COURSE GUIDE

minds wide open

Design Thinking

Project Based Learning

DESIGN THINKING
ACROSS THE CURRICULUM

DEEPER LEARNING THROUGH REAL-WORLD PROJECTS

NSW EDUCATION STANDARDS AUTHORITY

Completing the Minds Wide Open 'Design Thinking Across the Curriculum: Deeper Learning through Real-World Projects' course will contribute **5 hours of NESA Registered PD** addressing 2.2.2, 2.3.2, 3.2.2, 3.3.2, and 6.2.2 from the Australian Professional Standards for Teachers towards maintaining Proficient Teacher accreditation.

PROFESSIONAL LEARNING OBJECTIVES

In this course you will learn ways to:

- Respond to interests of students.
- Promote student-centred learning and problem solving.
- Encourage critical and creative thinking by engaging students in higher order thinking and risk taking within their learning.
- Use teaching strategies that challenge students to select appropriate thinking strategies for their learning.
- Promote critical and creative thinking through inquiry learning, problem based learning and relevant projects. **(3.3.2 ☑)**
- Use knowledge of curriculum, assessment and reporting requirements to inform PBL/Design Thinking teaching and learning programs. **(2.3.2 ☑)**
- Design programs which display logical sequencing of activities. **(2.2.2 ☑)**
- Ensure lesson plans incorporate practical activities and skills practice, not just content. **(3.2.2 ☑)**

RATIONALE FOR THIS COURSE

1. For teachers to build their capacity to teach Design Thinking and complex problem solving skills to their students

The teaching of design thinking skills and processes to K-8 students is compulsory in NSW from 2019.

2. For students' to experience deeper engagement at school

Students engage more with their learning when they are given a problem that is relevant to their lives and they feel a sense of purpose, ownership and empowerment in solving it.

3. To improve students' employability beyond school

Almost every job in the future will require the worker to have the capability to identify and solve complex unstructured problems.

FUTURE EMPLOYABILITY

The Fourth Industrial Revolution will transform the way we live and work. The future workforce will need to align its skillset to keep pace.

(Source: *The Future of Jobs*, WEF, 2016)

The *Top 10 Skills* needed in the workplace beyond 2020, as requested by employers:

1. Complex Problem Solving
2. Critical Thinking
3. Creativity
4. People Management
5. Collaborating
6. Emotional Intelligence
7. Judgement and Decision Making
8. Service Orientation
9. Negotiation
10. Cognitive Flexibility

PISA tests reveal that even in the best-performing countries, significant numbers of 15-year-olds do not have the basic problem-solving skills considered necessary to succeed in today's – let alone tomorrow's – world.

(Source: *PISA in Focus*, N38, 2014)

OTHER KEY FINDINGS FROM ANALYSING THE PISA DATA:

Australian students are comparatively stronger on the exploring and understanding and the representing and formulating processes, and are relatively ***weaker on the planning and executing process.***

('Thinking it through: Australian students' skills in creative problem solving', ACER, 2014)

This is an area where Australian students' skills could be improved; ***they need to be able to use their knowledge to devise a plan and execute the plan in order to solve a problem****.*

(Source: rd.acer.edu.au/article/australian-problem-solving-skills-in-context)

"COMPLEX PROBLEMS"?

"STRUCTURED" vs "UNSTRUCTURED" PROBLEMS EXPLAINED

Some problems are relatively straightforward or ***structured.***

A structured problem has but one solution and only a limited number of (pre-defined) paths to reach that solution.

For example, a Rubik's cube.

Many problems are quite complex or ***unstructured***.

An unstructured problem does not have one unique correct solution and there are potentially numerous (as-yet-undiscovered) paths to solving it.

For example, attaining World Peace.

In the future all structured problems will be solved by Artificial Intelligence. Unstructured (complex) problems will be solved by humans (with the assistance of AI).

(James Phelps)

FUTURE PROSPERITY?

1. Switzerland (number 1 in 2017)	11. Israel (17)
2. Netherlands (3)	12. Korea, Republic of (11)
3. Sweden (2)	13. Japan (14)
4. United Kingdom (5)	14. Hong Kong (China) (16)
5. Singapore (7)	15. Luxembourg (12)
6. United States of America (4)	16. France (15)
7. Finland (8)	17. China (22)
8. Denmark (6)	18. Canada (18)
9. Germany (9)	19. Norway (19)
10. Ireland (10)	20. Australia (23)

https://www.globalinnovationindex.org/Home

Australia slipping places is less a sign of a lack of progress as it is the surge in education, research and development and patent creation in other countries. These are factors we should look to address to maintain our competitiveness on the global stage. (Alex Gruszka, StartupAUS, 2017)

TEACHERS' FAQs

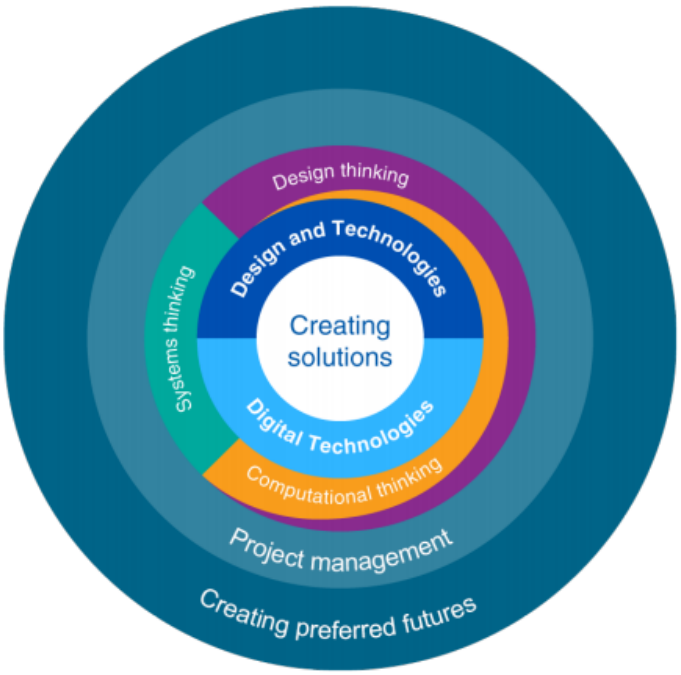
- What is "Design Thinking"?
- What is "Project Based Learning"?
- Are they the same thing or are they different?
- Are 'PBL' and 'Design Thinking' in the curriculum?
- If so, what do I teach?
- How much classroom time should I allocate to projects and Design Thinking?
- How do I identify a problem for my students to solve?
- How do I write a 'driving question'?
- What resources are available for planning and teaching?
- How do I keep all my students on track, on task and accountable?
- How do I make their thinking and learning more visible?

DESIGN THINKNG IN THE CURRICULUM

Technologies curriculum

Curriculum has been developed:

- from Foundation to Year 8 in two subjects: design and technologies, and digital technologies
- from Years 9 to 10 in two optional subjects: design and technologies, and digital technologies



*"**Design Thinking** underpins learning in design and technologies and is used in digital technologies."*

(Julie King, Technologies Lead, ACARA)

DEFINITION OF "TECHNOLOGIES"

Technologies are materials, data, systems, components, tools and equipment used to create solutions for identified needs and opportunities.

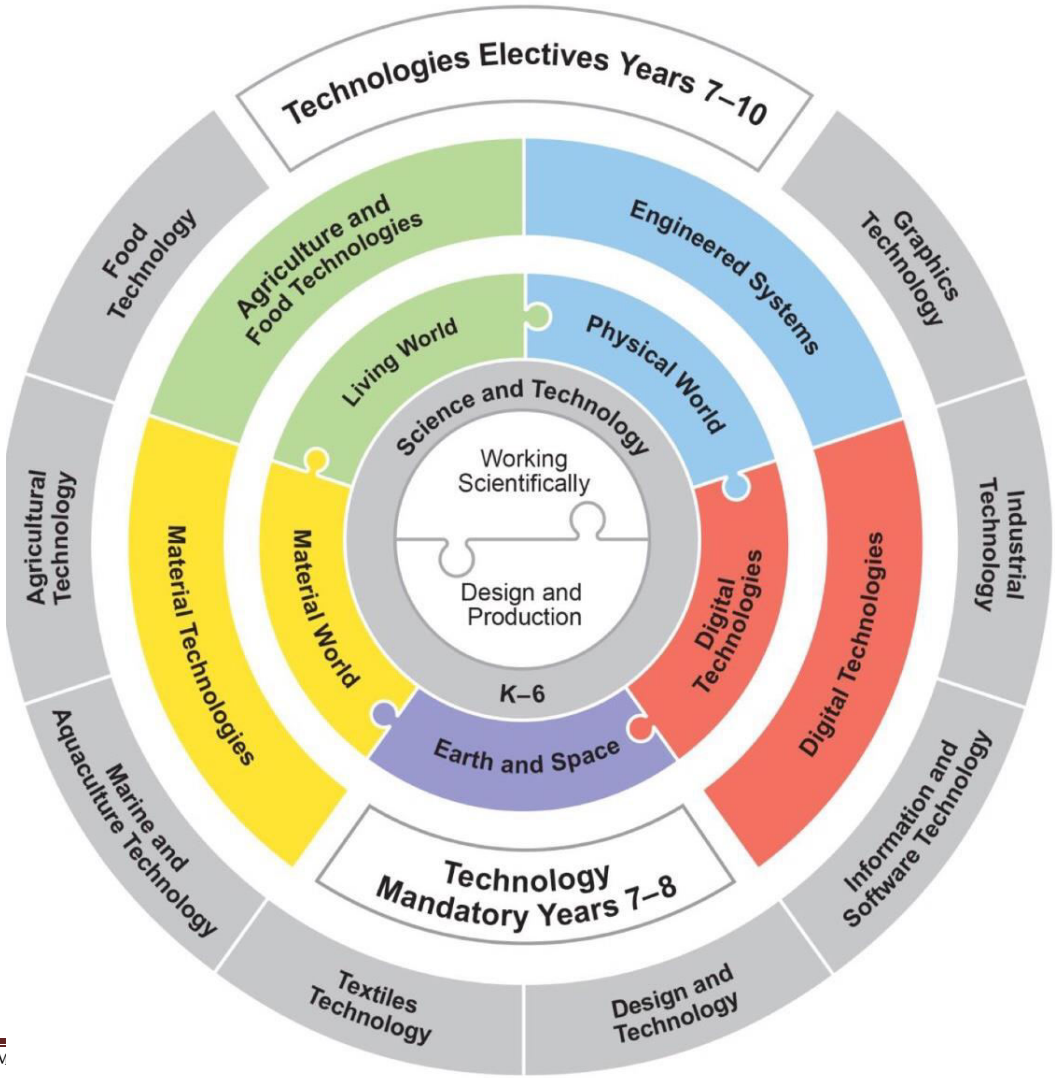
(Science & Technology K-6, NESA, May 2017)

'Technologies' are things created by humans that can solve problems or make our lives easier.

(Tony Montez, Year 1 teacher)

If we interpret the Australian Curriculum Technologies syllabus appropriately it is ***not about turning every child into a programmer*** *or software engineer. It is about* ***developing computational, design, and systems thinking*** *as means toward* ***creating preferred futures****.*

(Peter R. Albion, Digital Learning and Teaching Victoria, 2017)



Design and Production

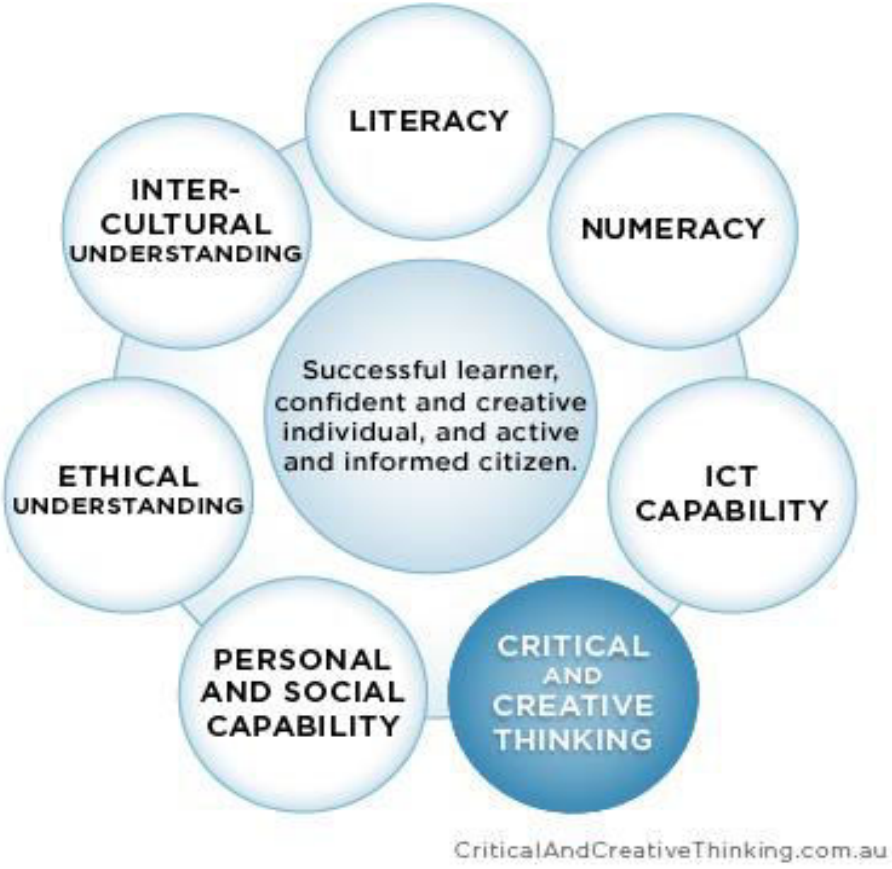
Design and Production skills are based on the major aspects of design thinking, design processes and production processes. The practical nature of Design and Production engages students in critical and creative thinking, including understanding interrelationships between systems when solving complex problems. A systematic approach to experimentation, problem-solving, prototyping and evaluation teaches students the value of planning and reviewing processes to realise ideas.

