skills, including open and closed questions, probing questions and using 'wait time'. Teachers provide appropriate feedback and support students to generate questions that lead them to further inquiry. Teachers collaboratively develop and implement protocols to build a respectful, trusting learning environment in which students feel confident to contribute. Teachers monitor student participation and learning progress to self-assess the effectiveness of their questioning skills.	Teachers work in Professional Learning Communities to collectively build and refine their capability to deploy a range of question types appropriate to the learning goals. Teachers consistently implement and reinforce agreed classroom protocols to build a respectful, trusting learning environment in which students feel confident to contribute. Teachers use peer observation to share and debrief about how well they are asking questions to gain evidence of student learning, to encourage thoughtful and considered responses, and to facilitate discussion.	Teachers are highly skilled at using questioning for a variety of purposes, including informal and formal assessment. Teachers support students to think critically by developing questions, posing problems and reflecting on multiple perspectives. They foster deep thinking, and facilitate discussion to engage all students in learning. Teachers use a range of data, including student feedback and peer observation, to monitor and evaluate the effectiveness of their questioning skills.

Evidence base

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8

High Impact Teaching Strategy
Feedback

Effective teachers use two-way feedback to gather information about a student's understanding, to assist students to advance their own learning, and to verify the impact of their own practice.

Strategy overview

Hattie (2009) found an effect size of 0.73 for feedback.

What is it?

Feedback informs a student and/or teacher about the student's performance relative to learning goals. Its purpose is to improve the student's learning. Feedback redirects or refocuses the actions of teacher and student so the student can align effort and activity with a clear outcome that leads to achieving a learning goal.

Both teachers and peers can provide formal or informal feedback. It can be oral or written, formative or summative. Whatever its form, it always comprises specific advice a student can use to improve their performance.

Hattie underlines feedback's two-way benefits. Teachers learn about how their practice influences student learning. When teachers use feedback to guide their practice, then they amplify their impact on student learning.

How effective is it?

Research shows appropriate feedback has very high effects on learning. Its effectiveness is evident for students and teachers (Education Endowment Foundation, 2015).

Studies with the highest effect sizes involved students receiving feedback about a task and how to do it more effectively. Feedback in the form of praise, punishment and rewards has lower effect sizes (Hattie & Timperley, 2007).

There is evidence that feedback is more effective if it focuses on the task, not the person, and that feedback on familiar tasks has more impact (Kluger & DeNisi, 1996).

Considerations

Positive feedback is powerful. It can have a negative influence too, unless close attention is paid to the type of feedback and the way it is given. Feedback is most useful in resolving misconceptions, and less useful in resolving a lack of understanding. Research suggests positive feedback is specific, accurate and clear.

Signature characteristics of positive feedback are that it:

- provides detail, such as 'You achieved a good outcome because you...,' rather than just 'correct' or 'incorrect'
- compares what a student is doing now with previous work, such as, 'I can see you focused on improving X –the result is much better than when you did Y last time'
- providing specific guidance on how to improve, and not just tell students when they are wrong
- is framed to encourage and support further effort
- is given sparingly so that it is meaningful
- is supported by effective professional development for teachers.

This strategy is demonstrated when the teacher:

- provides feedback on tasks that challenges students to review, reflect on and refine their understandings at various points in a learning sequence
- gives timely feedback, acknowledging areas well-handled and suggesting areas for improvement
- structures feedback to support further learning
- organises a variety of audiences to provide feedback
- uses student assessment data as a source of feedback on the effectiveness of their teaching practice.

This strategy is not demonstrated when the teacher:

- provides feedback that is about the person (such as, 'you are my best student') or vague (such as, 'good job')
- only provides feedback about students' performance in formal, summative assessment situations, without the opportunity for students to refine and develop understandings on the basis of instructive feedback.

This strategy is demonstrated when students:

- understand what they need to do to improve
- feel encouraged and supported to achieve the learning goals
- use feedback to monitor and self-regulate their learning.

Resources:

- Insight Assess Platform: http://www.insight.vic.edu.au/feedback-and-reporting
- Infographic, Things to Remember About Feedback http://www.ascd.org/ASCD/pdf/journals/ed_lead/el201209_takeaways.pdf
- AITSL Feedback resources: https://www.aitsl.edu.au/feedback
- AITSL videos: Providing feedback: https://www.youtube.com/watch?v=APvBYYV2l9A

Learning through feedback: https://www.youtube.com/watch?v=DOeF7FTYIlo

Using ICT to teach Languages: https://www.youtube.com/watch?v=O2BxsdgPLmQ

Examples that illustrate the strategy

Example 1: Primary

A group of regional primary teachers working in a Professional Learning Community (PLC) identified the need to make more consistent and effective use of feedback in the classroom. They formulated an objective to deliver richer qualitative feedback to students. They also decided to elicit feedback from students more regularly as a source of data about how to improve their teaching and learning practice.

Collaboratively, they developed two interventions to trial and implement simultaneously during Terms 1 and 2. The first intervention involved using Learning Observations to intervene in student learning, challenge students, and note their approach to set tasks. The second intervention involved using Exit Placemats to gather student feedback.

The teachers recognised that successfully implementing their chosen interventions relied on ensuring all students understood the learning goals and success criteria. They agreed to adopt a lesson structure that would be consistent for all classes.

For the first feedback intervention, the PLC focused on how to deliver meaningful, timely feedback about skills required to complete specific tasks. The teachers concentrated on framing feedback so that students could take specific actions to improve their performance and achievement. Their practice goal was to guide students to either the next area of focus, or to a new learning objective.

The second trial intervention involved Exit Placemats. They encouraged students to reflect on their confidence in a topic, and to self-assess their own learning from the unit. Each teacher analysed the data gathered from student reflection and self-assessment. They then used their findings to inform a classroom discussion in which students offered feedback to the teacher on their teaching practice.

Working in their PLC, the teachers monitored the implementation of their selected interventions, reflected on what worked, and modified practice based on the data they collected. Exit Placemats proved to be an effective way of enabling two-way feedback, supporting teachers to reflect on their practice, and evaluating the impact of their teaching.

Example 2: Secondary

A graduate teacher at a metropolitan secondary college identifies collecting and providing feedback as a key development area. With a mentor's help, the teacher designs a protocol for using verbal and digital feedback as an effective two-way information exchange with students.

Knowing the importance of linking data with feedback, the mentor demonstrates how to use centralised tests to extract individual achievement data. This data becomes the foundation for meetings with individual students. Together, the teacher and mentor establish a meeting structure. During the meetings, feedback focuses on the task, what needs improvement, and how to go about it. Drawing on the learning intentions and success criteria, the teacher provides feedback on specific aspects of the student's work, and offers specific advice on how to improve performance.

It proves incredibly powerful to assist students to review results in structured meetings. By centering discussion on clear feedback that encourages reflection, students deepen awareness of their learning. In monitoring the effect of this practice, the graduate teacher makes two observations. First, students are motivated to understand why they made a specific mistake. Second, they have data to help map a pathway for developing the required skills in preparation for next time.

As a second area of professional learning, and leveraging on digital technology skills, mentor and mentee trial Plickers (https://plickers.com/) to track student understanding of, and confidence in, lesson content. Building on traditional mini-whiteboard questioning techniques, each student is assigned a unique QR code. The code is photographed at key lesson stages and used to generate and share polls. This allows students to instantly and confidentially disclose how they think they are progressing. This provides data that captures the extent to which content is understood. As it is recorded automatically, feedback collected using Plickers is not only easy to track it is more accurate as students can answer honestly without being concerned that their peers might judge their responses adversely.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
Teachers provide students with feedback on strengths and areas for improvement.	To progress learning, teachers provide students with targeted feedback based on informed and timely judgements of each student's achievement, relative to their learning goals and their needs.	All teachers use formative and summative assessment strategies, and provide students with timely feedback that supports individualised learning. Teachers use assessment data as a source of feedback on their teaching practice, implementing changes and interventions where and when required.	A range of comprehensive assessment data provides the basis for regular feedback to students and parents. Teachers strategically gather and analyse assessment data to reflect on their practice. Student feedback is actively used to inform teaching.

Evidence base

- Evidence for Learning: *Teaching and Learning Toolkit – Australia.* http://evidenceforlearning.org.au/the-toolkit/
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High Impact Teaching Strategy
Metacognitive Strategies

Effective teachers use metacognitive strategies to help students develop awareness of their own learning, to self-regulate, and to drive and sustain their motivation to learn.

Strategy overview

Hattie (2009) found an effect size of 0.69 for metacognitive strategies.

What is it?

Metacognitive strategies empower students to think about their own thinking. Awareness of the learning process enhances control over their own learning. It also enhances personal capacity for self-regulation and managing one's own motivation for learning. Metacognitive activities can include planning how to approach learning tasks, evaluating progress, and monitoring comprehension.

How effective is it?

Evidence shows teaching metacognitive strategies can substantially improve student learning. Hattie measured the average effect size of metacognitive strategies at 0.69. The Australian Teaching and Learning Toolkit reports an impact equivalent to 8 additional months of progress.

Considerations

Students use metacognitive strategies to make the most of classroom instruction and to extend the learning beyond it. Metacognitive strategies do not directly influence how content knowledge is presented to students. In a sense, teaching metacognitive strategies entails teaching students to teach themselves.

Metacognitive strategies are taught explicitly, extensively modelled, embedded in routines and the lesson structure, and linked to the content being taught. Most importantly, the advantage of using a metacognitive strategy must be clear to students. These considerations apply to basic cognitive skills like notetaking and summarising, and to self-regulation strategies such as self-questioning and self-consequences.

This strategy is demonstrated when the teacher:

- provides students with specific strategies to set goals, and monitor and evaluate their learning progress
- assists students to identify and use strategies that support them to achieve learning goals
- demonstrates how to use a particular metacognitive strategy in ways that make content knowledge more accessible, malleable and intriguing
- uses a variety of learning and assessment strategies to scaffold and personalise the learning process
- provides support and scaffolding for tasks through checklists, self-questioning, student-teacher conferences and self-assessment
- uses ICT to increase student choice and flexible learning.

