



# Executive function

A beginner's guide

## Why are executive functions important?

Your executive functions have a huge impact on your health, happiness and success throughout your life. By actively developing executive functions you increase the chances of having a successful career.

### The reason for all this

In 2011, the Australian Government commissioned a research report from Professor Martin Westwell and Associate Professor Debra Panizzon at Flinders University. This report reviewed the research that linked executive functions to career success, and made strong recommendations that Australian schools and other government institutions take a more strategic approach to developing the executive functions of students and other stakeholders.

*The Adventures of You* is our way to help parents, teachers and students engage in deliberately building these vital cognitive skills.

## What are executive functions?

Executive functions are a collection of top-down mental processes that allow you to control your attention, thoughts and actions. They help you do things like handle stress, get organised, confront challenges and solve problems.

There are three main types of executive function:

### **Impulse inhibition**

Impulse inhibition is your ability to stop yourself acting on automatic impulse, as well as your ability to focus or filter out distractions.

### **Working memory**

Working memory is your ability to mentally hold and manipulate several pieces of information at once, from simple facts to personal goals.

### **Mental flexibility**

Mental flexibility is your ability to think of new ideas, make new plans and find new ways to overcome challenges

People with good executive function tend to have more successful lives overall. They are happier, healthier, live longer, achieve more, earn more money, have happier marriages, friendships and family relationships – executive functions contribute to success in all aspects of life.

On the other hand, people with poor executive function tend to have less successful lives: lower academic and career achievement, lower income, poorer health, less stable and less successful relationships.

Executive function is not something you are born with. It develops over time. While there may be a genetic component to executive function, there is lots of evidence to suggest that it can be deliberately developed and used effectively. In particular, it appears that targeted development of executive functions produces greatest benefits for those people with the greatest deficits (that is, the lower your executive function, the more benefit you get from trying to develop it).

The resources that accompany *The Adventures of You* are designed to show you the best ways to deliberately cultivate executive function in you, your students or your children.

## Understanding the executive functions

### Impulse inhibition

Impulse inhibition is being able to control yourself, stop acting on impulse, and overcome strong internal drives or external temptations. Examples include:

- getting up in the morning instead of going back to sleep
- running another 50 metres instead of quitting
- giving yourself more time to think while you answer a question
- stopping yourself from eating another delicious, delicious cupcake.

More broadly, the inhibitory executive function also covers your ability to selectively filter and pay attention to things around you, for instance:

- directing your attention away from an overheard conversation to something you are working on
- ignoring the ads around an article and focusing on the article itself
- putting aside your own mental chatter to stay focused on an important train of thought.

Without impulse inhibition we act without thinking, trapped in our old habits and automated responses – both good and bad – unable to make choices or take actions that we might know are better. Without inhibitory control we start to feel powerless. Impulse inhibition acts like a circuit breaker, letting you interrupt a behaviour so you can try something else; it's the 'stop' in stop-and-think.

Note that impulse inhibition is not always good. Sometimes our impulses are completely correct and we would do well to act on them. Sometimes reaction speed is critical and stopping to think about something prevents us acting upon it. The Nobel Prize Winner, Daniel Kahneman, calls this 'Thinking fast'. But when we use our impulse inhibition, it is 'Thinking slow'.

### Executive functions are not 'levels'

*The Adventures of You* animations talk about executive functions building on each other like levels. This is an oversimplification. The reality is that while the executive functions do build upon each other (you need impulse inhibition to free up working memory, and you need working memory to allow for mental flexibility) they are highly inter-dependent and create feedback loops between themselves. Rather than improving like a set of static achievements, they grow like a giant pile of neurological spaghetti.

## Working memory

Working memory involves holding information in mind and mentally working with it. This is different to short-term memory, which is just used to store new information before it is either integrated into your long-term memory or forgotten. Working memory draws on information stored in the short-term and long-term memories in order to use the memorised information in some way. You always use working memory when:

- reading a book and making sense of whole sentences on the page
- driving a car
- riding a bike
- making your lunch
- having a conversation with a friend
- following the storyline in a movie.