Students develop skills to manage projects to completion through planning, organising and monitoring activities and the use of resources. Students are taught to plan for sustainable use of resources when designing.

Design and Production provides students with opportunities to consider how solutions that are created now will be used to create preferred futures. Students identify the possible benefits and risks of creating solutions.

NESA, 2018

THE 8TH CAPABILITY?



DESIGN THINKING

WHAT IS "P.B.L."?

✓ **PROJECT-BASED LEARNING**

✓ **PROBLEM-BASED LEARNING**

Project Based Learning *is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem or challenge.*

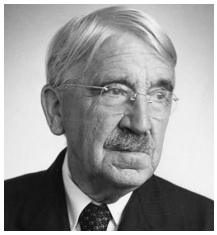
Buck Institute for Education, 2016

Problem Based Learning *is an educational approach that organises curriculum and instruction around carefully crafted problems.*

The Centre for Problem-Based Learning, Illinois Mathematics and Science Academy, 2008

ORIGINS OF PBL

Project-Based Learning originated from within the education sector with a goal to engage students more and promote deeper learning. (James Phelps)



John Dewey, *Experience of Education*, 1938

Give the pupils something to do*, not something to learn; and* ***the doing is of such nature as to demand thinking****; and learning naturally results.*

In 1969, the medical school at ***McMaster University*** *introduced a unique,* ***hands-on approach*** *to learning medicine called* ***Problem-Based Learning.*** (http://mdprogram.mcmaster.ca/)

Video: 'Project Based Learning Explained' (Buck Institute)

https://www.youtube.com/watch?v=LMCZvGesRz8

WHAT DOES THE RESEARCH SAY?

☹ **TOO TIME CONSUMING** - Researchers have reported that teachers experience frustration with the amount of time it takes to plan for and implement problem-based learning (Simons et al., 2004).

☹ **TOO DIFFICULT** - The demands of PBL management and instruction are difficult to master, and beginner PBL teachers frequently experience difficulties (Mergendoller & Thomas, 2005).

☹ **STUDENTS NOT READY** - Some students find it difficult to cope when asked to transform into active critical and creative thinkers and collaborators (Ngeow, Karen & Kong, Yoon-San, 2002).

☹ **LACK OF RESULTS** – Some studies have shown that there is no indication PBL improves students' engagement or learning (Johnson & Delawsky, 2013; Hattie, 2008).

WHAT DO THE STUDENTS SAY? ☹

Read-Think-Pair-Share
Read the following viewpoints from students
then discuss the problems with problem-based learning from a teaching perspective.

- *We do a lot of this in Year 10, but it takes up a lot of class time.*
- *I've had this kind of way of learning from 5th grade and it ONLY works if everyone wants to learn. PBL makes it possible to do nothing at all.*
- *This works well if all the students are equally motivated. Sadly, most of the time they aren't.*
- *The really big problem with PBL is; not everyone is able to work in groups, either because they just don't like working with others, or because of social problems.*
- *This system looks good on paper, but it doesn't exactly work out as perfect as they say it does.*

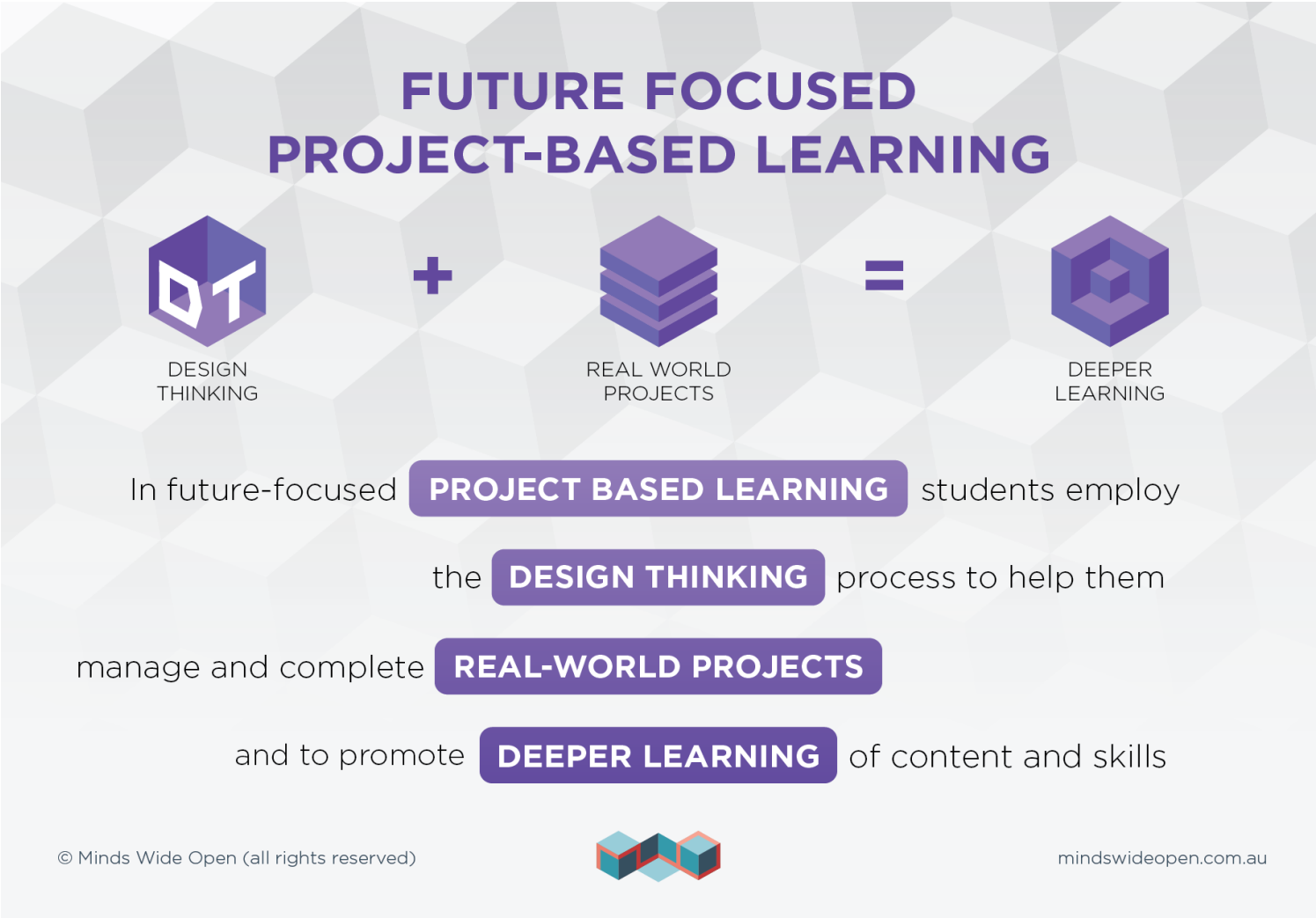
- *Here are some of the issues with group projects; 1) It's in a teen's nature to procrastinate. Everyone will procrastinate and not do the amount of research and collaboration the teacher wants. And 2) No matter how great an idea is, the majority vote comes into play.*

- *This doesn't work. It's a good theory, but most of the students I know don't split the work equally and it ends up being pushed onto one person, even if they report it to the teacher as "everyone did their fair share."*

- *I graduated from a high school that did PBL. The basics are ignored. When I went to college I had to RELEARN EVERYTHING! I was not prepared for a taste of the real world. A lot of this was due to PBL training students to do a great diorama, but not knowing how to properly read and write.*

- *As a kid who is actually in high school with teachers who do this stuff, I'd actually rather have the memorization stuff.*

Source - https://www.youtube.com/watch?v=LMCZvGesRz8



FUTURE FOCUSED

PROJECT BASED LEARNING

Future-focused learning prepares students across all curriculum areas and learning stages with skills and capabilities to thrive in a rapidly changing and interconnected world… Project-based learning (PBL) is an approach to teaching and learning that engages students in rich and authentic learning experiences.

(Futures Learning Unit, NSW DoE)

"Project-based learning allows students to take greater responsibility for their learning and allows them to make decisions based on findings from research, experimentation and testing of design ideas."

(The Australian Curriculum, *Design and Technologies,* 2015)

DESIGN THINKING

Design Thinking can be regarded as a problem solving method; <u>a process for the resolution of problems.</u>

(*Design Thinking*, Plattner, Meinel, & Weinberg, 2009)

Design thinking is the <u>thought process</u> involved in understanding and developing solutions to design needs and opportunities.

(NSW Science & Technology K-6 Syllabus, 2017)

Design Thinking is a <u>structured framework</u> for identifying challenges, gathering information, generating potential solutions, refining ideas, and testing solutions.

(Harvard Graduate School of Education, 2016)

Video: 'Design Thinking Explained'

(Co Barry, Middle School teacher)

ORIGINS OF DESIGN THINKING

Design Thinking emerged in the early 1970s from the writings of Herbet Simon and Victor Papanek and the concept has continued to evolve through widespread application within creative industries. Now identified as a key skill for all 21st century citizens, Design Thinking has found its way into the school curriculum.

(James Phelps)

Herbet Simon, *The Science of the Artificial*, 1969

The designer is concerned with how things ought to be — how they ought to be in order to attain goals and function.

Designers devise courses of action aimed at changing existing situations into preferred ones.

Victor Papanek, *Design for the Real World,* 1971

Design, if it is to be ecologically responsible and socially responsive, must be revolutionary and radical.

DEEPER LEARNING

*Any **learning solution** that could achieve deep learning would have to do four things:*

1. *it would need to be **irresistibly engaging** for both students and teachers,*
2. *it would have to be elegantly efficient and **easy to access and use,***
3. *technology would be **ubiquitous** 24/7 and*
4. *it would be steeped in **real-life problem solving**.*

Deep learning is learning that

1. *connects to **passion**,*
2. *is **team-related***
3. *has human **significance***
4. *involves **higher order cognitive processes***
5. *sticks*

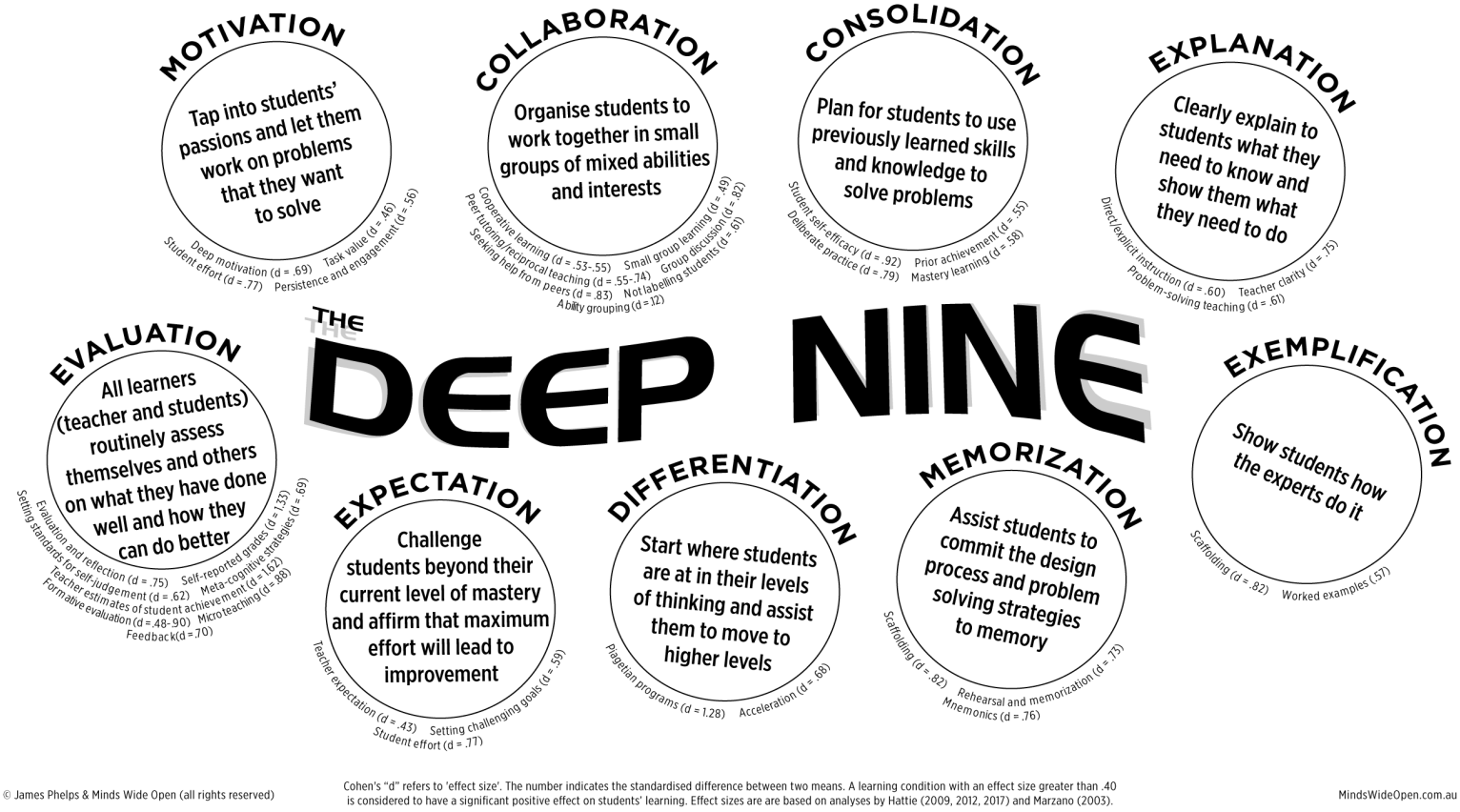
(Michael Fullan, *New Pedagogies for Deep Learning,* 2013)