This strategy is not demonstrated when the teacher:

- gives students a choice of activities but does not explain how they can use specific strategies to achieve particular learning goals
- does not encourage students to take responsibility for their own learning, or for applying metacognitive strategies.

This strategy is demonstrated when students:

- have a repertoire of learning strategies and can select strategies appropriate for the learning goals
- reflect on their learning processes, self-assess and acknowledge the impact of effort on achievement
- actively seek out feedback because they value it as a way to improve understanding of how they learn
- are capable of self-regulation and proactively take control of, and responsibility for, their own learning.

Resources:

- AITSL videos:
  Inquiry learning in play spaces: https://www.youtube.com/watch?v=G4BEMQuUk9s
- New Pedagogies for Deep Learning – Examples from Victorian schools: http://fuse.education.vic.gov.au/Resource/LandingPage?ObjectId=fadaf2dd-1faf-4626-a300-126b09b1951f

Examples that illustrate the strategy

Example 1: Levels 9-10 – Critical and Creative Thinking

A Humanities teacher decided to help her students develop metacognitive skills. From the start of the year every lesson included a planned discussion in which students shared the strategies they had used to complete lesson tasks and which strategies were most effective. The benefits of attention to metacognitive strategies were clear from the increasingly articulate manner in which her students explained their thinking processes.

In term two she realised that the metacognitive strategies would be more effective if embedded into learning activities. Her thinking led her to devise a plan for a unit on the Reconciliation Movement in Australia that emphasised metacognitive strategies. The learning goals related to students' knowledge of the Reconciliation Movement, and to their skills in interpreting and evaluating multiple evidence sources. The teacher selected a range of primary and secondary sources, including videos and transcripts of Prime Minister Keating's 1992 'Redfern Address' and Prime Minister Rudd's 2008 'Sorry Speech'.

Throughout the unit, she assisted students to describe strategies that supported them to achieve the learning goals, including whole class discussion, small group work, independent research and analysis. She demonstrated the links between particular strategies and productively engaging with the content knowledge.

Students researched government initiatives and policies during the 16 years between both speeches. They speculated on why it took so long to make the 'Apology to the Stolen Generations'. She scaffolded tasks with self-monitoring checklists and peer feedback. In the final assessment task students acted as journalists covering the 'Apology' speech and wrote about its part in the Reconciliation Movement.

Students were frequently reminded to think about how to approach learning tasks, evaluate progress, monitor comprehension, and when to redirect effort. Explicitly teaching metacognitive skills supported students to develop self-regulation and proactively take control of, and responsibility for, their own learning.

Example 2: Self-regulation in a specialist setting

A teacher became increasingly concerned about the difficulties experienced by a group of students with Autism Spectrum Disorder (ASD). When the classroom grew louder during on task activities, this group found learning particularly hard. He formulated a goal of supporting them to extend their repertoire of metacognitive strategies and considered a number of possible interventions. The teacher decided to explicitly teach tangible strategies that would enable them to problem solve independently, and to self-regulate in the classroom.

The teacher drew on his knowledge about learning and teaching practices that support good learning outcomes for students who have ASD. They learn well when they have opportunities to process information visually, when teachers use language appropriate to their receptive skills, and when they have sufficient time to process the information. Using these learning characteristics to guide the design of an intervention, the teacher scaffolded the self-regulation learning around clear instructions, visual cues and progressively reducing assistance.

When the class was becoming louder, the teacher brought these elements together. He moved towards the students and said, 'The room is getting loud – you can use your headphones.' He showed them a photograph of the headphones, prompted them to go where the headphones were located, and assisted them to put on the headphones. After working through this routine several times, prompts and verbal language were slowly reduced and the students began to enact the routine independently. It was apparent they could recognise their sensory triggers and use strategies to overcome them. They were developing metacognitive skills of self-regulation and understanding links between their thoughts, feelings and actions.

Reflecting on the intervention's effectiveness in a PLC meeting, another teacher commented that a key part in its success was observing what gave rise to the challenging behaviours or sensory meltdowns. Tracking the cause and creatively reducing its influence assisted students to recognise their thought processes and build appropriate self-regulation strategies.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
Teachers participate in professional learning to build their knowledge of metacognitive strategies. Teachers encourage students to be self-reflective learners by assisting them to think about their own thinking and about how they learn. Teachers emphasise that a person's ability to learn is not fixed and that it is always possible to learn effective learning strategies that improve performance. Teachers introduce learning strategies that students can apply to tackle specific tasks.	Teachers identify metacognitive strategies as a focus for learning and development in Performance and Development Plans. Teachers introduce students to a number of differentiated learning strategies they can apply to completing a range of problems. Teachers explain how to make informed choices about which strategies to use in particular situations to achieve the learning goals. Teachers teach students how to reflect on and monitor their own learning.	Professional Learning Communities support building knowledge and skills in using metacognitive strategies, as referenced in all teacher Performance and Development Plans. Teachers explicitly teach a number of metacognitive strategies, model their use, and embed them in routines and the lesson structure. Teachers encourage students to reflect critically on the strategies they use to complete tasks, and to identify which learning strategies are most effective for them. Teachers support students to consider their learning goals, plan and monitor their own learning, and evaluate their learning.	An integrated, whole-school approach to using metacognitive strategies is implemented, accompanied by regular monitoring and evaluation processes that ensure teacher accountability. Teachers effectively diagnose individual students' abilities, then select and coach them in appropriately challenging tailored strategies. Metacognitive strategies are explicitly taught, extensively modelled, embedded in routines and the lesson structure, and linked to the content being taught. Students take responsibility for their past and future learning – they understand the standards expected of them, set and monitor their own learning goals, and develop strategies for working towards them.

Evidence base

- Evidence for Learning: *Teaching and Learning Toolkit – Australia*. http://evidenceforlearning.org.au/the-toolkit/
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10

High Impact Teaching Strategy
Differentiated teaching

Effective teachers use evidence of student learning readiness, learning progress, and knowledge of individual student learning profiles, to make adjustments for individuals so all students experience challenge, success and improved learning.

Strategy overview

Hattie (2012) found an effect size of 1.07 for Response to Intervention.

What is it?

Differentiated teaching refers to methods teachers use to extend the knowledge and skills of every student in every class, regardless of their starting point. The objective is to lift the performance of all students, including those who are falling behind and those ahead of year level expectations.

Differentiated teaching provides appropriate challenge for all students in a class. It does so by responding to student differences in readiness, interest and learning profile.

To ensure all students master objectives, effective teachers plan lessons that incorporate adjustments for content, process (how students make sense of content), and product (how students demonstrate what they know and understand).

Teachers use assessment strategies to monitor student learning readiness and learning progress. They apply targeted interventions as components of differentiation.

How effective is it?

Differentiated teaching strategies, consistently applied, offer foundations on which all students can build meaningful learning.

Response to Intervention (RTI) combines highly tailored differentiation with evidence-based interventions which are monitored constantly (RTI is also known as Multi-Tier System of Supports).

Research shows a remarkable effect size of 1.07 for RTI.

Considerations

Differentiated teaching involves teachers supporting students to achieve success as they move through the learning process. It recognises all students have different abilities. It acknowledges and values the effort each student puts into improving their work.

Teachers who differentiate effectively call on information that pinpoints what students know now, and what they are ready to learn next. They use formative assessment to monitor learning, and to guide selection of targeted interventions corresponding with individual needs. Teachers implement interventions using fluid groupings to address students' current needs. As students gradually master the required skills teachers adjust groupings and may cease interventions.

This strategy is demonstrated when the teacher:

- uses pre-assessment of student readiness, interest and learning profile to understand individual student's needs and strengths
- sets high expectations for all students
- provides students with realistic, challenging goals, and recognise effort
- relies on formative assessment to monitor student learning progress toward and beyond learning goals
- uses a range of teaching strategies that support different abilities and ways of thinking and learning
- sets open-ended tasks that allow students to work at different levels and paces
- uses group and targeted interventions to remediate learning difficulties
- assesses student work against prior achievements rather than against other students' work.

This strategy is not demonstrated when the teacher:

- sets the same work for all students
- provides little variation in teaching strategies, resources and groups composition
- assesses all student work against general criteria
- applies differentiated teaching strategies only for gifted students
- establishes consistently inflexible groupings.

This strategy is demonstrated when students:

- can choose learning activities based on agreed goals
- are assessed against prior achievements, rather than against other students' work
- are supported and challenged to reach their learning potential.

Resources:

- Abilities Based Learning and Education Support: http://www.education.vic.gov.au/school/teachers/teachingresources/diversity/pages/ables.aspx
- Insight Assessment Platform: http://www.insight.vic.edu.au/
- AITSL videos:

  Supporting Japanese language learners https://www.youtube.com/watch?v=E8Z7snMqQDY

  Ancient Rome
  https://www.youtube.com/watch?v=jqITEmbhM2Q

Examples that illustrate the strategy

Example 1: Years 7-9 – Languages

Language teachers at a Melbourne secondary school were aware many students were not progressing at the expected rate. In their Professional Learning Community (PLC) during Term 2, they discussed their existing differentiation practices (giving students' either extension or revision tasks). They agreed these strategies were failing to extend all students. PLC members decided to monitor students' learning using student assessment data. Their analysis of the data prompted the PLC to consider how they could use student assessment data to improve design of differentiation strategies that meet diverse student needs.

In Term 3, the school appointed data managers for each year level. They assisted teachers to build accurate class profiles, and to establish precise learning objectives that specifically targeted student needs. The data enabled teachers to match learning goals with teaching and learning strategies, and supported lesson planning based on explicit teaching (see HITS 3). Teachers adopted flexible groupings which fostered mastery of new skills, allowing students to progress quickly to new learning.

