

## A learner – interaction model of learning

### Workshop notes <sup>1</sup>

**John Munro**

To foster effective learning, we need to

- understand how learners learn
- implement teaching that fosters effective learning.

**Concepts in contemporary theories of learning.** What are some key concepts, 'buzz words' that have emerged re learning and education over last 20 years. In small group, list as many as you can think of in 5 minutes. Examples are

multiple intelligences	Bloom's taxonomy	reflective practice	
peer coaching	metacognition	emotional IQ	
work place learning;	self based learning	Jigsaw	
scaffolding	brain storming		
ZPD	problem solving		

**How we learn : What things affect how we learn?** Think of two things you learnt recently, one you learnt in a positive way and another you didn't learn as well. What things do you think made a difference between the two situations ?

<u>Situation in which you learnt well</u>	<u>Situation in which you didn't learn well</u>

**Characteristics of effective learning.** What behaviours do students show when they are

<u>Engaged in effective learning ?</u>	<u>Not engaged in effective learning ?</u>

**What do you do to learn ?** Read the following and discover what a bof is, note why you made this decision, and what you did to learn more about bofs.

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<sup>1</sup> The content and materials in these notes are from Munro (1996). *Facilitating Effective Learning and Teaching in the Middle School*. Melbourne : EdAssist

*Peter knew enough about bofs to be aware of the danger he was in. He thought about his predicament. Bofs, he knew, were short-sighted, but had a very good sense of smell. They also had very sensitive hearing.*

*In the distance he could hear the roar of the river. Would that cover the noises that he was sure to make as he tried to escape? Slowly and silently he turned and backed away from the clearing.*

*The bof couldn't see Peter, but knew that he was escaping; its sense of smell told it this. It padded along on its huge paws, claws sharp and extended. It moved its head from side to side, its nose pointing up and swinging like a radar scanner searching for its target.*

*Peter made his way to the waterfall. He stopped on the bank of the river, keeping as still as he could.. Then he saw the bof again. It was standing on a rise that ran along the bank. It was hungry. It was also angry because it had been deprived of its dinner. It padded up and down on the green grass carpet making a soft grunting noise as it moved, It furiously sucked in air through its dilated nostrils as it searched for Peter's scent. Its huge arms thrashed around as it groped for its quarry. Suddenly its pointed ears pointed in Peter's direction.*

What, do you think, is a bof? What did you do in order to decide?

**Framework for examining learning:** To learn successfully, learners interact with the teaching information in various ways; they need to use 'learning functions'.

• a challenge or reason for learning something

• an idea of knowing where they will end up, see the goals

• make links with and use what students know re topic

- stimulate what they know a topic; let them see what they already know
- how they know, what they know about how to learn, how to think
- what the feel about themselves as learners of the ideas
- identify what they don't know about the topic
- use some of this knowledge automatically
- recode what they know to match the teaching

• see a pathway to the goal

• learn new ideas in specific limited, supported, 'scaffolded' ways

- learn in particular context as actions, imagery, in familiar language scaffold;
- ask questions *How can we get from ...to .. ?*
- recode imagery, action knowledge of new ideas into words
- practise new ideas

• deepen what they have learnt; abstract it, link it more broadly with what is known

- link episodic, semantic and procedural aspects of idea at once ; say, write, draw, do.
- review, consolidate what was learnt *What have you learnt ?*
- decontextualize, summarize, organize, link with what is known, main/subordinate ideas.
- elaborate and extend ideas through questioning.
- teach the conventional ways of communicating new ideas

• invest positive emotion in the new knowledge

• store what they have learnt in memory, practise remembering it

• identify how they learnt, what they did that helped them to learn

• see themselves making progress

• automatise what they have learnt so it can be more easily used

• transfer and generalise the new knowledge

• organise what they have learnt for assessment purposes

These functions determine the

- quality of the learning outcome
- what learners know about learning and themselves as learners.

Key issues include

- different learners display each function in different ways.
- teachers activate them through their systematic use of a range of teaching strategies.
- the effectiveness of a lesson depends on how they are put in place.