Video: 'New Pedagogies for Deep Learning'

Future-Focused Project Based Learning

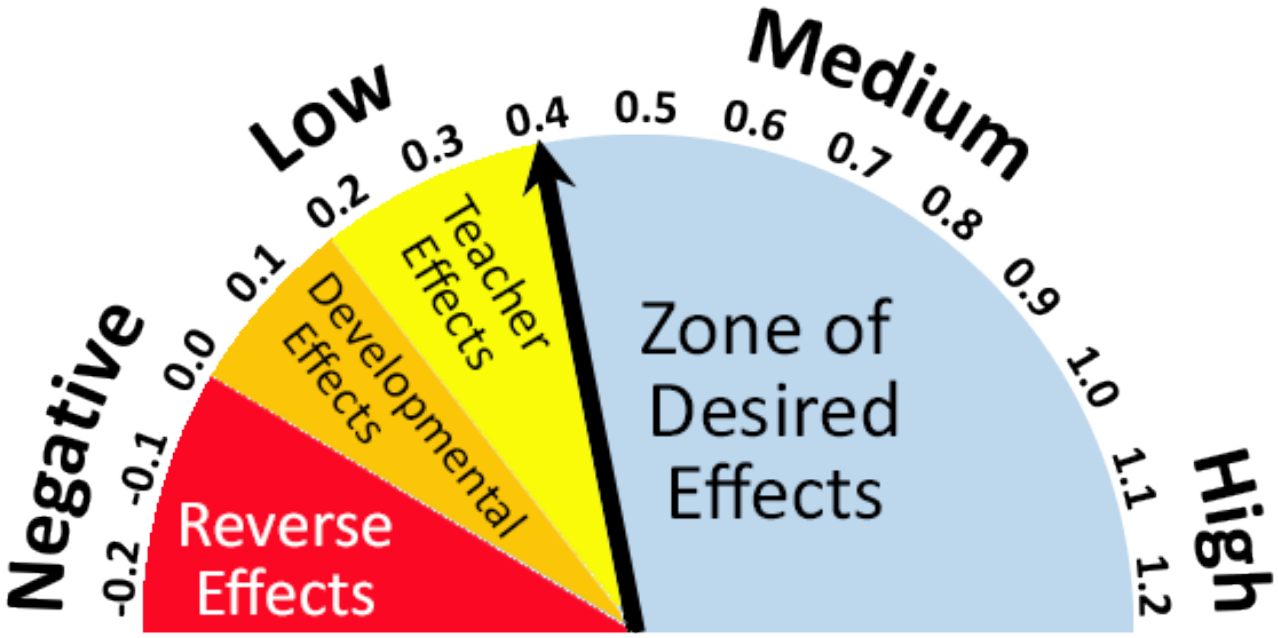
Deep Learning Pedagogy

Nine optimal conditions for mastering curriculum content and Design Thinking skills

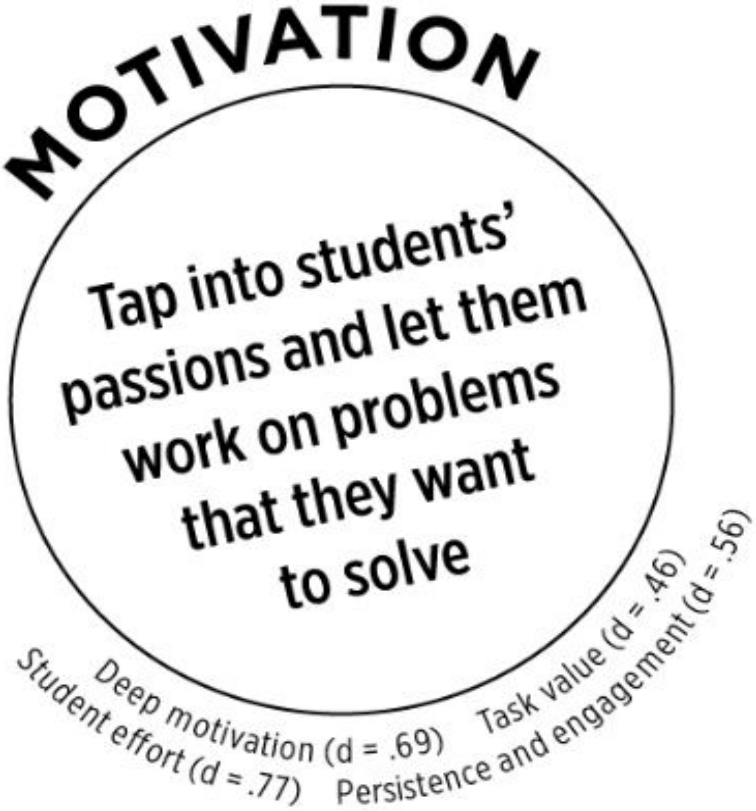


Cohen's "d" refers to 'effect size'. The number indicates the standardised difference between two means. A learning condition with an effect size greater than .40 is considered to have a significant positive effect on students' learning. Effect sizes are are based on analyses by Hattie (2009, 2012, 2017) and Marzano (2003).

MindsWideOpen.com.au

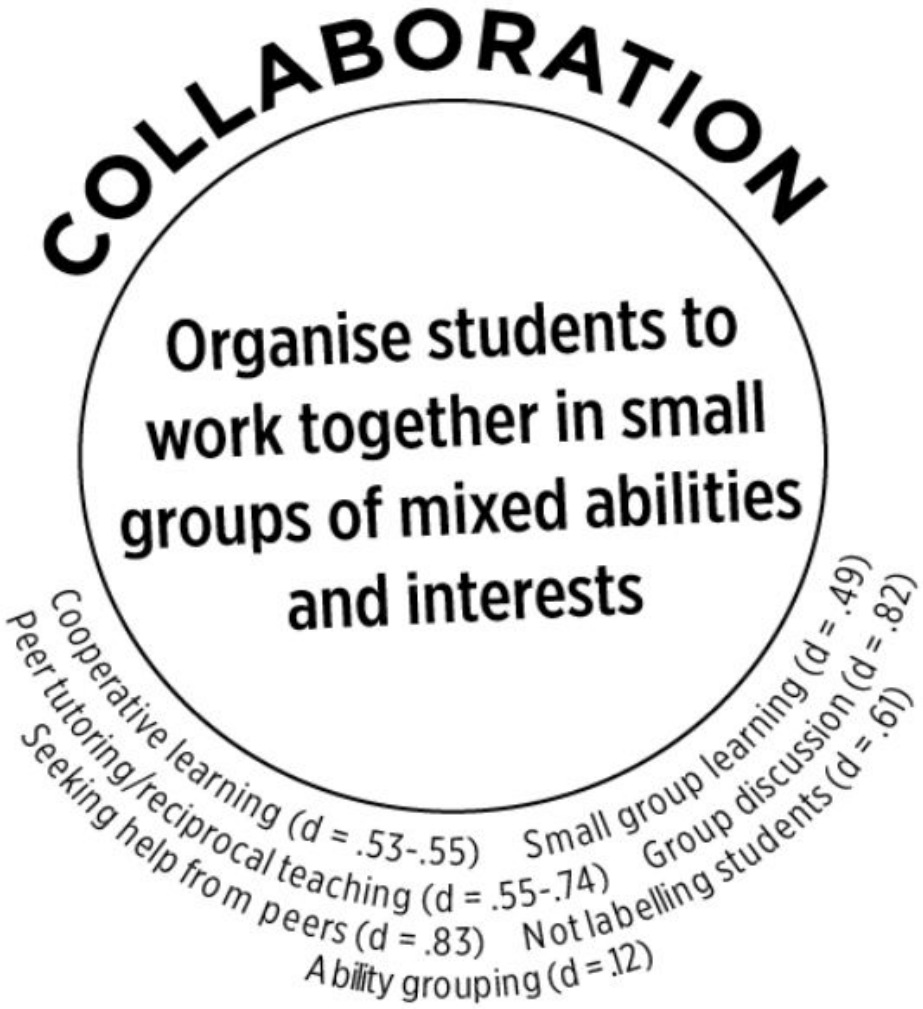


Source: Visible Learning, Corwin Australia, 2014



The greater the student's involvement in an issue, the greater their investment in its solution and the harder they will work.
(Robert Delisle, *How to Use Problem-based Learning in the Classroom,* 1997)

You learn the most from things that you enjoy doing. (Albert Einstein)



*Collaboration helps students **achieve better results** compared to when they work individually* (*d* = 0.59-0.78).

(Killian, 2015 citing Marzano, 2003 and Hattie, 2008)

*Empirically, collaborative problem solving has been shown in educational research to **enhance students' cognitive development**.*

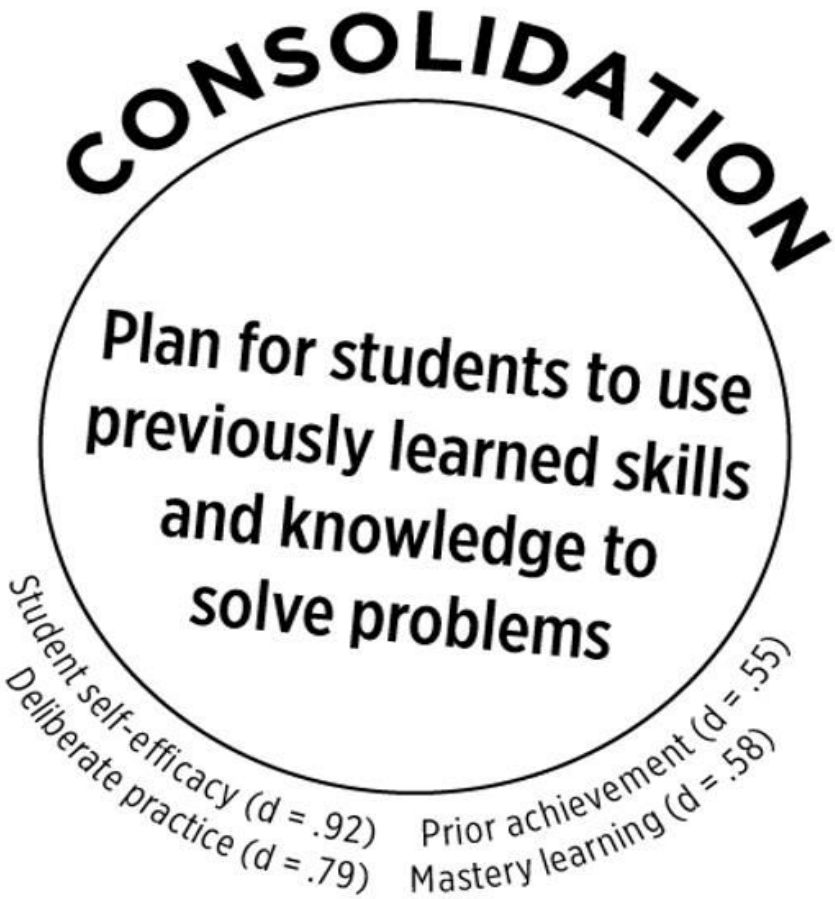
(Eva Baker & Jan Dickieson, 2011, citing Webb, 1998 and Zhang, 1998)

*The implementation of project-based learning with **group work in mixed ability** classes can contribute to: the development of self-efficacy in learning, the improvement of learning outcomes, pupils' participation in activities and their appreciation of on-task and co-operative behaviours.*

(Kaldi, S., Filippatou, D., and Govaris, C. 2011)

*Marzano and Hattie agree that cooperative learning is only effective when you have **small groups**.*

(Killan, 2015)



Education is that which remains if one has forgotten everything learned in school.

(Albert Einstein)

"By applying their [current] knowledge and practical skills and processes to create innovative solutions students develop [new] knowledge, understanding and skills."