Many of these tasks don't put a heavy demand on your working memory because they have been automated through extensive practice. However your working memory can become easily overloaded when you are doing something new, such as:

- learning to read, or reading something more complex than you are used to
- learning to drive a car – keeping in mind the road rules, the vehicles around you, the new controls, where you are going
- making a new type of lunch
- solving a particularly tricky problem
- trying to convince a friend to change their mind.

Working memory is one of the cognitive functions most strongly associated with general intelligence. The greater your working memory the more pieces of information you can manipulate at once, making your learning and mental work more effective. It's like making a meal and having all the ingredients close to hand, instead of having to keep going back and forth to the cupboard and fridge to get things that you've forgotten.

In *The Adventures of You* animations another aspect of working memory is highlighted – the ability to keep in mind higher-level goals and intentions while working in a complex environment. This is also the ability to act with strategic intent or to keep in mind why you are doing something.

## Mental flexibility

Mental flexibility is the ability to think of new ideas, approaches and perspectives. It allows you to see new paths, opportunities and solutions to problems. It lets you see things from someone else's point of view, maybe contrary to your own. It is the flexibility to change your behaviour when circumstances change, opportunities present themselves, or you simply realise you've been doing something wrong.

Mental flexibility is a kind of super-function that sits well above impulse inhibition and working memory. It usually develops much later than these other two functions and is associated with creativity, inventiveness and innovation.

## Deliberately building executive function

Executive functions develop naturally throughout childhood and adolescence. However due to a combination of genetics and environment they develop more effectively in some people than in others.

The good news is – you can work to improve executive function.

### How do you do it?

Executive functions are complex and interrelated, and it is not a trivial task to actively develop them or your ability to use them effectively.

The things that have been proven to be helpful, if approached the right way over an extended period of time, are:

- exercise, especially aerobic exercise that involves complex motor skills and mindfulness
- games and play, particularly play that encourages mental manipulation or perspective shifting
- self-management strategies, such as organisers, reminders and rules.

*The Adventures of You* includes downloadable resources to help guide you in each of these areas.

### Who can do it?

Anyone can benefit from a deliberate approach to developing executive function. It doesn't matter how young or old you are, or how deficient your skills might be – in fact deliberate practice has been shown to be of even greater benefit to people with poor executive function.

### What changes will I notice?

Executive functions are quite subtle and the effects of developing them are cumulative. You would expect to see improvements over time in mood, focus, engagement, achievement and dealing with relationships. At school, students might be less overwhelmed by complex tasks and see their grades improve.

There are a number of tests that can be used to assess aspects of executive function and measure improvements over time. One of the downloadable resources explains some of the most effective of these tests so that you can conduct your own assessments.

## How long will it take?

You can't rush this kind of thing. You should be expecting to see improvements over a 6–12 month period.

### There is no 'level zero'

Another oversimplification in *The Adventures of You* animations is the idea of 'level zero', a state in which you have no executive functions at all. Nobody has zero executive function. However, people's executive functions can be developed and used to a greater or lesser degree and a person with low executive function can seem like they have no impulse control relative to a person with strong executive function.

## How to use *The Adventures of You*

*The Adventures of You* resource has two components:

- animations designed to introduce important concepts to the widest possible audience, from ages 8 to 18+
- downloadable resources designed to help you develop executive functions in yourself or in others.

Hopefully *The Adventures of You* animations will be fun, but the real benefit will come from putting the advice in the downloadable resources into practice.

These resources include support guides and worksheets. The support guides include notes for individuals, teachers and parents, and the worksheets are targeted to a variety of age groups from 8 years.

The best way to start is with the 'Exercise' guide, since exercise is the single most effective way to develop general executive function. To develop executive function you need to continually challenge yourself. This can be done by continually taking on harder and more complex tasks, and by staying engaged in dynamic social relationships.

Why not involve friends and family in the quest for awesome. Share the videos. Start working on challenges together, so that your relationships help you all to build and maintain enthusiasm over time.

### Based on current research

All *The Adventures of You* content is built on the best available neuroscience evidence into executive function. Be aware that this is an area that has really only developed in the last decade so there is still a lot of ongoing research about exactly how executive functions work, how they should be categorised and related to each other, and how they can be deliberately developed.

As an emerging field of study, best practice may change over time.