Teachers agreed to implement new strategies consistently, and to monitor their impact on student outcomes. They used formative assessment to monitor individual student progress and to provide students with real time feedback. Teachers used on-the-spot interventions to clarify and correct misunderstandings, and when appropriate, to guide students to the next learning objective.

Throughout Terms 3 and 4, student data was shared at PLC meetings. The PLC studied the data to identify trends, evaluate student progress, and refine the strategies put in place. The data flow was encouraging as it showed students were more engaged and individual achievement levels were increasing.

Teachers welcomed this school-wide approach. They were empowered to use the collective knowledge and expertise in the PLC. They found the approach effective because it enabled them to target their teaching to the exact point of student need.

Example 2: Primary – Mathematics

A group of primary school teachers in a Mathematics PLC adopted a flipped classroom model to address a problem of practice. First, they wanted to provide effective differentiated instruction to a diverse range of students with mixed abilities. Second, they were determined to do so without compromising the quality of explicit teaching.

PLC members decided to substitute the explicit instruction phase of their lessons with video based instruction using online resources, including recordings of their own teaching. This approach allowed students to access the videos in their own time, thus freeing classroom, group and individual practice time.

School funds supported the purchase of Ziggy Cams, and with the use of web-based document sharing, teachers created an online repository of videos that were shared and viewed across classes. This approach yielded many benefits. It enabled effective scaffolding of learning. It provided students with greater virtual access to their teachers through videos on demand. It increased face-to-face student access to their teachers by freeing up time for group and one-on-one classroom feedback. Teachers were able to increase frequency and depth of individual and small group interventions. The videos provided explicit instruction delivered at the student point of need, creating opportunities for revision, extension and acceleration. Finally, teachers had increased opportunities to monitor student progress

The model developed and implemented by PLC members was a successful response to the challenge they set for themselves. Using videos in a thoughtfully calibrated manner proved effective in providing differentiated instruction. At the same time, teachers were able to maintain their emphasis on providing clear instructions, demonstrating the application of knowledge, and using worked examples.

Continuum of practice

1. Emerging	2. Evolving	3. Embedding	4. Excelling
Teachers use assessment strategies to identify what students know, and to monitor learning. Teachers use a variety of teaching strategies to accommodate the range of abilities and interests.	Teachers use a range of assessment activities to identify prior learning, and to diagnose student learning needs. Teachers modify and diversify their instructional delivery and behaviour management to meet the different needs of students.	Student assessment data is analysed and findings explicitly inform curriculum planning and teaching practice. Teachers use data to determine the targeted interventions required for individual students. Teachers 'teach-up' – that is, they teach high quality, rich curriculum to all students and scaffold learning so students achieve high level goals, rather than teach 'down' to students they perceive as having less ability.	After effectively diagnosing individual students' abilities, teachers select and explicitly teach using tailored, appropriately challenging strategies. Teachers contribute to the ongoing development of whole-school assessment policies and strategies, which support teachers to build their capability to use a range of assessment data to diagnose students' learning needs and inform planning for student learning. Differentiation is central to planning and delivery in all lessons.

Evidence base

- Hattie, J. (2009). *Visible Learning: A synthesis of over 800 meta-analyses relating to achievement.* Milton Park, UK: Routledge.
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Professional Practice

Professional Practice Note 14

USING METACOGNITIVE STRATEGIES TO SUPPORT STUDENT SELF-REGULATION AND EMPOWERMENT

'Where students have developed strong metacognitive skills, we see them evaluating and sharing evidence about their thinking.'

Dean Bush, Assistant Principal, Seymour College

OVERVIEW

Teaching metacognitive strategies can greatly enhance learning for all students in all subject areas.

This professional practice note provides advice to support school leaders and teachers in the integration of metacognitive strategies in everyday teaching.

In addition, it includes examples of how schools can implement metacognitive strategies to assist students to build self-regulation and develop a strong sense of agency in their learning.

See: *High Impact Teaching Strategies – Metacognitive Strategies*.

WHY DO TEACHERS USE METACOGNITIVE STRATEGIES?

'Metacognitive strategies empower students to think about their own thinking. Awareness of the learning process enhances control over their own learning. It also enhances personal capacity for self-regulation and managing one's own motivation for learning. Metacognitive activities can include planning how to approach learning tasks, identifying appropriate strategies to complete a task, evaluating progress, and monitoring comprehension.'

High Impact Teaching Strategies

Teaching students metacognitive strategies[1] offers students tools to "drive their brains"[2].

WHO BENEFITS FROM THE USE OF METACOGNITIVE STRATEGIES?

'Explicit attention to and application of thinking skills enables students to develop an increasingly sophisticated understanding of the processes they can employ whenever they encounter both the familiar and unfamiliar, to break ineffective habits and build on successful ones, building a capacity to manage their thinking.'

Victorian Curriculum and Assessment Authority

All students, regardless of their age, background or achievement level, benefit from the use of metacognitive strategies. This journey, which starts in early childhood and continues through primary school, secondary school and beyond, is mapped in the Critical and Creative Thinking capability of the Victorian Curriculum F-10 (the Curriculum).

The sophistication of the metacognitive skills students can master increases as they progress through education. Students can start with the ability to monitor progress towards the achievement of learning goals negotiated with the teacher. This negotiation and monitoring plays an important role in the learning of all students, regardless of their background or previous achievement.

Metacognitive strategies can also be differentiated to bolster the achievement of specific cohorts of students. They can be used to extend the learning of gifted and high achieving students, as well as a support strategy for low achieving students.

WHAT IS METACOGNITION AND HOW DOES IT DEVELOP?

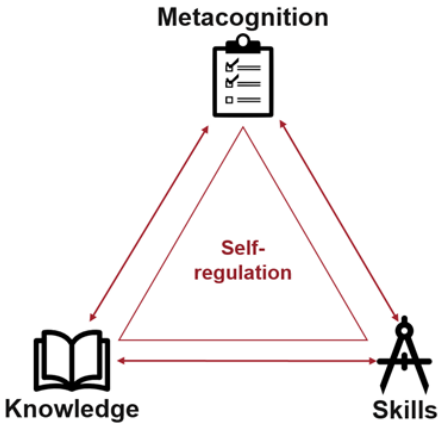
As recognised in the Capabilities of Curriculum, metacognition develops best when addressed in context and integrated in everyday teaching. This means that all teachers can assist students to concurrently learn and develop:

- **subject matter knowledge (Knowledge)**, which for example can be knowledge of a novel recently read in class and the specific terminology used in text analysis
- **subject matter skills and abilities (Skills)**, which can include the strategies and skills needed to conduct a character analysis and how to structure an essay

[1] Eisenhart, M., & DeHaan, R.L. (2005). Doctoral preparation of scientifically based educational researchers. *Educational Researcher*, 34(4): 3-13.

[2] Willis. J. (2012). A Neurologist Makes the Case for Teaching Teachers About the Brain. Edutopia.

- **metacognitive knowledge, skills and abilities (Metacognition)**, which includes an understanding of and the ability to plan for, monitor and evaluate the use of knowledge and skills; for example, how to interpret an essay question, how to identify and use the information and strategies most relevant to the question, and how to evaluate the end product.



When learning is scaffolded in each of these areas, teachers can assist students to:

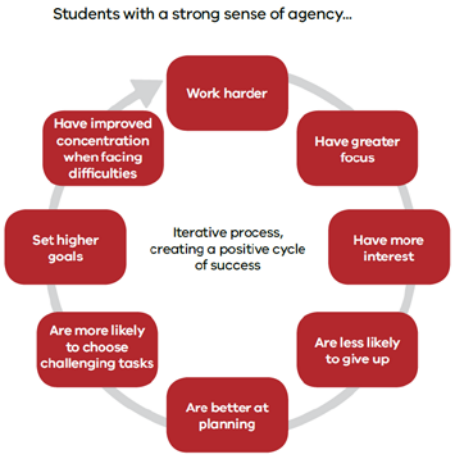
- learn new knowledge and skills
- practise new knowledge and skills
- develop the ability to independently apply the new knowledge and skills.

WHAT ARE THE BENFITS OF USING METACOGNITIVE STRATEGIES?

When teachers assist students to develop strong metacognitive abilities, students develop a deeper awareness of the learning process and gain control over their own learning. This leads to:

- enhanced personal capacity for self-regulation
- increased ability to manage one's own motivation
- students becoming more independent learners.

Metacognitive strategies also play a crucial role in enabling students to become active participants in their own learning and school communities. Students who have the opportunity to exercise voice, agency and leadership in designing, developing and assessing their own learning, have a greater chance of becoming resilient and independent learners.



From Amplify: Generating a positive cycle of learning

A focused effort on assisting students to develop metacognitive skills:

- provides students with opportunities to collaborate and make decisions with adults around what and how they learn and how their learning is assessed
- empowers students to direct and take responsibility for their learning
- assists students to understand and contribute to the community and the world around them.

HOW TO INTEGRATE METACOGNITIVE STRATEGIES IN YOUR CLASSROOM

A good starting point for every teacher is to assess their students' mindsets[3]. The presence of specific attitudes, motivations and dispositions in a learner can:

- enhance their capacity to learn
- determine their willingness to persevere with, and make sense of, discipline-based knowledge and content
- determine their willingness to persist with developing skills and capabilities that are experienced as difficult, elusive or challenging.

The following tools can help teachers do this. They can be used with students as a self-reflection tool to guide the design of learning experiences, to prompt classroom

[3] Dweck, C. (2015) Carol Dweck Revisits the 'Growth Mindset', *Education Week, https://www.edweek.org/ew/articles/2015/09/23/carol-dweck-revisits-the-growth-mindset.html*

discussions, and to track student progress in the development of the right learning dispositions.

- The Mindset Works Effort Rubric places the effort in the context of mindset. This tool helps students (and adults) identify what effort looks like for them within the learning process.
- The Growth Mindset Feedback and Growth Mindset Framing tools help teachers transform their language to growth-minded language, to give feedback to students about their progress and results, so that students can see growth, and learn new concepts and skills. [i]
- The Four Rs Tool, developed from the work and research of Professor Guy Claxton, can be a powerful way to identify strengths and development needs for each student, as well as a way to assist students to become increasingly aware and take control of their attitudes to learning, leading to improved self-regulation.