(The Australian Curriculum, *Design and Technologies,* 2015)

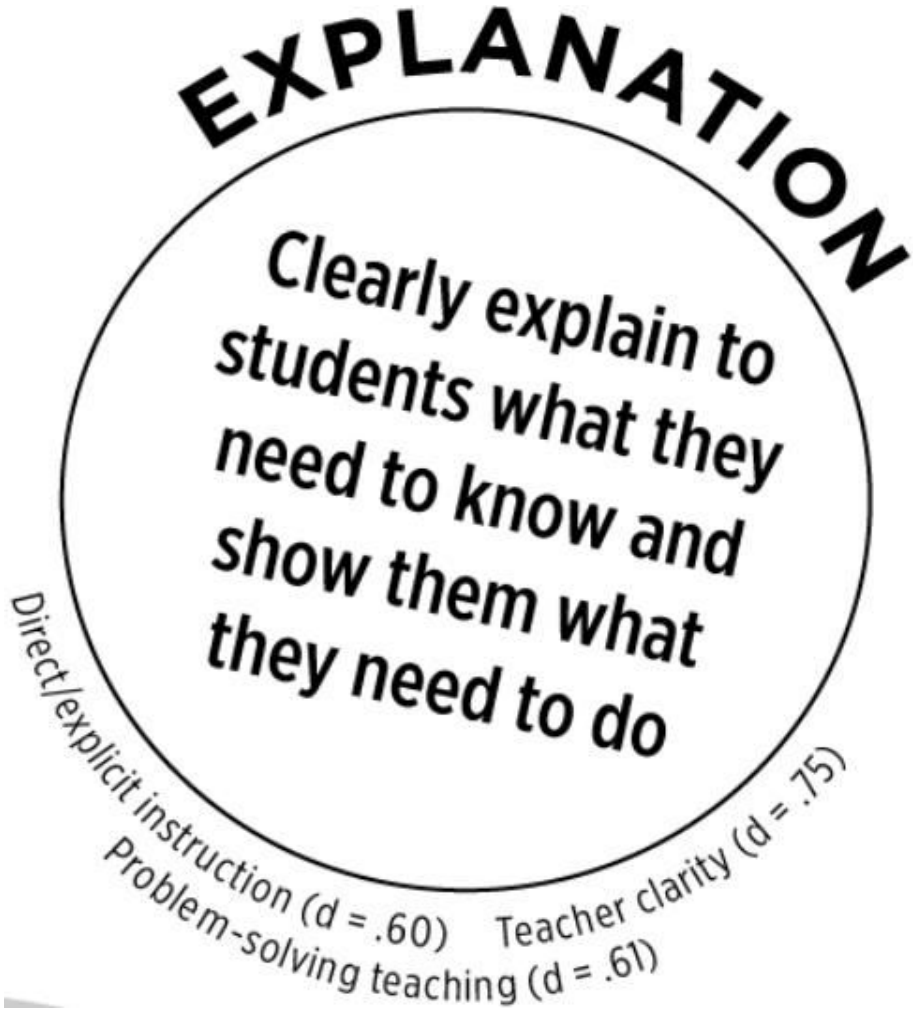
*Problem-solving has a **large effect** on students' understanding (d = 0.54-0:61) when the problem requires students to **apply previously learned knowledge and skills**.*

(Killian, 2015 on Marzano, 2003 & Hattie, 2008;)

Students use what they have learned → To solve real problems and dilemmas

Robert Marzano's synthesis of research revealed that problem-solving had a large effect (d = 0.54) on students' understanding. Marzano believes that problems should require students to apply previously learned knowledge and skills. Hattie found a similar effect size (d = 0.61). (Killian, 2015)

** However, when a problem is used to stimulate discovery learning, the opposite is true (d = 0.15).* (Killian, 2015)

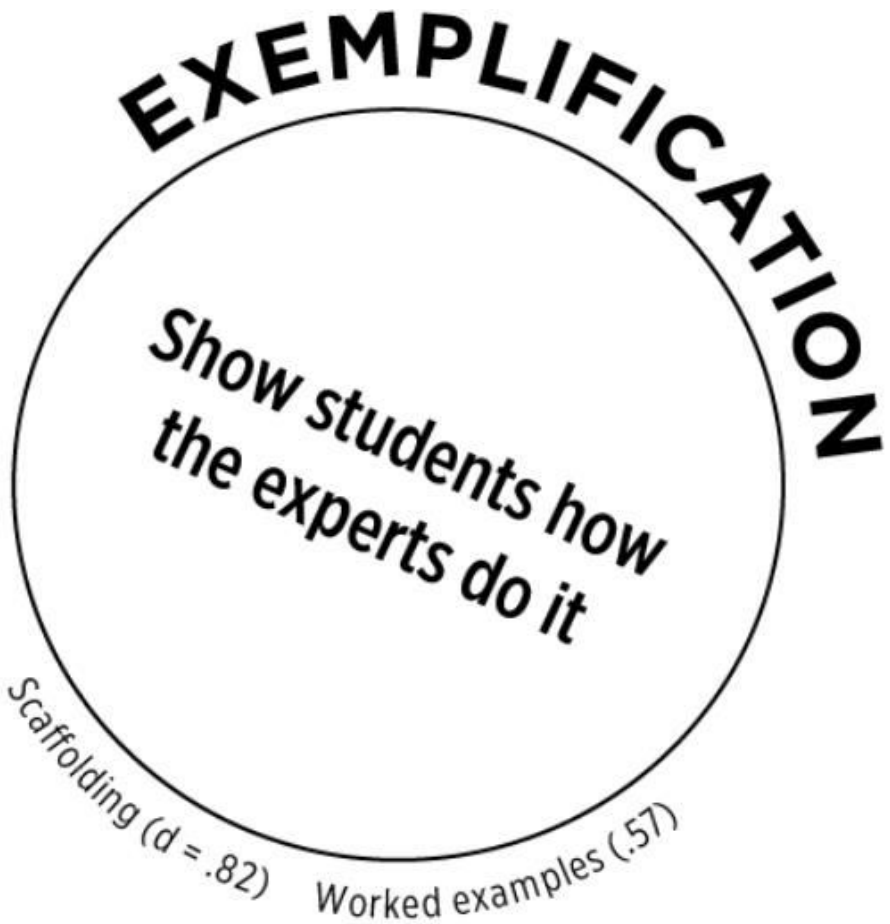


✓ The teaching approach with the strongest empirical support is *explicit instruction*. Without explicit instruction in problem-solving strategies students will experience little improvement.

(Abrami et al, 2008; Dewar, 2009)

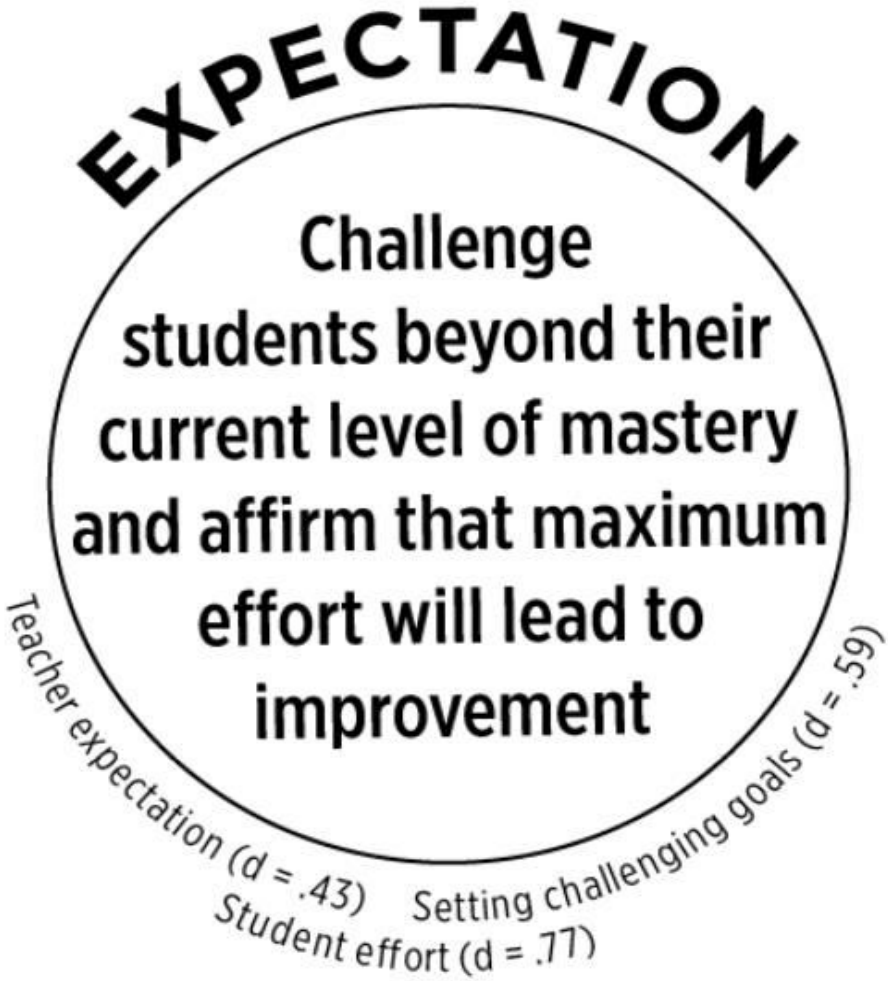
*Hattie emphasized the importance of teaching students **how** to solve problems, e.g. understand the problem → come up with a plan of action → implement the plan → review the results.*

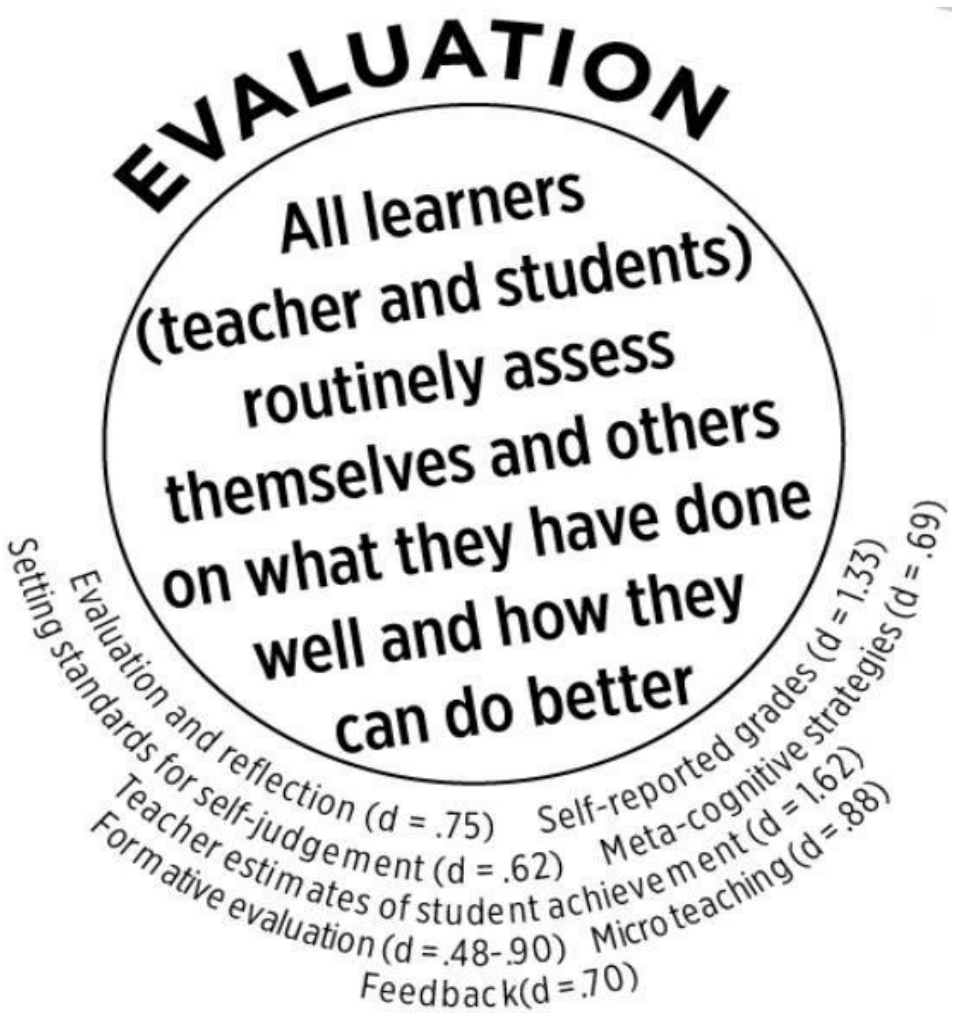
(Killian, 2015)