Effective teaching needs to support and foster these 'learning functions'.

### What do we learn : Two types of knowledge

<p><b>personal interest knowledge;</b> things you want to know more about -</p> <ul style="list-style-type: none"> <li>• how to play an electric guitar,</li> <li>• band of interest.</li> <li>• impressions of where they would like their lives to go, what they might like to do</li> </ul>	<p><b>culturally valued knowledge;</b> knowledge your culture thinks you need; - what we teach at school; learning how to</p> <ul style="list-style-type: none"> <li>• key learning areas</li> <li>• write essay showing that Hamlet was really mad</li> <li>• solve a numeracy task, add indices,</li> <li>• symbolise ideas, eg., use language, maths symbolism</li> <li>• solve problems, ways of thinking in different cultures</li> <li>• what to value.</li> </ul>
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Culturally valued knowledge won't interest students. Teachers and schools

- need to initiate the purpose for learning; challenge the learner to 'know'.
- make suggestions about how to learn.

### Understanding Adolescent Learning

We need to make sure that the teaching we put in place matches how students learn

How do adults think / learn ?	?	How does their physical development influence their learning ?
How does their transition from child to adult influence their learning ?	<b>How do middle school students learn ?</b>	How does their social interactional development influence how they learn ?
How is their knowledge organised ?	How does their self-concept develop ?	How does modern culture influence how they learn ?

These influences converge or combine to explain adolescent learning.

**Activity :** compare a four year old, a ten year old, an 18 year old and a 40 year old. Compare them on a number of dimensions you think are relevant questions re adolescent learning :

	1 year old	4 year old	13 year old	18 year old	40 year old
How is their knowledge organised ?					
How do they think / learn ?					
How does their social context influence how they learn ?					

Use this to identify some key ways in which adolescent learning differs from that of others.

Identify some frequently occurring problems of positive learning that concern you.

### **Adolescence : transition from guardian-child to adult-adult- growth of personal identity**

**Changes in thinking.** Adolescents' language develops so that they can

- think and talk about ideas in more abstract, generalised ways,
- think about propositions without reference to concrete situations
- think in probabilities, possibilities; they can discriminate between 'if - then' and 'when'.
- use generalisations
- can pursue abstract explanations and arguments
- can hypothesize- generate potential solutions to problems in systematic ways
- use abstract symbols and think in symbols
- more able to plan, manage, direct own learning, think about their own thinking
- more contemplative than younger children

However, they

- may often appear idealistic or utopian
- don't think at the same high level in all areas; need reference what they know in real life
- show greater variation in what they know, how they learn than at earlier periods.
- have difficulty mapping concepts into actions; split between what they say and what they do.
- see knowledge as a measure of them; more defensive of it than earlier.

**Our culture affects how adolescents think and what they know.** Today's adolescents differ from their peers ten years ago, part because

- the technological tools currently used to solve problems and to transact are better understood by adolescents who have grown up with them than their parents.
- the ways in which contemporary western cultures construct adolescence.

**Emotional fluctuations.** Move from a world of certainties to one where values are 'grey'.

**Vulnerable self esteem** Vulnerable self esteem because they begin to doubt earlier knowledge and because they get less positive feedback for what they know.

## Mapping adolescent learning into positive learning

**Explicit learning and teaching** Learning is most effective when specific aspects are unambiguous and clear to all participants; the outcomes, how knowledge changes and the teaching procedures need to be explicit both to teachers and students. This 'explicitness' is essential in teaching with adolescents. They may not 'know where they are'.

- Earlier non-profitable educational experiences let them know what they don't want.
- Shifting value systems means they often seek consistency and stability, of a kind that is different from what they experienced earlier.

The implications of the characteristics of adolescence for teaching are shown in the following table.