Some of the most common strategies used in everyday teaching to foster the learning and internalisation of metacognitive strategies are:

- ***Explicit teaching***, with a focus on activating prior knowledge, introducing new knowledge and skills, modelling the application of knowledge and skills, and providing ample opportunity for independent practice and reflection.
- ***Supporting students to plan, monitor, and evaluate their work/learning***. Explicitly teaching level-appropriate skills and structuring work around these phases will help students to gradually internalise these techniques and use them to take control of their own learning.
- ***Developing rubrics*** (and wherever possible co-designing them with students) to assist students to monitor their own learning/work and set individual learning goals that are specific, measurable, achievable, realistic and timely (SMART).
- ***Modelling thinking*** by verbalising the thought processes used to consider, analyse and solve problems. This may be as simple as 'thinking aloud'.
- ***Questioning***, by using questions to engage students, to monitor their progress and stimulate their thinking, and also by valuing questions from students as a form of feedback and an opportunity for clarification/extension of learning.

For more information on these and additional strategies, teachers can refer to:

- High Impact Teaching Strategies (HITS)
- HITS: Using metacognitive strategies
- Education Endowment Foundation report - Metacognition and self-regulated learning

SELF-REGULATION THROUGH CO-DESIGN OF LEARNING PROTOCOLS

'Self-regulated learning and metacognition have often been found to be context-dependent. […] This does not, however, mean that metacognitive knowledge and skills will automatically develop through content knowledge teaching.'

Education Endowment Foundation [4]

Rosanna Primary School used metacognitive strategies to explore what deep learning looks like. This example demonstrates how a process of collaborative inquiry and co-design helps students to develop metacognitive skills and the ability to self-regulate.

Teachers worked with the Junior School Council to develop a set of new learning protocols for the school. By involving student representatives from each class, they drew upon students' initial understanding of deep learning and pushed them further to question and understand what deep learning looks like.

'It is a good reminder for us as teachers and leaders that what we think might work well does not actually suit students, and that students can actually offer a very different perspective. Students told us what was not going to work and what we could try as teachers to enable them to become co-creators and co-designers of the whole process.'

Jeff Jackson, AP Rosanna Primary School.

Together, teachers and students created a visual model of deep learning matched by a set of learning protocols. Students and teachers can now refer to this model to monitor and guide their learning in class and beyond.

The co-design process gave students a greater understanding and awareness of the learning process, activating their metacognition. The resulting deep learning

[4] Education Endowment Foundation (2019) *Metacognition And Self-Regulated Learning, Guidance Report*, p.24

process and protocols empower students to take ownership and responsibility for their own learning. This leads directly to developing intrinsic motivation and self-regulation of students.

EMPOWERMENT OF STUDENTS THROUGH BUILDING MOTIVATION AND DISPOSITIONS

Epping Secondary College used metacognitive strategies that help students gain control of their motivation and attitude towards learning. The school explicitly taught the process and practices required to master new skills. This case study highlights how co-designing rubrics and giving students time to reflect, set goals and articulate issues related to learning, are powerful tools to help students become self-regulating learners.

Epping involved both staff and students in the co-design of 'process rubrics' which describe the process students can use to improve and self-direct their learning. Rubrics enabled teachers to introduce the metacognitive knowledge to students, and assisted students to develop the skills and abilities needed to manage the learning process.

The development of the process rubrics and the formal reflection and goal setting process built transparency and a common understanding of the metacognitive strategies. Students now use the rubrics to set goals and reflect on their learning, and to seek feedback and discuss progress with their peers, parents, guardians and teachers.

'This year I have learnt that the process of learning is more complicated than we think. We have to have a growth mindset, persistence, perseverance and commitment. It has shown me that if I work with commitment and determination, I will be more likely to reach my goals.'

Year 9 student, Epping Secondary College

Using the rubrics students have an opportunity to reflect on effort, the different strategies they use, and the processes they employ. This empowers students to become active creators of their own learning and gives them the ability to monitor and adjust their thinking to achieve their learning goals.

Rubrics assist teachers to make clear how and why students learnt something, and how and why they improved.

To help with this, teachers included in each formative and summative assessments a 'not yet' grade. This supports students to value growth mindsets and teachers to reward effort and resilience.

'It takes time and effort to strive and do better. You have to be willing and determined every day to make a difference and do extra homework and revise what you complete in class. This has changed the way I learn by making me prepared for the tasks given in class, it has helped me be more organised and improve my marks this year.'

Year 9 student, Epping Secondary College

RELEVANT TOOLS AND RESOURCES

This note is part of a series of professional practice notes to support school-based staff to continue improving their practice. For more information, see Professional Practice Elements.

Relevant tools and resources include:

- High Impact Teaching Strategies
- Amplify
- HITS: Using metacognitive strategies
- Victorian Curriculum F-10 - Critical and Creative Thinking
- Education Endowment Foundation report - Metacognition and self-regulated learning
- The four Rs tool - Assess the attitudes, motivations and dispositions of your students
- Mindsetworks resources for teachers
- Carol Dweck-Revisits the 'Growth Mindset'
- Carol Dweck-The Power of Believing you can Improve
- Metacognition: The Gift that Keeps Giving

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WHAT WORKS, WHAT DOESN'T

Some study techniques accelerate learning, whereas others are just a waste of time—but which ones are which? An unprecedented review maps out the best pathways to knowledge

BY JOHN DUNLOSKY, KATHERINE A. RAWSON, ELIZABETH J. MARSH, MITCHELL J. NATHAN AND DANIEL T. WILLINGHAM

ILLUSTRATIONS BY CELIA JOHNSON

ANDREW LILLEY /*Stockphoto (blocks)*

Education generally focuses on what you study, such as algebra, the elements of the periodic table or how to conjugate verbs. But learning how to study can be just as important, with lifelong benefits. It can teach you to pick up knowledge faster and more efficiently and allow you to retain information for years rather than days.

Cognitive and educational psychologists have developed and evaluated numerous techniques, ranging from rereading to summarizing to self-testing, for more than 100 years. Some common strategies markedly improve student achievement, whereas others are time-consuming and ineffective. Yet this information is not making its way into the classroom. Teachers today are not being told which learning techniques are supported by experimental evidence, and students are not being taught how to use the ones that work well. In fact, the two study aids that students rely on the most are not effective. One of them may even undermine success.

One potential reason is that the huge amount of research is overwhelming, making it difficult for educators and students to identify the most practical and advantageous ways to study. To meet this challenge, we reviewed more than 700 scientific articles on 10 commonly used learning techniques. We focused on strategies that seem to be easy to use and broadly effective. We also took a closer look at a couple of methods that are very popular with students.

To receive our recommendation, a technique must be useful in a range of learning conditions, such as whether a student works alone or in a group. It must assist learners of various ages, abilities and levels of prior knowledge—and it must have been tested in a classroom or other real-world situation. Learners should be able to use the method to master a variety of subjects, and their performance should benefit no matter what kind of test is used to measure it. The best approaches also result in long-lasting improvements in knowledge and comprehension.

Using these criteria, we identified two clear winners. They produced robust, durable results and were relevant in many situations. Three more are recommended with reservations, and five—including two popular learning aids—are not advised, either because they are useful only in limited circumstances or because not enough evidence supports a higher rating. We encourage researchers to further explore some of the untested techniques, but students and teachers should be cautious about relying on them.

FAST FACTS

Rating the Best Ways to Study

1» **Some study methods work in many different situations and across topics, boosting test performance and long-term retention. Learning how to learn can have lifelong benefits.**

2» **Self-testing and spreading out study sessions—so-called distributed practice—are excellent ways to improve learning. They are efficient, easy to use and effective.**

3» **Underlining and rereading, two methods that many students use, are ineffective and can be time-consuming.**

4» **Other learning techniques need further testing and evaluation. In the meantime, students and teachers can put proved study methods to use in classrooms and at home.**

THE GOLD STAR WINNERS

1. SELF-TESTING Quizzing Yourself Gets High Marks

HOW IT WORKS: Unlike a test that evaluates knowledge, practice tests are done by students on their own, outside of class. Methods might include using flash cards (physical or digital) to test recall or answering the sample questions at the end of a textbook chapter. Although most students prefer to take as few tests as possible, hundreds of experiments show that self-testing improves learning and retention.

In one study, undergraduates were asked to memorize word pairs, half of which were then included on a recall test. One week later the students remembered 35 percent of the word pairs they had been tested on, compared with only 4 percent of those they had not. In another demonstration, undergraduates were presented with Swahili-English word pairs, followed by either practice testing or review. Recall for items they had been repeatedly tested on was 80 percent, compared with only 36 percent for items they had restudied. One theory is that practice testing triggers a mental search of long-term memory that activates related information, forming multiple memory pathways that make the information easier to access.

WHEN DOES IT WORK? Anyone from preschoolers to fourth-year medical students to middle-age adults can benefit from practice testing. It can be used for all kinds of factual information, including learning words in foreign languages, making spelling lists and memorizing the parts of flowers. It even improves retention for people with Alzheimer's disease. Short, frequent exams are most effective, especially when test takers receive feedback on the correct answers.

Practice testing works even when its format is different from that of the real test. The beneficial effects may last for months to years—great news, given that durable learning is so important.

IS IT PRACTICAL? Yes. It requires modest amounts of time and little to no training.

HOW CAN I DO IT? Students can self-test with flash cards or by using the Cornell system: during in-class note taking, make a column on one edge of the page where you enter key terms or questions. You can test yourself later by covering the notes and answering the questions (or explaining the keywords) on the other side.

RATING: High utility. Practice testing works across an impressive range of formats, content, learner ages and retention intervals.

WE REVIEWED MORE THAN 700 SCIENTIFIC ARTICLES ON 10 COMMON LEARNING TECHNIQUES TO IDENTIFY THE MOST ADVANTAGEOUS WAYS TO STUDY.