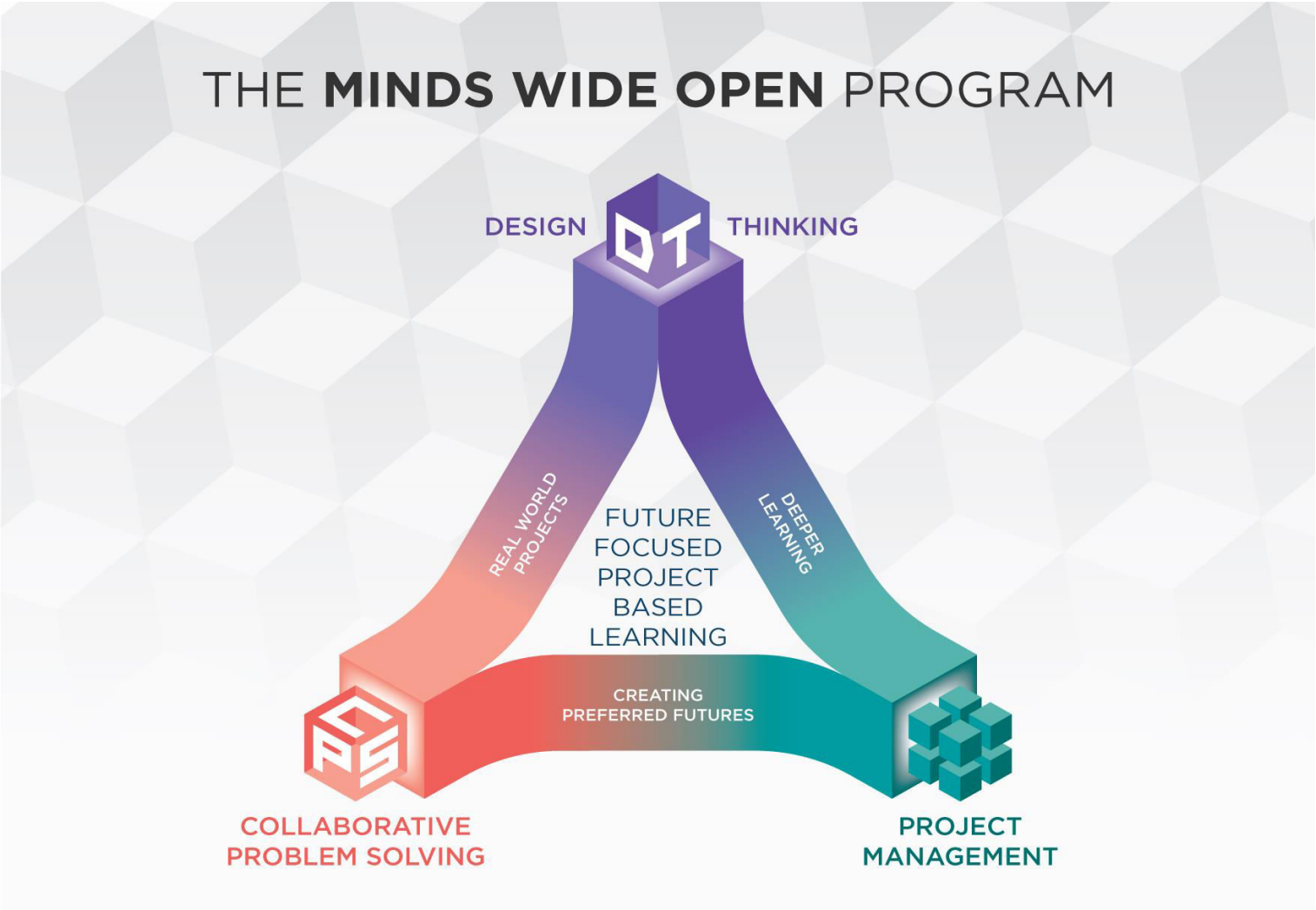


***An exemplar is *a person or thing serving as a good example or appropriate model or pattern to be copied or imitated*.**

*A scaffold is a **tool** for enculturating students into the **thinking patterns of experts**.*
(K. Hogan, *Scaffolding Student Learning,* 1997)


EXPECTATION
Challenge students beyond their current level of mastery and affirm that maximum effort will lead to improvement
Teacher expectation (d = .43)
Setting challenging goals (d = .59)
Student effort (d = .77)


EVALUATION
All learners (teacher and students) routinely assess themselves and others on what they have done well and how they can do better
Evaluation and reflection (d = .75)
Setting standards for self-judgement (d = .62)
Teacher estimates of student achievement (d = 1.62)
Formative evaluation (d = .48-.90)
Feedback(d = .70)
Self-reported grades (d = 1.33)
Meta-cognitive strategies (d = .69)
Micro teaching (d = .88)



SCOPE AND SEQUENCE

The scope and sequence describes what the <u>teacher will teach</u> and what the <u>students will do</u>… and <u>when</u>.

- *A scope and sequence identifies what learning content is to be taught and at which stage it will be taught.*
- *It assists teachers in their selection of topics, projects and learning activities when planning units of work.*

Q. *WHAT DO I USE THE SCOPE AND SEQUENCE DOCUMENT FOR?*

✓ Selecting stage appropriate topics and learning content.

❖ *Think-Pair-Share – Read the content from the FACT-FINDING strand relevant to your stage and identify existing units you already teach that include similar content.*

	ES1	S1	S2	S3
Design and Production	**STe-2DP-T** develops solutions to an identified need	**ST1-2DP-T** uses materials, tools and equipment to develop solutions for a need or opportunity	**ST2-2DP-T** selects and uses materials, tools and equipment to develop solutions for a need or opportunity	**ST3-2DP-T** plans and uses materials, tools and equipment to develop solutions for a need or opportunity
		ST1-3DP-T describes, follows and represents algorithms to solve problems	**ST2-3DP-T** defines problems, describes and follows algorithms to develop solutions	**ST3-3DP-T** defines problems, and designs, modifies and follows algorithms to develop solutions

Stage 4

TE4-1DP designs, communicates and evaluates innovative ideas and creative solutions to authentic problems or opportunities
TE4-2DP plans and manages the production of designed solutions
TE4-3DP selects and safely applies a broad range of tools, materials and processes in the production of quality projects
TE4-4DP designs algorithms for digital solutions and implements them in a general-purpose programming language

(NSW S&T S&S 2018)

continuum

The learning continuum assists teachers to identify <u>where</u> a student is <u>currently</u> at and <u>what</u> they need to learn <u>next</u>.

- *A learning continuum indicates the standards an average student would be expected to achieve at a given stage of learning.*
- *Teachers can use it to differentiate for learning, set learning goals, and assess and report on student achievement.*

Q. *WHAT DO I USE THE LEARNING CONTINUUM FOR?*

✓ Differentiating for learning, setting learning goals, assessing student progress, and for report comments.

❖ *Think-Pair-Share – Think of a student you know well and identify where they're at on the continuum.*

DESIGN THINKING IN THE NEW NSW SCIENCE & TECHNOLOGY SYLLABUS

CONTINUUM OF LEARNING - TECHNOLOGY K–8 (MANDATORY)

EARLY STAGE 1	STAGE 1	STAGE 2	STAGE 3	STAGE 4
uses a simple design process to produce solutions with identified purposes (STe-5WT)	uses a structured design process, everyday tools, materials, equipment and techniques to produce solutions that respond to identified needs and wants (ST1-5WT)	applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteria (ST2-5WT)	plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints (ST3-5WT)	applies design processes that respond to needs and opportunities in each design project (4.1.1) generates and communicates creative design ideas and solutions (4.2.1) selects, analyses, presents and applies research and experimentation from a variety of sources (4.2.2) applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects (4.3.1) demonstrates responsible and safe use of a range of tools, materials and techniques in each design project (4.3.2) applies management processes to successfully complete design projects (4.5.1) produces quality solutions that respond to identified needs and opportunities in each design project (4.5.2) applies appropriate evaluation techniques throughout each design project (4.6.1) identifies and explains ethical, social, environmental and sustainability considerations related to design projects (4.6.2)

For breadth of study, the curriculum has been developed to enable students to complete at least <u>one product</u>, <u>one service</u> and <u>one environment</u> within each band … in each of the technologies contexts: ***engineering principles and systems****;* ***food and fibre production and food specialisations****; and* ***materials and technologies specialisations****.*

(The Australian Curriculum, *Design and Technologies,* 2015)

UNITS OF WORK BY STAGE

Design Thinking / Real World Projects

STAGE LEVEL
☐ 5-6 ☐ 7-8 ☐ 9-10

Students complete three Real-World Projects every two years

UNIT TITLE
☐ EVEN YEAR ☐ ODD YEAR

⇒

☐ **ENGINEERING**
Principals and Systems
☐ **FOOD AND FIBRE**
Production and Specialisations
☐ **TECHNOLOGIES**
and Materials Specialisations

⇒

☐ One Product
☐ One Service
☐ One Environment

UNIT TITLE
☐ EVEN YEAR ☐ ODD YEAR

⇒

☐ **ENGINEERING**
Principals and Systems
☐ **FOOD AND FIBRE**
Production and Specialisations
☐ **TECHNOLOGIES**
and Materials Specialisations

⇒

☐ One Product
☐ One Service
☐ One Environment

UNIT TITLE
☐ EVEN YEAR ☐ ODD YEAR

⇒

☐ **ENGINEERING**
Principals and Systems
☐ **FOOD AND FIBRE**
Production and Specialisations
☐ **TECHNOLOGIES**
and Materials Specialisations

⇒

☐ One Product
☐ One Service
☐ One Environment

Across each band from Foundation to Year 8, students will have the opportunity to produce at least three designed solutions - one product, one service and one environment – with each one from a different Technologies context. (ACARA)

Possible links to STEM, TAS, HISTORY, VISUAL ARTS

Engineered Systems	• aeronautical • architectural • environmental • marine • medical • structural • transport systems • student-negotiated focus area of design

Possible links to PDHPE, GEOGRAPHY, ABORIGINAL STUDIES ENGLISH, COMMERCE, VISUAL ARTS

Food Technology	• food • food packaging • food presentation • marketing • nutrition • student-negotiated focus area of design

Possible links to STEM, GEOGRAPHY, HISTORY, ENGLISH, COMMERCE

Agriculture	• animal enterprise • environmental • marketing • plant enterprise • student-negotiated focus area of design

Possible links to STEM, TAS, VISUAL ARTS

Material Technologies	• electronics • graphics • jewellery • metals • packaging • multimedia • polymers • textiles • timber • student-negotiated focus area of design

WHOLE SCHOOL SCOPE AND SEQUENCE (TWO-YEAR CYCLE)

5-10 Overview – Design Thinking Units

Contexts	*5-6 Units**	*7-8 Units**	*9-10 Units**
ENGINEERING *Engineering principles and systems* ☐ ***Product*** ☐ ***Service*** ☐ ***Environment***			
FOOD AND FIBRE *Food and fibre production and food specialisations* ☐ ***Product*** ☐ ***Service*** ☐ ***Environment***			
TECHNOLOGIES *Materials and technologies specialisations* ☐ ***Product*** ☐ ***Service*** ☐ ***Environment***			

**For breadth of study, students should design and produce at least one product, one service and one environment within each stage of learning (ACARA).*

Q. *HOW MUCH PBL/DESIGN THINKING IS ENOUGH? (INDICATIVE HOURS)*

A. At least three design projects every two years in each of these contexts: Engineering, Food & Fibre, and Technologies/Materials.

A. Approximately 100 hours every two years in primary and 150-200 hours every two years in secondary.

Content structure for Technology Mandatory Years 7–8

The Technology Mandatory Years 7–8 syllabus outcomes are presented as:

- Skills
- Knowledge and Understanding

Context	Indicative hours
Digital Technologies	50
Agriculture and Food Technologies Engineered Systems Material Technologies	150

Course Delivery

- All four technology contexts must be delivered by the end of the stage
- Digital Technologies must be delivered for a minimum of 50 indicative hours
- Technology contexts may be taught individually
- Technology contexts may be taught concurrently
- Technology contexts may be repeated
- At least one design project must be based on each of the four Technology Contexts
- If technology contexts are combined, a single design project that addresses each context may be undertaken. The project must provide opportunities to assess student achievement of the specific context outcomes.

Design Projects

Design Projects involve the design, production and evaluation of quality solutions that are functional and meet identified needs or opportunities. Students must undertake a minimum of four design projects by the end of the stage. Students should develop design folios documenting evidence of the application of a design process and the specific technologies used in production.

Source – NSW Technology Mandatory Years 7–8 Syllabus, NESA, 2017

MACRO PHASES of a Real-World Project

1. **ENTRY EVENT** – The teacher arranges an interesting, inspiring and motivating experience for the students (that's related to the topic).
2. **FACT FINDING** – Students form groups, investigate the topic, identify a problem, need or opportunity, and agree on a problem statement and driving question.
3. **GENERATING IDEAS** – Students generate numerous possible solutions to meet the need or solve the problem.
4. **JUDGING IDEAS** – Students evaluate all their ideas/solutions and select the best one.
5. **PLANNING** – Students design a course of action and write a detailed action plan on how they will implement their idea/solution.
6. **PRODUCING** – Students execute their plan, and after prototyping (testing and modifying) they prepare to promote and present their product or solution.
7. **EXIT EVENT** – Students exhibit or pitch their completed product or solution to a group of users or an authentic audience.
8. **REFLECTION** – Students evaluate their product, and the processes they used, and identify what they have learned from participating in the project.

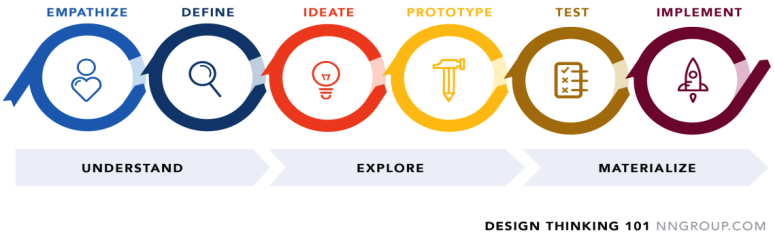
STUDENTS NEED SCAFFOLDING

*The **successful implementation of PBL in the classroom** lies on the teacher's ability to effectively scaffold students' learning, to motivate, to support and to guide them along the way.*

(Jo Earp, *Effective Implementation of Project-Based Learning*, Teacher magazine, 12.12.2016)

*Students need a **clear and consistent pathway** from creativity to implementation.*

(Tina Seelig, Stanford School of Engineering, 2016)



*As **routines are repeated**, children are able to gradually assume **more control and responsibility.***

Laureana Byrne & Sofia Scaricaciottoli, *Developmental Stages: Jerome Bruner*, 2012

TEACHERS NEED SCAFFOLDING TOO!