Characteristic	Implication for teaching
transition from identity in a guardian-child to adult-adult relationship	<ul style="list-style-type: none"> <li>• relationship between teacher (authority figure) and student is changing and students need to learn how to manage this</li> <li>• co-operative learning activities are appropriate</li> </ul>
transition to member of different cultures; they need to learn how to re-define their identity in terms of peer group	<ul style="list-style-type: none"> <li>• knowledge about how peer group culture operates needs to be explicit; adolescents explicate their knowledge of peer group, concerns.</li> <li>• Teachers provide alternative pathways for student approach.</li> <li>• Mentor programs, in which older students show younger students how to manage, to see options, to see how they can 'make the trip'.</li> <li>• Teachers need to understand the role of the peer group on learning.</li> </ul>
seek to be less dependent on adults	<ul style="list-style-type: none"> <li>• They need to learn how to operate more independently as learners, how to manage and control their learning</li> </ul>
Their identity is often defined in part in terms of what they know and what they are learning. They see knowledge as an extension of themselves.	<p>The teaching needs</p> <ul style="list-style-type: none"> <li>• To help students develop a positive self concept as a learner and to develop useful metaphor of learning.</li> <li>• To provide effective feedback for knowledge change.</li> <li>• To help students separate learning from their self esteem and to be allowed to 'change their minds' without penalty.</li> <li>•</li> </ul>
idealistic, work in generalisations without being realistic or contextually relevant.	<ul style="list-style-type: none"> <li>• Need to teach directly episodic (experiential) knowledge, help students see when it is appropriate to use ideas learnt.</li> </ul>
don't think at the same level in all areas	<ul style="list-style-type: none"> <li>• Need to allow students to refer ideas back to real world for checking</li> </ul>
show greater variation in what they know	<ul style="list-style-type: none"> <li>• Need to take account of different ways of knowing in our teaching</li> </ul>
abstract concepts not linked or mapped into procedures	<ul style="list-style-type: none"> <li>• Need to teach students how to link abstract concepts into networks and into procedures.</li> </ul>
drowning in the amount and range of information they need to handle to learn	<p>Need to</p> <ul style="list-style-type: none"> <li>• automatise knowledge, learn how to manipulate information</li> <li>• learn how to use what they know more effectively</li> <li>• see pathways through topics they are learning, negotiate action plans.</li> <li>• learn to use advance organisers to get what they know ready for learning</li> <li>• learn to set learning goals for themselves, see where they will end up</li> <li>• see themselves making progress</li> <li>• learn time management episodes</li> <li>• have time to learn how to manage themselves in novel situations.</li> </ul>
Earlier 'black and white' values are replaced by 'grey' values.	<ul style="list-style-type: none"> <li>• Need opportunity to link emotional knowledge and value system with their new conceptual knowledge</li> </ul>

**Building the learning functions in effective teaching;** the teaching needs to help students to

- ***stay motivated to learn / achieve.*** Adolescents are most effectively motivated to achieve in ways different from those for younger students. They are more likely to stay motivated to learn if they see that
  - curiosity and enquiry are valued, that it is acceptable to ask questions as they learn.
  - that what they already know is valued and relevant.
  - they have some control over how they will learn.
  - believe that they can learn the idea successfully, that we believe that they can learn it.
  - see that there is some payoff for them to learn the idea.
- ***reflect both on the ideas they are learning and how they learn.*** Adolescents can 'replay' and analyse earlier experiences and decide what 'might have been', identify what worked for them in various contexts and select what they might do in the future. To be self-managing, they need to engage in this reflective activity.
- ***display what they know and to get corrective feedback for this.*** Each function involves students showing what they know. They show their change in knowledge in different ways. Showing what they know helps them receive corrective feedback. This is important for those who often feel 'all at sea' and unsure of where they are going.
- ***see themselves making progress.*** In line with showing what they know and receiving feedback, adolescents need to see themselves making progress. The teaching needs to include procedures for helping see themselves making progress.
- ***manage and direct their own learning.*** The teaching needs to allow students to learn to manage and direct their own learning and progress. They can learn to use each function independently and see how it works for them.
- ***learn in a range of contexts.*** Adolescents are frequently expected to learn in large-group expert-student contexts. They need to have access as well to individual learner interactions and to small group peer-centred co-operative and collaborative learning contexts. These are important; they help students to negotiate their knowledge, to support each other's knowledge and to learn one's identity in small groups.