ISTOCKPHOTO (*star*)

2. DISTRIBUTED PRACTICE
For Best Results, Spread Your Study over Time

HOW IT WORKS: Students often "mass" their study—in other words, they cram. But distributing learning over time is much more effective. In one classic experiment, students learned the English equivalents of Spanish words, then reviewed the material in six sessions. One group did the review sessions back to back, another had them one day apart and a third did the reviews 30 days apart. The students in the 30-day group remembered the translations the best. In an analysis of 254

studies involving more than 14,000 participants, students recalled more after spaced study (scoring 47 percent overall) than after massed study (37 percent).

WHEN DOES IT WORK? Children as young as age three benefit, as do undergraduates and older adults. Distributed practice is effective for learning foreign vocabulary, word definitions, and even skills such as mathematics, music and surgery.

IS IT PRACTICAL? Yes. Although textbooks usually group problems together by topic, you can intersperse them on your own. You will have to plan ahead and overcome the common student tendency to procrastinate.

HOW CAN I DO IT? Longer intervals are generally more effective. In one study, 30-day delays improved performance more than lags of just one day. In an Internet-based study of trivia learning, peak performance came when sessions were spaced at about 10 to 20 percent of the retention interval. To remember something for one week, learning episodes should be 12 to 24 hours apart; to remember something for five years, they should be spaced six to 12 months apart. Although it may not seem like it, you actually do retain information even during these long intervals, and you quickly relearn what you have forgotten. Long delays between study periods are ideal to retain fundamental concepts that form the basis for advanced knowledge.

RATING: High utility. Distributed practice is effective for learners of different ages studying a wide variety of materials and over long delays. It is easy to do and has been used successfully in a number of real-world classroom studies.

THE RUNNERS-UP

Despite their promise, the following learning techniques fall short, in many cases because not enough evidence has been amassed to support their use. Some techniques, such as elaborative interrogation and self-explanation, have not been evaluated sufficiently in real-world educational contexts. Another emerging method called interleaved practice has just begun to be systematically explored. Nevertheless, these techniques show enough potential for us to recommend their use in the situations described briefly here.

3. ELABORATIVE INTERROGATION Channel Your Inner Four-Year-Old

HOW IT WORKS: Inquisitive by nature, we are always looking for explanations for the world around us. A sizable body of evidence suggests that prompting students to answer "Why?" questions also facilitates learning.

With this technique, called elaborative interrogation, learners produce explanations for facts, such as "Why does it make sense that…?" or "Why is this true?" In one experiment, for example, students read sentences such as "the hungry man got into the car." Participants in an elaborative interrogation group were asked to explain why, whereas others were provided with an explanation, such as "the hungry man got into the car to go to the restaurant." A third group simply read each sentence. When asked to recall which man performed what action ("Who got in the car?"), the elaborative-interrogation group answered about 72 percent correctly, compared with about 37 percent for the others.

WHEN SHOULD I USE IT? When you are learning factual information—particularly if you already know something about the subject. Its power increases with prior knowledge; German students benefitted from elaborative interrogation more when they were learning about German states than about Canadian provinces, for example. It may be that prior knowledge permits students to generate more appropriate explanations for why a fact is true.

PROMPTING STUDENTS TO ANSWER "WHY?" QUESTIONS, CALLED ELABORATIVE INTERROGATION, ALSO FACILITATES LEARNING.

The effects of this technique appear to be robust across ages, from fourth graders through undergraduates. Elaborative interrogation clearly improves memory for facts, but whether it also might enhance comprehension is less certain, and there is no conclusive information about how long the gains in learning persist.

IS IT PRACTICAL? Yes. It requires minimal training and makes reasonable time demands. In one study, an elaborative-interrogation group required 32 minutes to do a task that took 28 minutes for a reading-only group.

RATING: Moderate utility. The technique works for a broad range of topics but may not be useful for material more complex than a factual list. Benefits for learners without prior knowledge may be limited. More research will be needed to establish whether elaborative interrogation generalizes to various situations and different types of information.

4. SELF-EXPLANATION How Do I Know?

HOW IT WORKS: Students generate explanations of what they learn, reviewing their mental processing with questions such as "What new information does the sentence provide for you?" and "How does it relate to what you already know?" Similar to elaborative interrogation, self-explanation may help integrate new information with prior knowledge.

WHEN SHOULD I USE IT? It benefits kindergartners to college students and helps in solving math problems and logical reasoning puzzles, learning from narrative texts and even mastering endgame strategies in chess. In younger children, self-explanation can help with basic ideas such as learning numbers or patterns. The technique improves memory, comprehension and problem solving—an impressive range of outcomes. Most studies, however, have measured effects within only a few minutes, and it is not known whether the technique is more lasting in people of high or low knowledge.

IS IT PRACTICAL? Unclear. On the one hand, most students need minimal instruction and little to no practice, although one test of ninth graders showed that students without training tended to paraphrase rather than generate explanations. On the other, a few studies report that this technique is time-consuming, increasing time demands by 30 to 100 percent.

RATING: Moderate utility. Self-explanation works across different subjects and an impressive age range. Further research must establish whether these effects are durable and whether the time demands make it worthwhile.

(The Authors)

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5. INTERLEAVED PRACTICE
Mixing Apples and Oranges

HOW IT WORKS: Students tend to study in blocks, finishing one topic or type of problem before moving on to the next. But recent research has shown benefits for interleaved practice, in which students alternate a variety of types of information or problems. In one study, for example, college students learned to compute the volumes of four different geometric shapes. In a so-called blocked-practice condition, they finished all the problems for one shape before moving on to the next. In interleaved practice, the problems were intermixed. When tested one week later, the interleaved

What Doesn't Work

These techniques were rated as low utility because they are inefficient, ineffective or beneficial only for certain types of learning and for short periods of retention. Most students report rereading and highlighting, yet these techniques do not consistently boost performance, and they distract students from more productive strategies. Other methods mentioned below are just too time-consuming.

HIGHLIGHTING

Students commonly report underlining, highlighting or otherwise marking material. It is simple and quick—but it does little to improve performance. In controlled studies, highlighting has failed to help U.S. Air Force basic trainees, children and remedial students, as well as typical undergraduates. Underlining was ineffective regardless of text length and topic, whether it was aerodynamics, ancient Greek schools or Tanzania.

In fact, it may actually hurt performance on some higher-level tasks. One study of education majors found that underlining reduced their ability to draw inferences from a history textbook. It may be that underlining draws attention to individual items rather than to connections across items.

WHAT YOU SHOULD DO INSTEAD: Highlighting or underlining can be useful if it is the beginning of a journey—if the marked information is then turned into flash cards or self-tests. Given that students are very likely to continue to use this popular technique, future research should be aimed at teaching students how to highlight more effectively—which likely means doing it more judiciously (most undergraduates overmark texts) and putting that information to work with a more useful learning technique.

REREADING

In one survey of undergraduates at an elite university, 84 percent said they reread textbooks or notes during study. It requires no training, makes modest demands on time, and has shown some benefits on recall and fill-in-the-blank-style tests.

Yet the evidence is muddy that rereading strengthens comprehension, and whether its effects depend on knowledge level or ability is also woefully underexplored. Most of the benefit of rereading appears to accrue from the second reading, with diminishing returns from additional repetitions. No experimental research has assessed it using materials from actual courses—ironic, given that this strategy is the one most commonly reported by students.

WHAT YOU SHOULD DO INSTEAD: Don't waste your time—in head-to-head comparisons, rereading fares poorly against more active strategies such as elaborative interrogation, self-explanation and practice testing.

Three less commonly used study techniques also fared poorly in our assessment. "Imagery for text learning" needs more evidence before it can be recommended, whereas "summarization" and "keyword mnemonic" appear to be ineffective and time-consuming.

In summarization, students identify a text's main points, excluding unimportant material. Whether it works is difficult to answer, as it has been implemented in many different ways. It is unknown whether summarizing small pieces of a text or large chunks of it works better or whether the length, readability or organization of the material matters.

With keyword mnemonics, imagery is used to enhance memory; for example, a student learning the French word *la dent* ("tooth") might use the similar-sounding English word "dentist" to form a mental image of a dentist holding a large molar. Mnemonics do seem to help with foreign-language vocabulary, word definitions and medical terminology, but the effects have not been shown to endure, and in the end the effort involved in generating keywords may not be an efficient use of time.

Another technique that uses mental pictures is imagery for text learning, in which students are told to create images for every paragraph they read. Research has revealed a patchwork of inconsistent results that have not been shown to last over the long term. Teachers may consider instructing students to attempt using this technique with image-friendly texts, but further demonstrations of its usefulness are necessary.

» See the *Psychological Science in the Public Interest* article "Improving Students' Learning with Effective Learning Techniques: Promising Directions from Cognitive and Educational Psychology," on which this story for *Scientific American Mind* is based, at the Association for Psychological Science's Web site: **www.psychologicalscience.org**

practice group was 43 percent more accurate. Interleaving allows students to practice selecting the correct method and encourages them to compare different kinds of problems.

WHEN SHOULD I USE IT? When the types of problems are similar, perhaps because juxtaposing them makes it easier to see what is different about them. Blocked practice—doing all the items from one category in a row—may be more effective when the examples are not very much alike because it highlights what they have in common.

It is possible that interleaved practice benefits only those who are already reasonably competent. Outcomes are also mixed for different types of content. It improves performance on algebra problems and was effective in a study that trained medical students to interpret electrical recordings to diagnose cardiac disorders. Yet two studies of foreign-vocabulary learning showed no effect for interleaved practice. Nevertheless, given how much difficulty many students have in mathematics, it may still be a worthwhile strategy for that subject.

STUDENTS ARE NOT BEING TAUGHT THE BEST STRATEGIES, PERHAPS BECAUSE TEACHERS THEMSELVES ARE NOT SCHOOLED IN THEM.