*The Australian Curriculum embraces General Capabilities that necessitate teachers working in a trans-disciplinary mode, but does not provide a **flexible framework** teachers can use to **scaffold creative thinkers and learners**.*

'What if teachers had the tools to understand and enhance the creative thinking of students? '

(The Journal of Digital Learning and Teaching Victoria, Volume 4 | Number 1 | 2017)

1. USE SCRIPTS

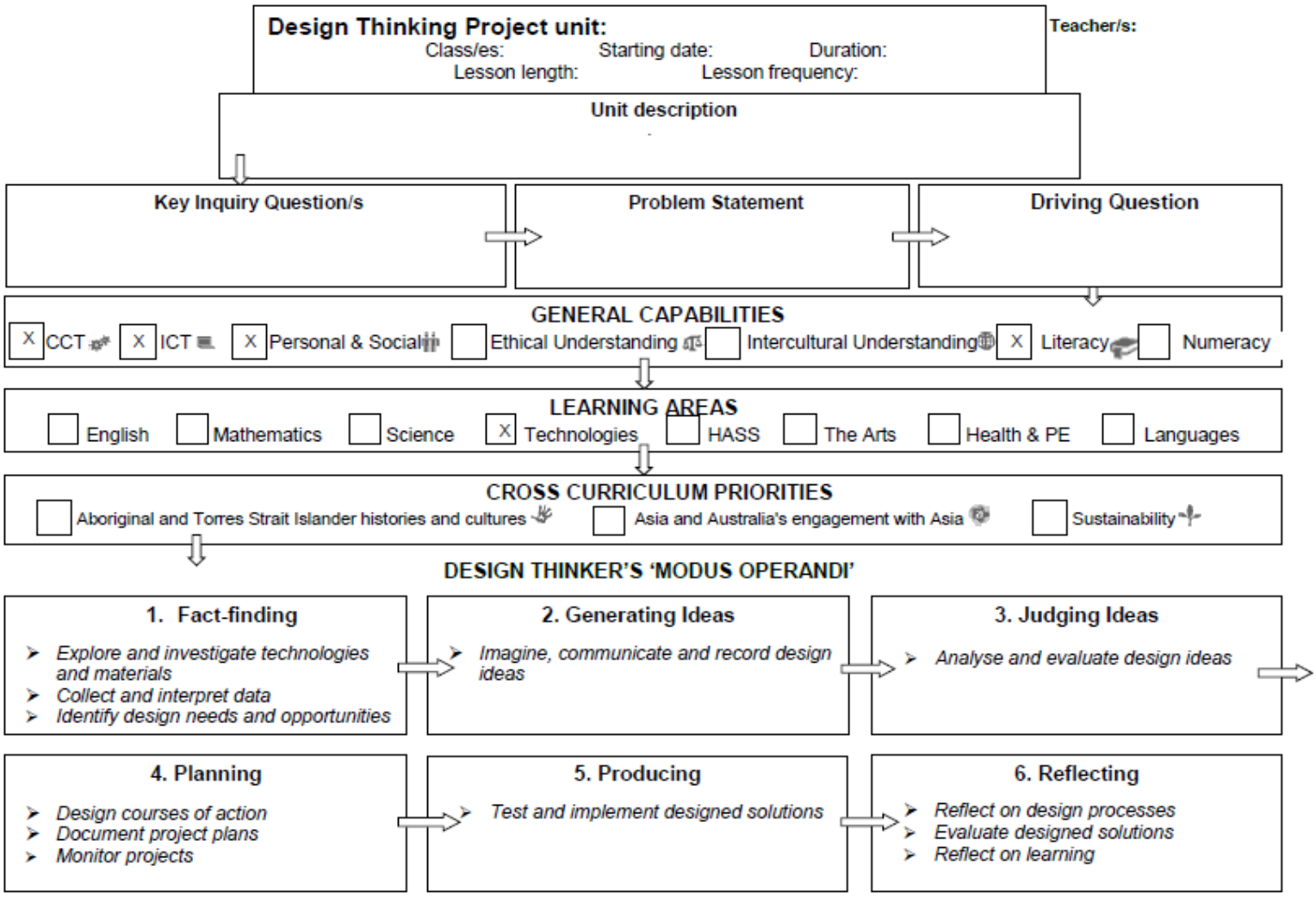
*Classroom **scripts for specific activities** help teachers (and students) know what practices are appropriate at different times in the project sequence.*

Peggy Ertmer & Krista Simons, *Scaffolding Teachers' Efforts to Implement Problem-Based Learning*, Purdue University, 2006

2. FOLLOW RITUALS & ROUTINES

Rituals** can help teachers feel comfortable in their roles as facilitators by providing them with **specific cues and procedures** for **managing and carrying out the macro phases of the process.

Peggy Ertmer & Krista Simons, *Scaffolding Teachers' Efforts to Implement Problem-Based Learning*, Purdue University, 2006



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THE ENTRY EVENT

Experienced PBL teachers recommend getting students thinking about the project before the unit begins … planting seeds of curiosity… and that teachers "hook" students through the use of an engaging opening scenario.

(Peggy Ertmer & Krista Simons, *Scaffolding Teachers' Efforts to Implement Problem-Based Learning*, Purdue University, 2006)

The Entry Event could/should:

- ✓draw students' attention to the issue, problem or topic
- ✓engage them emotionally
- ✓ inspire them to want to explore the topic or problem and pursue a solution
- ✓'tap into' existing aspirations of students
- ✓include an exemplar

http://splash.abc.net.au/ ,
https://blog.ted.com/9-talks-by-impressive-kids/
https://www.positive.news/

IDENTIFY STUDENTS' HIDDEN TALENTS AND ASPIRATIONS

MIPAC: Matrix Identifying Passion and Confidence
Pre-project Self-reflection

F - 6

STUDENT: CLASS:

In each of the boxes below draw a picture of an activity or describe a skill to do with:

HIGH PASSION

1. I love doing this but I'm not very good at it.	2. I love doing this and I'm good at it.
3. I don't like doing this and I'm not good at it.	4. I don't like doing this but I'm good at it.

LOW CONFIDENCE HIGH CONFIDENCE

LOW PASSION

The Coloured Thinking Caps

The Coloured Thinking Caps Scaffolding is based on empirical research and best practice of 'what works' for the problem solving and design process.

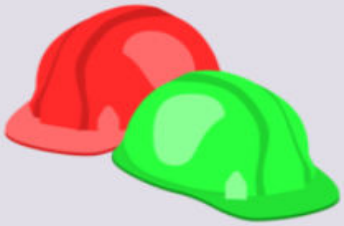
Teachers can coach students on how to apply the six-step design process by using a range of provided resources including music, video tutorials and worksheets.

Fact Finding

Students investigate the topic or issue, clarify the problem and identify needs and opportunities

Generating Ideas

Students generate numerous possible solutions to meet an identified need or to solve a complex problem



Judging Ideas

Students evaluate all their ideas/solutions and select the best one

Planning

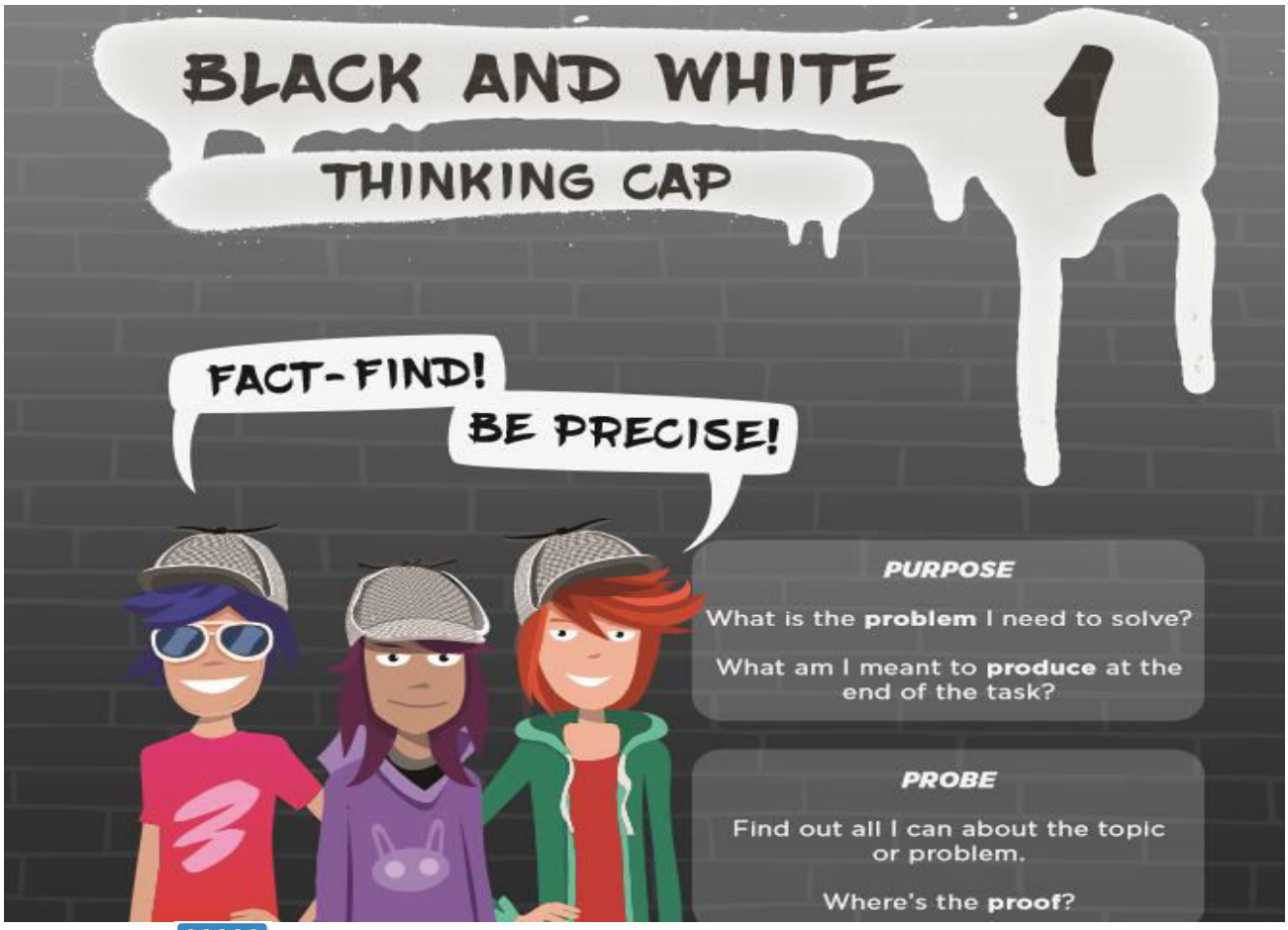
Students design a course of action and write a detailed action plan

Producing

Students implement their plan, and after prototyping (testing and modifying) they present their product

Reflection Phase

Students evaluate their product, design processes and learning



Video: ***Black and White Thinking Cap Tutorial*** (by Sofia)

WRITE A PROBLEM STATEMENT

Defining the Problem to Be Solved

SUITABLE FOR YEARS 3-10

"A problem well stated is a problem half solved."
- CHARLES KETTERING

A problem statement clearly explains the problem your project will address.

Identify these three elements before composing your problem statement:

The issue of...	
affects... *(who or what?)*	
and has a negative impact by...	

Now complete your problem statement making sure it includes the above three elements and is based on the criteria below.

Your problem statement:

- ☑ focuses on only one problem
- ☑ contains no more than two sentences
- ☑ describes how people, place or things are harmed or disadvantaged
- ☑ does not include a solution

*A problem statement can either come after the inquiry stage or at the beginning to guide the inquiry.

A Real-World Project by Amy, Ella and Sofia (Stage 3)

1. PROBLEM STATEMENT

"Too many Australians are being conned into eating junk food from McDonalds through persuasive advertising. Eating too much junk food can cause long-term health problems like obesity and diabetes which affects an individual's quality of life and places an extra burden on the health system."

Your problem statement:

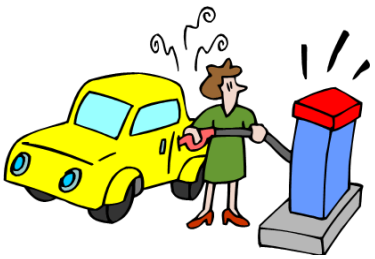
- ☑ focuses on only one problem
- ☑ contains no more than two sentences
- ☑ describes how people, place or things are harmed or disadvantaged
- ☑ does not include a solution

WHAT'S A 'DRIVING QUESTION'?

The Driving Question (DQ) takes the learner on a journey towards a destination - a designed solution in the form of a product, service or environment.
A good DQ effectively puts the teacher in the 'back seat' and the student in the 'driver's seat'. (James Phelps)

HOW TO WRITE A 'DRIVING QUESTION'

USE THIS PNEMONIC!



"You can't DRIVE without G.A.S."

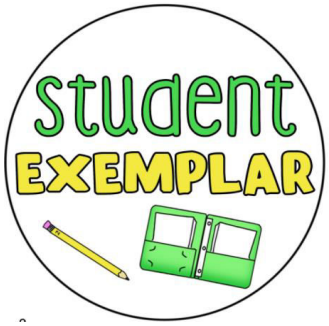
☑ **Not Googleable!** – It's impossible to find a definitive answer by using a search engine.

☑ **Action!** – The question has a 'call to action'. You have to produce something to answer the question.

☑ **Several Solutions?** – The question is open-ended. Therefore it will lead to several different solutions.