## For teachers

### Using the animations to engage your students

If the development of executive functions in school is treated similar to a public health issue, the animations that start *The Adventures of You* can be used to get students' attention, provide a shared frame of reference, and convince the students that executive function is something worth taking seriously and worth putting effort into. However there is no shortcut to developing executive function. Students need to be engaged and challenged in the right ways, on a daily basis, over an extended period of time.

Each animation contains important ideas that are worth exploring in depth. Consider having a class discussion after each animation based on the discussion questions and follow-up activities in 'Executive function animations' PDF.

### Using the downloadable resources

As part of *The Adventures of You* there are a number of guides to help you develop executive functions in your students. Some of the advice in the guides might be disruptive to your current classroom practice, but you will find that many suggestions are really just twists and variations on things you currently do.

As well as providing activities, the guides explain the principles behind executive function development and show how these can be used to create beneficial activities. Please use these principles to invent your own activities and interventions. Perhaps you could share any resources or activities you develop for yourself with the educational community on myfuture.

## For parents and carers

Raising children is really hard work, and most of us who are parents will feel disappointed at times with our ability to provide our children with the support, attention or help we think they might need.

However, you can easily provide support by valuing executive functions yourselves and letting children see them in action. For example, you can model executive function use by pointing out the planning processes you use to meet work and life demands. This provides a meaningful way for children and teenagers to see executive function in action and begin to value them themselves.

Beyond this, *The Adventures of You* will help you by highlighting the kinds of activities that can be deeply beneficial to a child's development. Some of these activities require expense but many are simple and free – they just need attention and interest.

Explore the resources, put some of the ideas into practice and share your stories with the myfuture community. You can choose the myfuture 'Contact us' service or the myfuture social media accounts on Facebook, Twitter and Google+.

## Resources

### Related [support guides](#) on the myfuture website

- Attention: the art of noticing
- Exercise: move that body to build the brain
- Serious play: games and play to develop executive functions
- Support strategies: goal setting and planning to support executive function
- Teaching tips: advice for the classroom
- Testing executive function: a quick guide to free, online tools
- Executive function animations: exploring the key ideas

### Websites

Center on the Developing Child 2011, 'Building the brain's "Air Traffic Control" system: how early experiences shape the development of Executive Function: working paper No 11', Harvard University, <http://www.developingchild.harvard.edu/>

### Books

Many books about executive function tend to focus too heavily on self-organisation and regulation – essentially the impulse inhibition aspects of executive functions. It's worth remembering that working memory and mental flexibility need to be developed, and that these are not developed through management strategies alone. Rich, complex, stimulating experiences that continually challenge are also needed.

Branstetter, R 2013, The everything parent's guide to children with executive functioning disorder: strategies to help your child achieve the time management skills, focus, and organization needed to succeed in school and life, Adams Media, Avon, Mass

Cooper-Kahn, J and Dietzel, LC 2008, Late, lost and unprepared: a parents' guide to helping children with executive functioning, Woodbine House, Bethesda, MD

Hoerr, TR 2013, Fostering grit: How do I prepare my students for the real world?, ASCD, Alexandria, VA

Tulley, G and Spiegler, J 2011, 50 dangerous things (you should let your children do), New American Library, New York

You can find a good further reading list at Cognitive connections therapy,

[http://cognitiveconnectionstherapy.com/Portals/0/Recommended\\_Reading.pdf](http://cognitiveconnectionstherapy.com/Portals/0/Recommended_Reading.pdf)



## Sources of information

Diamond, A 2013, 'Executive functions', *Annual review of psychology*, 64, 135–168.

Moffitt, TE, Arseneault, L, Belsky, D, Dickson, N, Hancox, RJ, Harrington, H & Caspi, A 2011, 'A gradient of childhood self-control predicts health, wealth, and public safety', *Proceedings of the National Academy of Sciences*, 108(7), 2693–2698.

Diamond, A & Lee, K 2011, 'Interventions shown to aid executive function development in children 4 to 12 years old', *Science*, 333(6045), 959–964.

Department for Education and Child Development, 2013, *Leading learning*, Government of South Australia, <http://www.acleadersresource.sa.edu.au>