IS IT PRACTICAL? It seems to be. A motivated student could easily use interleaving without any instruction. Teachers could also use the technique in the classroom: After one kind of problem (or topic) is introduced, practice first focuses on that problem. Once the next kind of problem is introduced, it is mixed in with examples of earlier subjects. It may take a little more time than blocking practice, but such slowing most likely is worthwhile, reflecting cognitive processes that boost performance.

RATING: Moderate utility. Interleaved practice improves learning and retention of mathematical knowledge and boosts other cognitive skills. The literature on interleaved practice is small, however, and includes enough negative results to raise concern. It may be that the technique does not consistently work well, or perhaps it is not always used appropriately—topics for future research.

What We Have Learned

Why don't students use more effective study techniques? It seems they are not being taught the best strategies, perhaps because teachers themselves are not schooled in them. In our survey of six educational-psychology textbooks, only one technique—"keyword mnemonics"—was covered in every book. None offered much guidance on the use, effectiveness or limitations of different ways of studying.

A second problem may be that in the educational system, the emphasis is on teaching students critical-thinking skills and content. Less time is spent on teaching them how to learn. The result can be that students who do well in their early years, when learning is closely supervised, may struggle once they are expected to regulate their own learning in high school or college.

Some questions, such as the best age for students to start using a technique and how often they will need to be retrained or reminded, still require further research. But even now teachers can incorporate the most successful approaches into lesson plans so that students could adopt them on their own. For instance, when moving to a new section, a teacher can start by asking students to do a practice test that covers important ideas from the previous section and providing immediate feedback. Students can interleave new problems with related ones from preceding units. Teachers can harness distributed practice by reintroducing major concepts during the course of several classes. They can engage students in explanatory questioning by prompting them to consider how the information is new to them or why it might be true.

These learning techniques are no panacea. They benefit only those who are motivated and capable of using them. Nevertheless, we expect that students will make meaningful gains in classroom performance, on achievement tests and during their lifetime. M

(Further Reading)

- **Ten Benefits of Testing and Their Applications to Educational Practice.** H. L. Roediger III, A. L. Putnam and M. A. Smith in *Psychology of Learning and Motivation,* Vol. 55: *Cognition in Education.* Edited by Jose P. Mestre and Brian H. Ross. Academic Press, 2011.
- **Interleaving Helps Students Distinguish among Similar Concepts.** D. Rohrer in *Educational Psychology Review,* Vol. 24, No. 3, pages 355–367; September 2012.
- **Using Spacing to Enhance Diverse Forms of Learning: Review of Recent Research and Implications for Instruction.** S. K. Carpenter, N. J. Cepeda, D. Rohrer, S.H.K. Kang and H. Pashler, ibid., pages 369–378.
- **When Is Practice Testing Most Effective for Improving the Durability and Efficiency of Student Learning?** K. A. Rawson and J. Dunlosky, ibid., pages 419–435.

TEST ANXIETY

During exams, do you...

- feel like you "go blank"?
- become frustrated?
- find yourself thinking "I can't do this" or "I'm stupid"?
- feel like the room is closing in on you?
- feel your heart racing or find it difficult to breathe?
- suddenly "know" the answers after turning in the test?
- score much lower than on homework or papers?

When performing, do you…

- become distracted?
- feel overwhelmed?
- miss important cues from your surroundings?
- "go blank" and forget what you are supposed to do?
- have distracting thoughts of failure or of poor performance?
- perform more poorly than in practice?

YES? Then this information may be just what you need!

Source: www.highschoolblues.com

How to use this resource:

The intent of this booklet is to help students and parents better understand test anxiety, and to provide methods to help students cope with test anxiety and ultimately be successful in their courses. Students should read this booklet carefully, consider which aspects of test anxiety apply to them, and then identify coping strategies that may help address the anxiety. Ideally, parents would read this booklet with their student and participate in the resulting discussion and identification of coping strategies. Remember that support from family members is always positive, and will ultimately help students deal with their anxiety.

Table of contents

This document was compiled & prepared by:
Mark Gilbert (Rutland Senior Secondary School) , and
Karen Gilbert (George Elliot Secondary School).

Several sources have been blended and compiled to create this package:

www.how-to-study.com
www.highschoolblues.com
www.schoolcounselor.org
www.anxietybc.com

Resources also came from:
DR. LYNN MILLER, Ph. D., R. Psych.
Assistant Professor at the University of British Columbia

PART 1: IDENTIFYING TEST ANXIETY

PSYCHED UP, BUT NOT PSYCHED OUT!

In order to perform well in a challenging situation, you must be psychologically and physically alert. You certainly won't perform well on an exam or in an event if you are nearly asleep! This level of "alertness" is also called arousal. Some degree of arousal is essential for optimal performance. Increasing arousal is the idea behind "psyching up"- and it works - in many cases, psyching up enhances performance. The problem is that when the intensity of arousal gets too high, we often begin to feel nervous and tense and experience anxiety. At this level, anxiety becomes distracting and performance declines - we get "psyched out." For optimal performance, you need to keep your arousal at an intermediate level - psyched up, but not psyched out!

TEST ANXIETY ~ "PSYCHED OUT"!

Almost everyone feels nervous or experiences some anxiety when faced with a test or an exam. In fact, it is unusual to find a student who doesn't approach a big test without a degree of anxiety. Many students experience some nervousness or apprehension before, during, or even after an exam. It is perfectly natural to feel some anxiety when preparing for and taking a test.

Too much anxiety about a test is commonly referred to as test anxiety. Test anxiety is very common among students! It can interfere with your studying, and you may have difficulty learning and remembering what you need to know for the test. Further, too much anxiety may block your performance. You may have difficulty demonstrating what you know during the test.

Test anxiety can cause a host of problems in students. Although each person will experience a different collection of symptoms with differing degrees of intensity, the symptoms fall into a few categories.

- **Physical** - headaches, nausea or diarrhea, extreme body temperature changes, excessive sweating, shortness or breath, light-headedness or fainting, rapid heart beat, and/or dry mouth.
- **Emotional** - excessive feelings of fear, disappointment, anger, depression, uncontrollable crying or laughing, feelings of helplessness
- **Behavioral** - fidgeting, pacing, substance abuse, avoidance
- **Cognitive** - racing thoughts, 'going blank', difficulty concentrating, negative self-talk, feelings of dread, comparing yourself to others, difficulty organizing your thoughts.

Stressful emotions can inhibit a student's ability to absorb, retain and recall information. Anxiety creates a kind of "noise" or "mental static" in the brain that blocks our ability to retrieve what's stored in memory and also greatly impairs our ability to comprehend and reason.

Research has shown that providing students with tools and strategies that build both emotional skills and healthy physical habits when preparing for a test can help them overcome test anxiety and the associated symptoms, while improving their ability to prepare for and perform on critical testing.

Sources: www.highschoolblues.com
www.how-to-study.com

PART 2: THINK ABOUT THINKING

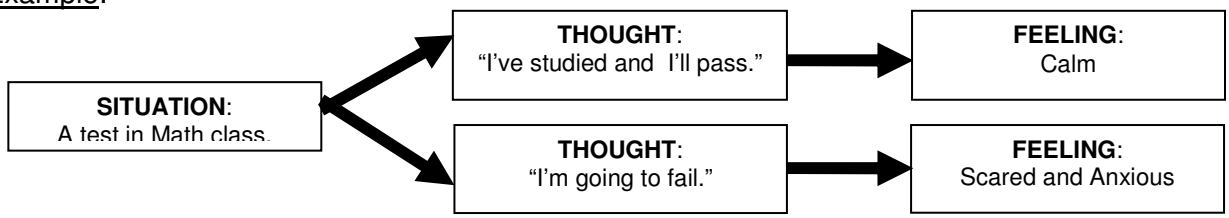
REALISTIC THINKING FOR TEST ANXIETY!

Realistic thinking means looking at all aspects of a situation (the positive, the negative and the neutral) before making conclusions. In other words, realistic thinking means looking at yourself, others, and the world in a *balanced* and *fair* way.

Step 1: Pay attention to your *self-talk*

Thoughts are the things that we say to ourselves without speaking out loud (self-talk). We all have our own way of thinking about things, and how we think has a big effect on how we feel. When we think that something bad will happen – such as failing a test – we feel anxious. For example, imagine you have a test in Math class. If you think you are going to fail, you will feel scared and anxious. But, if you think you can pass, you will feel calm.

Example:



Often we are unaware of our thoughts, but because they have such a big impact on how we feel, it is important to start paying attention to what we are saying to ourselves.

Step 2: Identify thoughts that lead to feelings of anxiety

It can take some time and practice to identify the specific thoughts that make you anxious, so here are some tips. Pay attention to your shifts in anxiety, no matter how small. When you notice yourself getting more anxious, that is the time to ask yourself:

- 'What am I thinking right now?'
- 'What is making me feel anxious?'
- 'What am I worried will happen?'
- 'What bad thing do I expect to happen?'

Step 3: Challenge your 'anxious' thinking

Thinking something doesn't mean it's true or that it will happen. For example, thinking that you will fail a test doesn't mean you will actually fail. Often, our thoughts are just guesses and not actual facts. Therefore, it is helpful to challenge your anxious thoughts because they can make you feel like something bad will definitely happen, even when it is highly unlikely.

Sometimes, our anxiety is the result of falling into **thinking traps**. Thinking traps are unfair or overly negative ways of seeing things. Use the chart on the following page and consider which thinking traps contribute to your own anxiety.