☑ **Specific?** – The question sets a clear and specific goal or challenge.

❖ *During the drafting and refining process you will need to constantly check that your Driving Question passes the G.A.S test.*



A Real-World Project by Amy, Ella and Sofia (Stage 3)

1. PROBLEM STATEMENT

Too many Australians are being conned into eating junk food from McDonalds through persuasive advertising. Eating too much junk food can cause long-term health problems like obesity and diabetes which affects an individual's quality of life and places an extra burden on the health system.

2. DRIVING QUESTION

"How can we persuade students in our school to stop eating McDonalds?"

☑ **(Not) Googleable** – It's impossible to find the answer by using a search engine.
☑ **Action?** – The question has a 'call to action'. You have to do something to answer it.
☑ **Several solutions?** – The question is open-ended. It could have several different solutions.
☑ **Specific?** – The question sets a clear and specific goal.

- Which of these Stage 3 Geography questions pass the G.A.S. test?

☐ ***How do people and environments influence one another?***
☐ ***How can the impact of bushfires or floods on people and places be reduced?***
☐ ***How can we design a flood-proof house?***
☐ ***How can I modify the design of my house so it is safe from natural hazards?***

- Which of these Stage 4 Geography questions pass the G.A.S. test?

☐ ***What effect does environmental quality and access to services have on people's wellbeing?***
☐ ***How can strong community identity and social connectedness enhance the liveability of places?***
☐ ***How can we assist those sleeping rough to feel more socially connected?***

DQ VERB BANK

SUITABLE FOR YEARS 3 - 8

STUDENT: CLASS: DATE:

Write a Driving Question

for a Problem-based Learning or Design Thinking project

Here is a selection of action verbs that you can choose from to assist you in writing a driving question for your project:

accommodate	deliver	form	optimize	restore
adapt	design	free	overcome	retrieve
advance	determine	fund	persuade	reverse
advocate	develop	grow	prepare	safeguard
assist	devise	help	preserve	save
avoid	distribute	implement	prevent	secure
build	educate	improve	promote	sell
change	enable	increase	protect	simplify
clean	encourage	influence	provide	solve
conciliate	engage	maximise	raise	stimulate
construct	enhance	mediate	reduce	support
control	establish	minimise	reform	teach
cure	expand	modernise	rehabilitate	train
debunk	extend	motivate	renew	troubleshoot
decrease	fix	negotiate	repair	upgrade

Here are some examples of problems - and driving questions written using verbs from the 'bank'. A driving question (**DQ**) should steer you towards finding a solution to the problem (**P**).

P: Some of the classrooms in our school are small and overcrowded and not conducive to group work.
DQ: How can we *construct* an outdoor learning space that will be user-friendly and eco-friendly?

P: Several families have fled persecution, war and poverty to seek refuge in Australia but are struggling with the change and disruption.
DQ: How can we *support* refugees that are moving into our town or suburb?

P: Cane toad populations are increasing and spreading rapidly. Their toxin can kill most animals that eat frogs. They therefore pose a risk to both native fauna and pets such as cats and dogs.
DQ: How can we better *protect* the native animals and pets in our local area from cane toad poisoning?

Your turn!

State a problem worth solving: _____

_____

Now draft three driving questions that could start you on a journey towards finding a solution for the problem. Explore different possibilities by experimenting with several verbs from the list. (If you get more than three ideas write them on the back.)

How can we _____?

How can we _____?

How can we _____?

A Driving Question can have TWO verbs!

GROUP SYNERGY!

Mixed abilities

Heterogeneous groups tend to be more successful in problem-solving activities than homogeneous groups, and heterogeneous groups are especially advantageous for low-ability students when mixed with high-ability students. (Webb, 1998)

Mixed interests, genders and personalities

Diverse teams see the same problem from many angles. They have a better understanding of any given situation and generate more ideas, making them more effective problem solvers. (IBM on Design Thinking, 2014)

Diversity is an important factor for creative ideation.
(Fleming, 2004; Nijstad, Stroebe, & Lodewijkx, 2002)

Teacher's call!

Teachers should consider multiple factors, and rely on their own judgement and experience – rather than empirically derived rules – when forming PBL groups.
(Emmer & Sabornie, *Handbook of Classroom Management: Research, Practice, and Contemporary Issues,* 2006)

Think-Pair-Share - Share ideas for forming mixed groups and team bonding.

I do not like to state an opinion on a matter unless I know the precise facts.
(Albert Einstein)

BLACK & WHITE THINKING CAP

Fact-Find ~ Be PRECISE!

SUITABLE FOR YEARS 5-10

NAME/S: CLASS: PROJECT:

STARTING DATE: / / COMPLETION DATE: / /

A. What kind of **PROJECT** will this be? Identify and explain.

- ☐ I have found a **PROBLEM** worth solving.
- ☐ My teacher has set a challenge.
- ☐ This is a personal **PASSION PROJECT**.

B. **POINTS OF VIEW?** *(Identify relevant groups with different viewpoints.)*

Who is affected by the problem?

Who will be the audience or end-users of my product or performance?

C. **PERSPECTIVES?** (Use 'O.W.N.') I will conduct searches, interviews or surveys to find out the Opinions, Wants or Needs of

- **i.** those affected by the problem and/or
- **ii.** the audience or end-users of my potential solution.

I have collected and analysed the data and these are my conclusions:

OPINIONS (How they *feel* and what they *believe*)	**WANTS** (What they want)	**NEEDS** (What they need)

WRITE THE PROBLEM STATEMENT HERE
WRITE THE DRIVING QUESTION HERE

D. What will I **PRODUCE** at the end of this project?

☐ **PRODUCT** ☐ **PERFORMANCE** ☐ **SERVICE** ☐ **ENVIRONMENT**

What *form* could my final product possibly take?
(You may tick several boxes now but you can change your mind later.)

☐ 3D model	☐ comic	☐ infographic/flowchart	☐ small business
☐ advertisement	☐ concert	☐ instructions/manual	☐ song/instrumental
☐ animation/cartoon	☐ dance/choreography	☐ machine	☐ speech
☐ app/program	☐ debate/argument	☐ map	☐ story
☐ artwork	☐ demonstration	☐ mural	☐ storyboard
☐ biography	☐ display/exhibition	☐ podcast	☐ timeline
☐ blog	☐ documentary	☐ poem	☐ toy
☐ book (digital)	☐ drama (mime/play/skit)	☐ portfolio	☐ video
☐ book (hard copy)	☐ flag/banner/sign	☐ poster	☐ website
☐ brochure	☐ food	☐ rap	☐ Other?
☐ clothing/costume	☐ fundraiser	☐ research report	_____
☐ coaching/teaching	☐ game	☐ script	_____

E. What will be the **POINT** and **PURPOSE** of my final product?
(Use 'P.I.E.S.') (Tick the appropriate boxes then explain your point and purpose.)

☐ To **P**ersuade _____
☐ To **I**nform _____
☐ To **E**ntertain _____
☐ To **S**ell _____
☐ To **S**erve _____

F. **PRIOR KNOWLEDGE?** What knowledge and skills do I already have that I could use to solve the problem or make the product?

I know: _____

I can: _____

G. **PROBE!** *(Dig deeper and look for **PROOF.**)*
What are the 'gaps' in my knowledge? What else do I need to find out about the problem or topic before I start?

_____

Here is a summary of the information I found. I have double-checked that this information is accurate.

_____

H. **PERSONAL GOALS?**
What new *skills* and/or *dispositions* will I need to learn to complete this project?

_____

To develop these new skills/dispositions I will _____

Video: *Rainbow Thinking Cap Tutorial* (by Sofia)

"BE CREATIVE… BE *VERY* CREATIVE!"

If at first the idea is not absurd then there's no hope for it.
(Albert Einstein)

Studies have shown (Chen, Himsel, Kasof, Greenberger & Dmitrieva, 2006) that when teachers instruct their students to "be creative" – that is, ***give them 'permission' to generate wild ideas****, both the quantity and originality of ideas improve significantly.* (James Phelps)

BE NON-JUDGEMENTAL!

Video excerpt: 'Double-Decker Couch' (*The Lego Movie*)

I have learned that if students feel that they, or their ideas, might be criticised or ridiculed they simply stop generating ideas.
(James Phelps)

BE PROLIFIC… *VERY* PROLIFIC!

The number of distinct ideas generated also influences the quality of the selected subset. If an equal number of ideas are selected from the initial pool, the ***best idea from a larger pool will be better on average than the best idea from a smaller pool.***

(Girotra, Terwiesch & Ulrich, 'Idea Generation and the Quality of the Best Idea', 2009)

The hybrid process [solo plus group sessions] generates about ***three times as many*** *ideas per unit of time, and these ideas have significantly higher average quality.*

(Girotra, Terwiesch & Ulrich, 'Idea Generation and the Quality of the Best Idea', 2009)

BE PATIENT…

I do know that fate allowed me to find a couple of nice ideas after many years of labour. (Albert Einstein)

It's not that I'm so smart, it's just that I stay with problems longer.

(Albert Einstein)

Oftentimes creative ideas result from a ***period of incubation*** *- a process whereby initial conscious thought is followed by a period during which one refrains from task-related conscious thought.*

(Ritter & Dijksterhuis, 'Creativity – The Unconscious Foundations of the Incubation Period', 2014)

2 RAINBOW THINKING CAP

Generate Ideas ~ Be PROLIFIC!

SUITABLE FOR YEARS 5 - 8

NAME/S: CLASS: PROJECT:

Here are seven tips to help you generate numerous ideas:

1. Explore **POSSIBILITIES**. Let your imagination go wild and generate plenty of ideas and possible solutions.
2. **POSE QUESTIONS**. Ask numerous 'What if…?" questions.
3. **PIGGYBACK** on a friend's idea by developing it further (elaboration).
4. **PROPOSE ALTERNATIVES**. "Instead of doing it that way, maybe we could try it this way?"
5. **POOL**. Collect several ideas from different sources and combine them.
6. **PINCH** existing ideas (e.g. products) and suggest improvements.
7. **PAUSE**… Don't judge the ideas yet!

Now generate a minimum of **seven** ideas and describe them:

"The best way to get good ideas is to get lots of ideas..."
LINUS PAULING
NOBEL CHEMISTRY PRIZE (1954)
NOBEL PEACE PRIZE (1962)

1.
2.
3.
4.
5.
6.
7.

☐ My teacher has sighted my seven ideas.

Teacher

(You may now move onto the next stage)

Video: ***Red and Green Thinking Cap Tutorial*** (by Sofia)

GREEN & RED THINKING CAP

Judge Ideas ~ PICK!

SUITABLE FOR YEARS 5 - 8

NAME/S: CLASS: PROJECT:

MAKE PREDICTIONS

APPLY LOGIC AND REASONING

A. **PREDICT**

Imagine what would happen if you put each idea into action. Use the following two questions to guide your thinking process, then complete the table below:

i. **POSSIBLE and PRACTICAL?**
Do you realistically have the means to put the idea into action?

ii. **POTENTIAL for success?**
Are people likely to enjoy/buy/use your finished product?

Let's judge an idea…

From the Design Thinking Learning Continuum
Years 3 & 4 Learning Goals - Judging Ideas

- Evaluate the idea against identified criteria for success, including environmental sustainability considerations.
- Explain how the idea will/won't meet needs of communities and their environments.
- Describe how the features of technologies would make it possible/ impossible to implement the idea.

*Groups employing the hybrid process are able to **better discern their best ideas** compared to teams that rely purely on group work.*

(Girotra, Terwiesch & Ulrich, 'Idea Generation and the Quality of the Best Idea', 2009)

Idea	Possible? Practical? (Yes or No)	Potential for success? (Yes or No)	Identify the PROS & CONS (Explain the reasons for your Yes or No)
#1			
#2			
#3			
#4			
#5			
#6			
#7			

B. **PEER JUDGEMENT**
Ask students (who are not in your group) for their opinions of your ideas.
The most popular ideas were _____

C. **PICK** the most practical idea with the most potential for success. (This is the idea that you will put into action.) Give it a novel but suitable name and briefly describe it.

_____

Video: ***Pink Thinking Cap Tutorial*** (by Sofia)

PINK THINKING CAP

Design a Course of Action ~ PLAN!

SUITABLE FOR YEARS 5 - 8

NAME/S: CLASS: PROJECT:

A. **PRODUCT?**

Re-state your end-goal. *(By now your end-product may be quite different to the one you stated in the Fact-Finding stage.)*

Create a detailed diagram and/or description showing what your finished product/performance will look like and what it will do.

This is what my product/performance will look like:

This is what my product will do:

B. **PARTS & PIECES?** List all of the resources you will need to make your product:

Technology	Materials

NAME/S: PINK THINKING CAP - PAGE 2

C. **PEOPLE?** Will you need expert help? If so, who will provide this help?

For example: another student, sibling, parent, teacher or mentor? (Check with them first.)

My expert helper's name is _____

Contact: _____

My expert has been approved by my teacher/parent _____

D. **PROCESS?** A process is a "series of actions or steps taken in order to achieve a particular end".

What steps will you take to produce your product or performance? Use the template on the next page to write an **action plan**. Include all of the key steps that you believe are necessary to be successful.

For each step in your plan answer these five questions:

WHAT action is to be taken?
WHO is responsible for this action?
HOW will it be achieved?
WHERE will this step happen?
WHEN is this step due to be finished?