**Activity** Select a student in whom you would like to foster more positive learning. Comment on the extent to which the student implements each key learning function.

key learning functions: The student	Student
has an explicit purpose or reason for learning the ideas	
has an impression of the outcome of the learning	
<ul style="list-style-type: none"> <li>• links the new information with what is known</li> <li>• believes she /he can learn key ideas successfully</li> <li>• has positive emotions linked with what she/he knows about topic</li> <li>• knows how to learn in formal contexts</li> <li>• can recode what she /he knows to match the teaching</li> </ul>	
knows how to learn effectively in specific contexts	
can decontextualise / abstract the new ideas	
usually responds positively emotionally to the ideas learnt	
learns the strategies to learn successfully	
sees her /him self making learning progress	
encodes efficiently the new idea in long term memory	
transfers and applies ideas in a range of situations	
automatises them	
practises organising the knowledge for display in assessment contexts	

**Activity : Analyse problems** Return to the frequently occurring problems you identified earlier. Select some, describe each from a learning perspective and recommend learning -based interventions.

problem	describe from a learning perspective	recommend learning -based interventions



## Incorporating the learner interactions into teaching

To illustrate the learning actions I will use a context in which I was recently involved. My task was to teach a class how fish breathe.

<b><i>A purpose for learning</i></b>	Fish are dying in Darebin Creek because they can't breathe in the water. How could you improve the quality of water in the creek so they could breathe better ?
<b><i>The outcomes of the learning</i></b>	Students imagine the outcomes of learning how fish breathe, what their finished project will look like. What will they say in it ? What might they know when they have learnt this topic?
<b><i>Learners make links with and use what they know about the topic</i></b>	
what they know about the topic	<ul style="list-style-type: none"> <li>• What do you do when you breathe ? Imagine you have been shrunk and you are travelling in a bubble of air your friend has breathed in. Where would you go ? What would you see ? Where does it stop ? In small groups students compiled a picture showing where the air goes ?</li> <li>• In a 'think-pair-share activity, students listed the words they thought of when talking about how they breathe (such as throat, lungs, blood, every part of the body). What actions do you do when you breathe ?</li> <li>• What happens when you run fast ? They review how their breathing changed when they engaged in exercise. Practise breathing. Breathe fast/ slowly. They did and described the breathing action.</li> <li>• Review : mouth –throat-lungs –blood –all parts of body</li> <li>• They imagined how their pets breathed and thought about the question : Do all living animals need air to stay alive ?</li> <li>• Imagine a fish swimming in water ? How does it breathe ? What things might make it hard for you to breathe ?</li> </ul>
what they know about how to learn it	students said how they would go about learning a topic, what they would do and how they would direct and focus their learning activity.
what they believe about themselves as learners of the ideas	<p>students saw that they</p> <ul style="list-style-type: none"> <li>• knew a lot about how other animals breathed</li> <li>• knew what to do to learn about fish and breathing</li> </ul>
what they don't know about the topic	students brain-stormed the topic in small groups and noted some questions they weren't sure of about how fish breathe. What will you do to learn more about how fish breathe ?
<b>A pathway to the goal</b>	<ul style="list-style-type: none"> <li>• What will you need to do to finish your project ?</li> <li>• What extra things do you need to learn ? What questions might you need to answer ?</li> </ul>