THINKING TRAPS & TEST ANXIETY

THINKING TRAP	EXAMPLE re: tests & school performance
Fortune-telling: This is when we predict that things will turn out badly. But, in reality, we cannot predict the future because we don't have a magic ball!	*"I know I'll mess up."* *"I'll never be able to pass math."*
Black-and-white thinking: This is when we only look at situations in terms of extremes: things are either good or bad, a success or a failure. But, in reality, most events call for a more 'moderate' explanation. For example, missing one class assignment does not mean you have failed the entire course ~ you just need to get caught up in class and/or complete the next assignment.	*"If I don't get a good mark, I'll totally fail."* *"I planned to study 6 hours and I know I only studied for 4 and a half. Now there's no way I can pass!"*
Mind-reading: This trap happens when we believe that we know what others are thinking and we assume that they are thinking the worst of us. The problem is that no one can read minds, so we don't really know what others are thinking!	*"Everyone will think I'm stupid."* *"The teacher doesn't like me."*
Over-generalization: This is when we use words like 'always' or 'never' to describe situations or events. This type of thinking is not helpful because it does not take all situations into account. For example, sometimes we make mistakes, but we don't always make mistakes.	*"I always fail school work."* *"I never pass tests."*
Labeling: Sometimes we talk to ourselves in mean ways and use a single negative word to describe ourselves. This kind of thinking is unhelpful and unfair. We are too complex to be summed up in a single word!	*"I'm dumb."* *"I'm a loser."*
Over-estimating danger: This is when we believe that something that is unlikely to happen is actually right around the corner. It's not hard to see how this type of thinking can maintain your anxiety. For example, how can you not feel scared if you think that you could have a heart attack at any time?	*"I'm going crazy."* *"I'm dying."* *"I will throw up."*
Filtering: This happens when we only pay attention to the bad things that happen, but ignore all the good things. This prevents us from looking at all aspects of a situation and drawing a more balanced conclusion.	*Believing you got a bad mark on a test because you left 3 questions blank, even though you know you did all of the other 32 questions on the paper.*
Catastrophizing: This is when we imagine that the worst possible thing is about to happen, and predict that we wont be able to cope with the outcome. But, the imagined worst-case scenario usually never happens and even if it did, we are most likely able to cope with it.	*"I'll freak out and everyone will sit and watch me. No one will help."* *"I'm going to look like such an idiot! The other kids will laugh and I'll die from embarrassment."*
Should statements: This is when you tell yourself how you "should", "must", or "ought" to feel and behave. However, this is NOT how you actually feel or behave. The result is that you are constantly anxious and disappointed with yourself and/or with others around you.	*"I should stop worrying about my tests."* *"I should never make mistakes in my schoolwork."*

PART 3: COPING WITH TEST ANXIETY

Use the **THINKING TRAPS & TEST ANXIETY FORM** to help you identify the traps into which you might have fallen.

Here are some questions to ask yourself to help challenge your negative thoughts or self-talk:

- Am I falling into a thinking trap (for example, catastrophizing or mind-reading)?
- What is the evidence that this thought is true? What is the evidence that this thought is not true?
- What would I tell a friend if he or she had that thought?
- Am I confusing a "possibility" with a "probability"? It may be possible, but is it likely?
- Am I 100% sure that _____ will happen?
- How many times has _____ happened before?
- Is _____ really so important that my future depends upon it?
- What is the worst that could happen?
- Is this a hassle or a horror?
- If it did happen, what can I do to cope or handle it?

Here's an example to help you challenging your negative thinking:

You have an important math test tomorrow and have been feeling quite anxious about it. You may think : *"I'm going to fail the test tomorrow!"*

To challenge this thought, you can ask yourself the following questions:

- **Am I falling into a thinking trap?**
  Yes, I have fallen into the trap of fortune-telling, predicting things will turn out badly before the event even takes place. But I still think I'm going to fail.

- **Am I basing my judgment on the way I '*feel*' instead of the '*facts*'?**
  I might feel like I'm going to fail, but there is no evidence to support it. I'm prepared for the test, and I have passed other tests at school before.

- **Am I 100% sure that I will fail?**
  No, but what if I do this time?

- **Well, what's the worst that could happen? If the worst did happen, what could I do to cope with it?**
  The worst that could happen is I do fail the test. It'll be disappointing, but it won't be the end of the world. I can go for extra help to find out what went wrong, and ask my teacher if there is anything I can do to improve my mark.

Source: www.anxietybc.com

REALISTIC THINKING & TEST ANXIETY FORM

Use copies of this **REALISTIC THINKING & TEST ANXIETY FORM** to regularly write down thoughts that make you anxious. Use the **THINKING TRAPS & TEST ANXIETY FORM** along with this handout to help you replace your anxious thoughts with more realistic ones.

SITUATION or TRIGGER	"ANXIOUS" or "WORRIED" thoughts	REALISTIC THOUGHTS
Math test tomorrow	I'm not good at math and I'm terrible at tests. I'm going to fail. I'll never pass Math!	I will study tonight and try my best tomorrow. I am fortune-telling and I don't know for sure that I will fail. I passed the last test. I have done fine on the homework assignments, so I will probably pass Math even if I don't do that well on this test.

HELPFUL REALISTIC THINKING TIPS

Tip #1: **COPING STATEMENTS**

Try coming up with statements that remind you how you can cope with a situation.

For example: *"If I get anxious, I will try some calm breathing."*
"I just need to do my best."
"People cannot tell when I'm feeling anxious."
"This has happened before and I know how to handle it."
"My anxiety won't last forever ."

Tip #2: **POSITIVE SELF-STATEMENTS**

Regularly practice being 'kind' to yourself (say positive things about yourself), rather than being overly self-critical.

For example: Instead of saying "*I will fail*.", say something like …
"I know I can do this."
"Everyone experiences anxiety. I can handle this."
"I'm not a loser if I have trouble with a test. Lots of students struggle with tests."
"I'm strong enough to do this test. I will do my best."

Tip #3: **ALTERNATIVE BALANCED STATEMENTS BASED ON CHALLENGING NEGATIVE THOUGHTS**

Once you've looked at the evidence or recognized that you've fallen into a thinking trap, come up with a more balanced thought based on facts, not feelings.

For example: When you are facing a math test, a more balanced thought could be:
"*There is a chance that I will not pass the math test tomorrow. But, not passing a math test does not mean I will fail the entire class. Even if I don't pass the test, it doesn't mean I will never graduate from high school. I have passed many school assignments and tests before."*

Source: www.anxietybc.com

DEALING WITH PHYSICAL TENSION TO HELP TEST ANXIETY

Here are a few exercises you can try to help relieve the tension in your body. It can help you relax and boost your energy level.

Focal Breathing

Often, stress is a result of a lack of oxygen. This exercise focuses on breathing and optimizing oxygen intake on every breath. Start by exhaling all the air in your lungs. Exhale slowly for ten seconds. Then, keep exhaling until you feel your lungs are completely empty. Breathe in through the nose to a count of eight. Keep your shoulders down and focus on filling your rib cage. As you feel it expand, start to push down into your abdomen. You should feel your lower body expand and near the end, pressure in your lower back as your diaphragm lowers. Exhale slowly, focusing your breathing by shaping your lips in an ooh position. Pretend there is a candle in front of your mouth that you are trying to blow out. Focusing on this type of breathing will help to focus your mind as well as work to re-oxygenate your blood and reenergize your body.

Body Check

Sit down someplace comfortable and close your eyes. Focus on the muscles in your feet and notice if there is any tension. Tell the muscles in your feet that they can relax. Do the same with your ankles, then move up to your calves, thighs, and buttocks. Tell each group of muscles to relax. Work slowly being sure to scout out any tension that may be hiding in obscure places. Do the same for your lower back, diaphragm, chest, upper back, neck, shoulders, jaw, face, upper arms, lower arms, fingers, and scalp. Pretend you are tracking an electrical current through your body that it starting at your toes and escaping from your fingertips and scalp. You may have to do this twice to be sure not to overlook any tension, but be thorough in your search.

Exercise Aerobically

This is more of a lifestyle than a practical on-site method. Still, it can help to reduce general stress and even improve your health. Do some form of exercise that elevates your heart rate and keeps it beating at that rate for twenty to thirty minutes. It should be something you enjoy, and that you can do at least three times a week. Aerobic exercise includes cycling, basketball, running, swimming, and tennis just to name a few.

Source: Dr. Lynn Miller, Ph. D., R. Psych.
*original source unknown

REDUCING TEST ANXIETY

- Being well prepared for the test is the best way to reduce test taking anxiety.
- Space out your studying over a few days or weeks, and continually review class material, don't wait until the night before and try to learn everything the night before.
- Try to maintain a positive attitude while preparing for the test and during the test.
- Exercising for a few days before the test will help reduce stress.
- Get a good night's sleep before the test.
- Show up to class early so you won't have to worry about being late.
- Stay relaxed. If you begin to get nervous take a few deep breaths slowly to relax yourself and then get back to work.
- Read the directions slowly and carefully.
- If you don't understand the directions on the test, ask the teacher to explain it to you.
- Skim through the test so that you have a good idea how to pace yourself.
- Write down important formulas, facts, definitions and/or keywords in the margin first so you won't worry about forgetting them.
- Do the simple questions first to help build up your confidence for the harder questions.
- Don't worry about how fast other people finish their test; just concentrate on your own test.
- If you don't know a question skip it for the time being (come back to it later if you have time), and remember that you don't have to always get every question right to do well on the test.
- Focus on the question at hand; don't let your mind wander on other things.

Source: Dr. Lynn Miller, Ph. D., R. Psych.
*original source unknown

DOS AND DON'TS OF DEALING WITH TEST ANXIETY

- **Don't** cram for an exam. The amount you learn won't be worth the stress.
- **Don't** think of yourself or the test in a negative sense.
- **Don't** stay up late studying the night before. You need the sleep. Begin studying a week in advance if possible.
- **Don't** spend time with classmates who generate stress for you on test day.
- **Don't** take those last few moments before the test for last minute cramming. Try to relax and spend that time reading the newspaper or some other distraction.

- **Do** remind yourself that the test is only a test.
- **Do** focus on integrating details into main ideas.
- **Do** reward yourself after the test with food or a movie or some other treat.
- **Do** something relaxing the last hour before the test.
- **Do** tell yourself that you will do your best on the test, and that will be enough!