ACTION PLAN – Example of Step 1

What?	Who?	How?	Where?	When?
Create a storyboard for our animation	Rebecca and Kyle	Illustrate on a large whiteboard, take photos and send to other group members for comment and approval	In the school library at lunch time	By Friday of Week 3

Managing projects involves identifying and sequencing tasks, determining the required resources, and allocating the time to each task so that the project is completed on time.

PINK THINKING CAP
Design a Course of Action - PLAN!

ACTION PLAN

This action plan has been designed by: CLASS: PAGE: of
Our goal is to: BY: / /

#	WHAT action is to be taken?	WHO is responsible for that?	HOW will it be achieved? (Include any Spending)	WHERE will this happen?	WHEN is this step due to be finished?	✓

E. **PITFALLS?**

Play it safe. Identify any possible risk of accident or injury to yourself or others during the implementation of your plan.

F. **PREVENTION?**

Explain how you will prevent accidents or injuries from happening.

G. **PROFIT or LOSS?**

Are you running a business? Are you selling a product? Are you organising a fundraiser? If so, write a budget, with projected earnings, and attach it to your Action Plan.

Video: *Purple Thinking Cap Tutorial* (by Sofia)

A. PROTOTYPE IT

Produce a first attempt or draft of your product and submit it to your teacher.

How will you show your teacher/mentor your prototype?

- ☐ Photo
- ☐ Video
- ☐ Audio recording
- ☐ Screenshots
- ☐ Hard copy
- ☐ Demonstration
- ☐ Other _____

B. POST IT

Where exactly can your teacher/mentor view your prototype?

- ☐ I have sent an email
- ☐ It's on my USB stick
- ☐ I will demonstrate in the classroom
- ☐ Web link _____
- ☐ Dropbox link _____
- ☐ Google Drive _____
- ☐ iTunesU _____
- ☐ School folder _____
- ☐ Other _____
- ☐ Yes, my teacher has viewed my prototype _____

C. PRACTICE IT. POLISH IT. PERFECT IT.

Test your prototype or draft numerous times. As you make improvements, list the changes you have made and give reasons for the changes.

Modification	Reason

Testing is an opportunity to learn about your solution <u>and</u> your user.
(Institute of Design, Stanford University)

GATHERING PERSPECTIVES
Product Testing

SUITABLE FOR YEARS 2-8

PRODUCT: DESIGNER/S: CLASS:

Choose two people and observe them using your draft or prototype.
Notice what they DID and SAID. Ask them what they THOUGHT and FELT.

USER 1	
DID	SAID
THOUGHT	FELT

D. PRESENT IT. PROMOTE IT.

How will you show your finished product/performance?

- ☐ Classroom presentation
- ☐ In-school exhibition
- ☐ Product launch
- ☐ Expo outside of school
- ☐ Other _____

How will you tell the world about your product/performance? Explain.

- ☐ Digital media
- ☐ Print media
- ☐ Social media
- ☐ Other _____

_____

_____

 CriticalAndCreativeThinking.com.au

Video: *Orange Thinking Cap Tutorial* (by Sofia)

I am entirely devoted to reflection. (Albert Einstein)

ORANGE THINKING CAP

Reflect ~ PONDER!

NAME/S: CLASS: PROJECT:

Think about your actions, process and thinking...

A. Describe two actions you took during the process which you are most **PROUD** of.
e.g. "We resolved friction in the group. We improvised when we had problems with our prototype."

B. **PINPOINT** two actions in the process which you now think could have been done better.
e.g. "We should have started sooner and asked for expert help."

C. **PONDER.** Think about your thinking...
Identify aspects of your *thinking* that you did well or that could be improved.
e.g. "We generated numerous ideas but we needed to let our ideas 'incubate' more."

D. **POLL**

1. PUBLIC POLL. Design and conduct a simple survey to collect feedback from your audience, customers or end-users.
2. PEER JUDGEMENT. Interview two other students (not from your group) and ask them what they thought of your product or performance.
3. TEACHER APPRAISAL. Reflect on the evaluation your teacher/mentor gave you.

Summarise your findings. Overall, what did others think of your final product/performance?

E. **PONDER.** So, what would you do differently if there was a 'next time'?

F. **PROGRESS in Learning**
What do you now know that you didn't know before this project began?

G. **PERSONAL GROWTH**
How are you different as a person? Identify the new skills and dispositions you acquired as a result of this whole experience.

FEEDBACK and ASSESSMENT METHODS

"Effective feedback and assessment will always tell the student ***what they have done well and how they can do better."***

(James Phelps)

3 x 3.

Students can assess themselves,
and be assessed by their peers and teacher,
in three ways:

1. **Assess the *PROCESS***

2. **Assess the *PRODUCT***

3. **Assess the *PUPIL***

DESIGN PROCESS ASSESSMENT

Application of Design Thinking skills and strategies

7-10

PROJECT: NAME/S: CLASS:

You used the:		0	1	2	3	4	5
Black & White Thinking Cap	***Fact-finding*** You researched and gathered a range of perspectives on the issue or need, you identified a problem worth solving and you identified the goal of your project. You researched the topic to fill in gaps in your knowledge using primary sources and reliable secondary sources. You acquired new skills you identified as necessary to complete your project.						
Rainbow Thinking Cap	***Generating ideas*** You generated a minimum of seven different solutions that could potentially meet the identified need or solve the problem.						
Green & Red Thinking Cap	***Evaluating ideas*** You carefully considered the pros and cons of each idea, you discarded the unsuitable ones and selected your best idea based on criteria, and you provided good reasons for your decisions.						
Pink Thinking Cap	***Planning*** You designed a course of action by identifying: all the key steps in the production process, team members' roles and responsibilities, materials and technologies required, and potential risks and safety strategies.						
Purple Thinking Cap	***Producing*** You created a prototype of your designed solution, tested several iterations, made modifications to improve it, and found creative ways to promote and present your final product.						
Orange Thinking Cap	***Reflecting*** You evaluated your final product to determine how well it solved the problem and met the criteria for success. You reflected on the processes you used by identifying the successes and failures you encountered throughout the project. You sought out, and considered, feedback from others, and you reflected on your own personal growth.						

TEACHER:

DATE: / /

PRODUCT ASSESSMENT

Feedback on your designed solution

SUITABLE FOR YEARS 2-10

PROJECT: NAME/S: CLASS:

Your solution is:		0	1	2	3	4	5
Creative	Your product is unique and interesting and it captures the attention of others.						
Practical	Your product is useful and worthwhile and it improves the lives of others.						
Inexpensive	The cost of developing and implementing your product is small compared to the benefits it will bring.						
Sustainable	The cost of maintaining your product is achievable and manageable. There is minimal (or zero) negative impact on the environment and natural resources.						

TEACHER:

DATE: / /

Assess the *PUPIL*

Standard / **Criteria**	**Novice**	**In Progress**	**Meets Expectations**	**Exceeds Expectations**
Identifies problem	Does not recognise that there is a problem, it needs to be pointed out	Recognises there could be a problem but cannot identify the cause	Recognises there is a problem and understands the underlying cause	Recognises the real problem, the underlying cause, and the extent of the problem
Collects information	Does not collect information to solve problem, needs to be prompted	Collects inaccurate or incomplete information, is unsystematic	Collects accurate and complete information, spots and eliminates some irrelevant information	Collects accurate complete and relevant information, using a systematic method
Applies techniques to solve the problem	Does not apply any techniques to solve the problem	Applies one plausible technique to solve the problem	Applies two or three appropriate techniques to solve problem	Applied four or more techniques with some evidence of creativity to solve problem
Evaluates effectiveness of solutions to problems	Shows little evidence of reasoning skills to evaluate effectiveness of solutions	Analyses the effectiveness of or one or two techniques, demonstrates knowledge of problem solving process	Analyses and evaluates the effectiveness of all of the solutions, demonstrates an understanding of the problem-solving process	Evaluates the effectiveness of all the solutions, reflects on the implications, demonstrates in-depth understanding of problem-solving process, and looks towards improvement

Design Thinking Rubric

	Empathise	Define	Ideation	Prototype	Evaluate
Extending	Has sought more than one way to connect with users and shows insight and depth when talking about users' needs.	The design brief is clearing re-framed around a user and the needs of the user are included into the new design brief.	A large number of ideas that shows variety in thinking. They choose a few ideas to further develop that are diverse. They work as a team to build on each other's ideas.	The prototype demonstrates how it is a solution for users and the iterations as well as challenges are described in reference to any testing completed.	The designer describes in detail all iterations and what was learnt from each user testing as well as how effective their final product is in relation to the needs of the user.
Proficient	Empathy is expressed by explaining what needs the users have including user essentials. They discuss what surprised them about their users.	The design brief is revised and described with the user in mind.	A large number of ideas ranging from sensible and easy to create to those which are creative and difficult to create. They choose a few ideas to further develop.	The prototype shows how it has been improved on and how it reflects any user testing.	The designer can describe the steps taken as well as how effective their final product is in relation to the needs of the user.
Developing	Describes the user but relies on prior knowledge rather than new information.	Mentions the user but the design brief remains unchanged.	Limited range of ideas that are similar in nature.	The prototype shows some iteration and testing as it is developed.	The designer can describe the steps taken to complete their design.

Source - http://www.digitaltechnologieshub.edu.au

EARLY STAGE 1
uses a simple design process to produce solutions with identified purposes
(STe-5WT)

STAGE 1
uses a structured design process, everyday tools, materials, equipment and techniques to produce solutions that respond to identified needs and wants
(ST1-5WT)

STAGE 2
applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteria
(ST2-5WT)

STAGE 3
plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints
(ST3-5WT)

STAGE 4
applies design processes that respond to needs and opportunities in each design project (4.1.1)

generates and communicates creative design ideas and solutions (4.2.1)

selects, analyses, presents and applies research and experimentation from a variety of sources (4.2.2)

applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects (4.3.1)

demonstrates responsible and safe use of a range of tools, materials and techniques in each design project (4.3.2)

applies management processes to successfully complete design projects (4.5.1)

produces quality solutions that respond to identified needs and opportunities in each design project (4.5.2)

applies appropriate evaluation techniques throughout each design project (4.6.1)

identifies and explains ethical, social, environmental and sustainability considerations related to design projects (4.6.2)

The Australian Curriculum Collaborative Problem-Solving Assessment Framework (ACCPSAF)

Collaborative problem solving competency is the capacity of an individual to effectively engage in a process where two or more students attempt to solve a problem by sharing the understanding and effort required to come to a solution, and by pooling their knowledge, skills and efforts to reach that solution.

(PISA, 2015)

The Australian Curriculum Collaborative Problem-solving Assessment Framework for collaborative problem-solving has specifically been developed based on elements from Critical and Creative Thinking and Personal and Social Capability.

(Collaborative Problem-Solving Online Assessment and The Australian Curriculum, 2016)

Video: 'Collaborative Problem Solving Online Assessment' (ACARA/NSW DoE)

Ignite a spark!

Light a fire!

"By the end of each stage students should be provided with <u>opportunities</u> to engage with the full range of Design and Production Skills."

(NESA, 2018)

BY OFFERING A REAL-WORLD PROJECT YOU PROVIDE A SIGNIFICANT OPPORTUNITY TO YOUR STUDENTS

(WHICH THEY MIGHT NOT BE ABLE TO CREATE FOR THEMSELVES OTHERWISE)

ONE OF YOUR PROJECTS COULD BE A LIFE CHANGING EXPERIENCE FOR A STUDENT!

MINDS WIDE OPEN CONTACT DETAILS AND INFORMATION

Design Thinking/PBL/CCT questions/feedback
JamesPhelps@MindsWideOpen.com.au

Minds Wide Open PD and courses info
https://mindswideopen.com.au/

In-school PD enquiries and NESA hours validation
admin@MindsWideOpen.com.au

Classroom teaching portal
http://cct.education/

Critical and Creative Thinking online course info
https://cct-pl.education/elearning-details/

Facebook
https://www.facebook.com/KidsCanThinkForThemselves/

Blog
https://mindswideopen.com.au/blog/

DESIGN THINKING ACROSS THE CURRICULUM

DEEPER LEARNING THROUGH REAL-WORLD PROJECTS

minds wide open

Feedback - Professional Learning Objectives

Please indicate how well you think the objectives of this workshop have been met.

1. This course has given me ways to respond to the interests of my students and promote student-centred learning (APST 3.3.2).

   1 **2** **3** **4** **5**

2. This course has given me ways to encourage critical and creative thinking, higher order thinking and risk-taking in my students' learning through problem based learning and relevant projects (APST 3.3.2).

   1 **2** **3** **4** **5**

3. This course has given me knowledge of curriculum and assessment requirements to inform my teaching and learning programs (APST 2.3.2).

   1 **2** **3** **4** **5**

4. This course has taught me how I can design units of work which
   - display logical sequencing of activities (APST 2.2.2) and
   - ensure lessons incorporate practical activities and skills practice, not just content (APST 3.2.2).

   1 **2** **3** **4** **5**

5. Many schools have included future-focused skills like creativity, problem-solving and innovation in their school plan or Strategic Directions. The information in this course has provided us with some strategies and resources that our school can use to help us achieve those goals (APST 6.2.2).

   1 **2** **3** **4** **5**

Do you have any comments (positive or negative) that you would like to make regarding the content or delivery of the workshop?

_____

_____

_____

_____

Can we add your comment to our PL website? **YES** / **NO**

Position / role: _____

Name: _____

School: _____

How did you find out about this course? _____