<b>Learn in specific context</b>	<ul style="list-style-type: none"> <li>• watched videos of fish swimming. Do they come to the surface to gulp in air ? What do they do as they swim ? What would happen if they tried to breathe through their nose ? Where is the air you will breathe in a minute ? Where is the air that fish breathe? How do they get it out of the water ?</li> <li>• inspected dead fish; identify the gills and the fins.</li> <li>• imitated how fish move as they swim.</li> </ul> <p>Students investigated each scenario, and</p> <ul style="list-style-type: none"> <li>• heard / read about how fish breathe, situations in which they have been helped to stay alive, visualised and discussed the story, paraphrased the key ideas.</li> <li>• learnt the key terms relating to how fish breathe</li> <li>• learnt the actions that fish use to breathe.</li> <li>• recorded their new knowledge about fish breathing in notes, pictures and showed what they thought.</li> </ul>
<b>Abstract or deepen the new understanding</b>	<ul style="list-style-type: none"> <li>• linked episodic, verbal and action aspects of how fish breathe ; said, wrote, drew, did ‘fish breathing.</li> <li>• examined whether all fish breathe in the same way and how fish that don’t have gills breathe, categorised fish on the basis of how they breathe, selected the main ideas.</li> </ul> <div style="text-align: center;"> <p>ways of breathing</p> <pre> graph TD     A[ways of breathing] --- B[lungs (us)]     A --- C[gills (fish)] </pre> </div> <ul style="list-style-type: none"> <li>• elaborated, extended their understanding through questioning; <ul style="list-style-type: none"> <li>• “When would it be hard for fish to breathe ?”</li> <li>• “Would fish breathe better swimming closer to the bottom of a river, near where the plants grow or closer to the surface because the air rises ? Would you catch fish better if your line was just below the surface of the water ?</li> </ul> </li> <li>• learn the conventional ways of communicating new ideas. They reviewed the key words such as gills, fins, dissolve, blood.</li> </ul>
<b>Invest positive emotion in the new knowledge</b>	<p>Students</p> <ul style="list-style-type: none"> <li>• discuss the value of what they knew now, how they could use it.</li> <li>• decided that it was their knowledge, that they did the learning, it was in their heads, they could make work for them.</li> </ul>
<b>Store what they have learnt in memory</b>	<ul style="list-style-type: none"> <li>• Say briefly what they have learnt about how fish breathe</li> <li>• Describe how it is similar to /different from what you knew about how animals breathe ?</li> <li>• Picture in your minds a fish breathing</li> <li>• Imagine yourself remembering the ideas.</li> <li>• Drawing an icon of the main ideas to remind yourself.</li> </ul>
<b>Identify how they learnt</b>	<p>What things did you do to help you learn about how fish breathe ?</p> <ul style="list-style-type: none"> <li>• Making links between ideas.</li> <li>• Making pictures in my mind.</li> <li>• Thinking of differences between us and fish.</li> </ul>
<b>Making progress as a learner</b>	<ul style="list-style-type: none"> <li>• What questions they can answer now that they couldn’t answer earlier ?</li> </ul>

<p><b><i>Automatise what they have learnt</i></b></p>	<p>Students linked fish breathing with ‘getting air out of water’ and ‘using gills instead of lungs’.</p>
<p><b><i>Transfer and generalise the knowledge</i></b></p>	<ul style="list-style-type: none"> <li>• explored and analysed the new understanding from a range of perspectives, for example, <ul style="list-style-type: none"> <li>• Would the gills in all fish have the same shape ?</li> <li>• Do bigger fish have more gills ?</li> </ul> </li> <li>• transferred the ideas (near and far transfer). Would a fresh water fish be able to breathe as well if it <ul style="list-style-type: none"> <li>• swam into deeper water ?</li> <li>• swam into warmer water ?</li> <li>• swam into sea water ?</li> </ul> </li> <li>• What fish might be more likely to survive in 100 years ?</li> <li>• categorised problem solving contexts in terms of how useful ideas are <ul style="list-style-type: none"> <li>• Why is it harder for fish to breathe in muddy water ?</li> <li>• How would dangerous chemicals in the water affect how well fish breathe ?</li> </ul> </li> <li>• used the knowledge in open-ended creative problem solving: They were asked to work in pairs or groups of three and were given the challenge : <i>You are member of committee advising the Darebin Council about what steps to take to stop the fish from dying in the Darebin Creek. What would you suggest the council do ?</i> The groups, over ten minutes, came up with a number of possibilities : <ul style="list-style-type: none"> <li>• Pump air into the creek; this group drew a picture of pumps pumping air into the creek at various points.</li> <li>• Put air into water under pressure and put it in river</li> <li>• Keep water cool; have water coolers ; this group drew a picture of the creek flowing past big coolers.</li> <li>• Make the creek salt water and put in sea fish; this group thought of converting the freshwater creek to sea water.</li> <li>• Grow plants in the water</li> <li>• Breed special fish that need less air to live</li> <li>• Give fish places where they can be safe from fishermen</li> <li>• Make ‘air spaces’, ‘air bubbles’ in the water</li> <li>• Put pipes into the water that allow air to get into it</li> <li>• Slow release air tablets.</li> </ul> <p>The students valued hearing ideas that other groups had. Each group then agreed to draw a poster showing their suggestion.</p> </li> <li>• created new episodes for the ideas. In the future the world may need fish to grow faster. Imagine what fish that grew faster would look like</li> </ul>
<p><b><i>Organise what they have learnt for assessment</i></b></p>	<ul style="list-style-type: none"> <li>• Work in small groups, design and write a poster that showed what they judged to be important to say about how fish breathe.</li> <li>• Talk to the class about one aspect of their group poster; each student selected one aspect.</li> <li>• Work in small groups, make up a quiz of 5 questions for another group, who assembled and wrote their answers to the test. Work individually, write 10 important questions about how fish breathe and their answer to each.</li> </ul>