Source: Dr. Lynn Miller, Ph. D., R. Psych.
*original source unknown

PART 4: TIPS FOR TEST SUCCESS

TEST PREPARATION TIPS

- Budget your time. Make sure you have sufficient time to study so that you are well prepared for the test.
- Go to review. Pay attention to hints that the instructor may give about the test. Take careful notes and ask questions about items you may be confused about.
- Ask the instructor to specify the areas that will be emphasized on the test.
- Make sure you go to the class right before the test; it's another prime time for the instructor to give out more hints or the format of the test.
- Go over any material from old tests, HW's, sample problems, review material, the textbook, class notes... that might be on the test.
- Eat before a test, having food in your stomach will give you energy and help you focus, but avoid heavy foods which can make you groggy.
- Don't try to pull an all nighter, get at least 3 hours of sleep before the test.
- Put the main ideas/information/formulas onto a sheet that can be quickly reviewed many times, this makes it easier to retain the key concepts that will be on the test.
- Try to show up at least 5 minutes before the test will start.
- Set your alarm and have a backup alarm set as well.
- Go to the bathroom before walking into the exam room, you don't want to waste anytime worrying about your bodily needs during the test

Source: Dr. Lynn Miller, Ph. D., R. Psych.
*original source unknown

Test Taking Tips

BEFORE YOU BEGIN:

1. Preview the test before you answer anything. This gets you thinking about the material. Make sure to note the point value of each question. This will give you some ideas on budgeting your time. As you read the questions, jot down brief notes indicating ideas you can use later in your answers.

2. Quickly calculate how much time you should allow for each section according to the point value. (You don't want to spend 30 min. on an essay question that counts only 5 points.)

3. Do a mind dump. Using what you saw in the preview, make notes of anything you think you might forget. Write down things that you used in learning the material that might help you remember. Outline your answers to discussion questions.

GENERAL TEST TAKING TIPS:

Come prepared; arrive early for tests.

Stay relaxed and confident. Don't let yourself become *anxious*. Don't talk to other students before a test; anxiety is contagious. Instead, remind yourself that you are well-prepared and are going to do well.

Be comfortable but alert. Choose a good spot to take the test. Make sure you have enough room to work. Maintain an upright posture in your seat.

Bring all your supplies! Bring at least two pens/pencils with good erasers, calculator with enough batteries and any other resources that your instructor allows you to.

Bring a watch to the test with you so that you can better pace yourself.

Keep a positive attitude throughout the whole test and try to stay relaxed. If you start to feel nervous take a few deep breaths to relax.

Keep your eyes on your own paper. You don't want to appear to be cheating and cause unnecessary trouble for yourself.

When you first receive your test, do a quick survey of the entire test so that you know how to efficiently budget your time.

Read the directions. (Can more than one answer be correct? Are you penalized for guessing? etc.) Never assume that you know what the directions say.

Answer the easy questions first. This will give you the confidence and momentum to get through the rest of the test. You are sure these answers are correct. Try not to spend too much time on one question.

Do the problems that have **the greatest point values first**.

Don't rush but **pace yourself**, read the entire question and look for keywords.

Ask the instructor to explain any items that are not clear. Do not ask for the answer, but phrase your question in a way that shows the instructor that you have the information but are not sure what the question is asking for.

Write legibly, if the grader can't read what you wrote they'll most likely mark it wrong.

Always **read the whole question carefully.** Don't make assumptions about what the question might be.

Go back to the difficult questions. While looking over the test and doing the easy questions, your subconscious mind will have been working on the answers to the hardest ones. Also, later items on the test might give you useful or needed information for earlier items.
Don't worry if others finish before you; focus on the test in front of you.

Answer all questions (unless you are penalized for wrong answers).

Try to answer the questions from the instructor's point of view. Try to remember what the instructor emphasized and felt was important.

Use the margin to help you figure out if the question does not seem clear or if the answer seems ambiguous.

Circle key words in difficult questions. This will force you to focus on the central point

Express difficult questions in your own words. Rephrasing can make it clear to you, but be sure you don't change the meaning of the question.

Use all of the time allotted for the test. If you have extra time, cover up your answers and actually rework the question.

Reserve 10% of your test time for review. Review the test; resist the urge to leave as soon as you have completed all the items. Make sure you have answered all the questions. Proofread your writing for spelling, grammar, and punctuation.

Don't worry if others finish before you; focus on the test in front of you.

Double check to make sure that you **put your first and last name on the test**.

MULTIPLE CHOICE TEST TAKING TIPS (Good for provincials exams in grade 10)

Read the question before you look at the answer.

Do all the questions you know first. Go back and try the others after.

Come up with the answer in your head before looking at the possible answers. This way the choices given on the test won't throw you off or trick you.

Eliminate answers you know aren't right.

Read all the choices before choosing your answer.

If there is no guessing penalty, **always take an educated guess** and select an answer.

Don't guess if you have no basis for your choice and if you are penalized for guessing.

Since your first choice is usually correct, **don't change your answers unless you are sure** of the correction or unless you miss-read the question.

In "All of the above" and "None of the above" choice questions, **if you are certain one of the statements is true don't choose "None of the above"**. Also, if one of the statements is false, don't choose "All of the above".

In a question with an **"All of the above" choice**, if you see that at least two correct statements, then "All of the above" is probably the answer.

A positive choice is more likely to be true than a negative one.

Usually the correct answer is the choice with the most information. Be careful to read the entire question and the answer selections regardless so you are making a thoughtful choice.

ESSAY TEST TAKING TIPS

When taking essay tests, think before you write. Create a brief outline for your essay by jotting down a few words to indicate ideas you want to discuss.

When taking essay test, get right to the point. State your main point in the first sentence. Use your first paragraph to provide an overview of your essay. Use the rest of your essay to discuss these points in more detail.

Part 5: How to Study

Time Management: Planning Your Success

Review, Repeat, Review, Repeat, Review ... {You Get the Idea}

- **Plan Your Entire Semester or Course in Advance**: Make sure you understand the 'Big Picture' for the semester or term and plan each course with this in mind. This involves mid-terms, major projects, papers, and final exam schedules. With the big picture in mind, tailor your weekly and daily schedule accordingly.

- **Daily Reviews**: Conduct short reviews of lecture notes before and after class. Begin reviewing after your first day of class. Re-copy your lecture notes each evening as a study exercise. This is especially helpful in courses that require you to memorize. Look over examples dome in class for courses like Math and Science. Daily review seems time consuming but really only take a few minutes each night. Small amounts each day will save you from huge study sessions later in the course.

- **Weekly Reviews**: Dedicate at least one afternoon or entire evening during the weekend to review all of your courses. Make certain you have an understanding of where each course is going and that your study schedule is appropriate.

- **Periodic Tactical Reviews**: On your calendar, schedule special reviews. The week before a mid-term or final exam should be blocked out for “special tactical review” ~ a larger study session spread over a few days so you don’t have to cram it all into the night before the test. If you have kept a good daily and weekly schedule, studying for a test or exam should only be reaffirming what you already know.

HOW TO STUDY EFFECTIVELY

Studying in an effective manner not only improves grades but can also help test anxiety.

GENERAL STUDY TIPS

- Minimize distracting noise. Some people need some sound while some prefer silence. Find what works for you.
- Consider a "do not disturb sign" and turning off your phone. Let voicemail take your calls for a while. You can catch up with people later.
- Use proper lighting. It's hard to feel motivated sitting in the dark! If you use a desk lamp, place it opposite the dominant writing hand and don't have it too close to you.
- In terms of temperature, it is better to be cool than warm. Warm rooms tend to make people sleepy.
- Have plenty of room to work; don't be cramped. Your study time will go better if you take a few minutes at the start to straighten things up and organize your materials.
- A desk and straight-backed chair is usually best. Don't get too comfortable ~ a bed is a place to sleep, not study.
- Have everything (book, pencils, paper, coffee, dictionary, laptop, calculator, tape recorder, etc.) close at hand. Don't spend your time jumping up and down to get things.
- Studying requires the correct attitude. Be calm and patient with yourself as you review the material. Beating yourself up will do no good. Try to open your mind as much as possible by putting other things aside and letting go of frustration.
- Focus on the areas that need the most attention**.** Many students feel that any time studying counts as real studying, but studying is less effective if you do not target the areas that need study. For example, if you know how to do all the math or science questions of one type, do not focus your attention on those questions. Instead work on the questions or concepts you find the most difficult. That way you are work on improving your knowledge instead of just reinforcing what you know.
- Good class notes are important as they make studying and review much easier. Don't expect to learn everything later on your own. Pay attention in class and make your own good notes wherever possible. If you've been absent, ask the teacher or a friend if there are notes you could photocopy. Taking good notes familiarizes you with the material; further review and study solidifies it up.
- Use your class materials when studying. Good notes can often help you work on the material you find most difficult. If your teacher has given you worksheets, data booklets, quizzes, etc. during class, use those to help you study. Effective studying uses all the resources you have, not just an open text book.

The Presenter

Tim Connell is a keynote speaker, cognitive coach, consultant and trainer. He presents at conferences, schools and to parent groups.

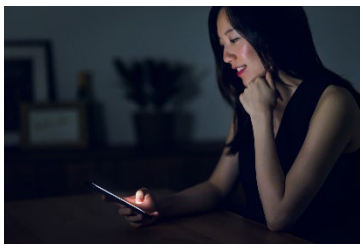
Tim has over 20 years' experience across all sectors in a variety of executive and consultancy roles including 10 years as a Specialist Behaviour Consultant with Department of Education (DET) and 7 Years as a Special Education Consult with (AISNSW). Tim is currently Head of Academic Support at Sydney Grammar School, College St.

Tim has worked with hundreds of students, parents and schools to support a range of issues including Effective Learning, Brain Science, Academic Potential, ADHD, Autism, Specific Learning Disorders, anxiety and depression, Tourette Disorder, classroom management and more.

Tim is the director of **Tim Connell Australia** – Special Education Consulting and **Potentia Mentis** – a coaching and training resource dedicated to optimising cognitive performance, motivation and self-efficacy.

Tim Connell Australia

Potentia Mentis



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