### Challenge students to learn

**What teachers can do** Use tasks that are challenging, meaningful and effective. Provide the initial challenge to learn by providing an 'arresting opening' to the teaching, to present ideas as

problems to be solved	
challenge questions	
ideas that don't fit with what they know, ambiguous situations	
having unexpected outcomes	
novelty, use fantasy and imagination	
things useful for us to know or do	
open-ended tasks	

Students can work together in co-operative learning activities to frame up a group response to a challenge. They can co-operatively develop a group set of goals that will guide the group learning.

### Let students see where they will end up

We are also more likely to learn if we know where we might end up, what we will learnt, what the outcome will be / can do for us, how it can help us, its value. This involves showing students what they will actually know or be able to do. It is more than simply stating a behavioural objective. Rather, it is the students actually seeing the outcome being modelled for them.

**What teachers can do** Have students imagine the learning outcomes, estimate their usefulness:

<i>This is what you will be know / be able to do when you have learnt ...?</i>	
What will you know / be able to do having learnt	<i>What might you know about the feeding habits of sharks ? What might be some questions you be able to answer?</i>
Visualise outcomes	<i>"Visualise your project on the solar system. What will it look like ? What will it have in it.</i>
Use of outcomes	<i>You will have finished reading and summarising this topic / able to factorise these types of tasks.</i>

Have students, either alone or on groups,

- develop their own 'learning pathway or journeys' through subjects or topics they are learning.
- use these as map their progress through the topic.

**Stimulate what students already know**

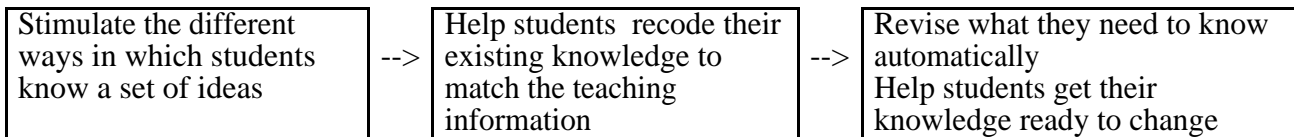
**Learning starts with what students know** The different ways in which we can know the banking revolution and what it means for you : you can

imagine yourself in your local bank or at an ATM	experiential or episodic knowledge.
general concepts re banking, investing and borrowing money	abstract knowledge.
language used to talk about banking	domain specific language
the actions you do when you bank; knowing 'how to'	procedural knowledge
emotional reaction to banking	attitudinal knowledge
recall how you learn / think about banking issues	knowledge of how to learn

Knowledge in these areas work together to influence how we learn. Effective teaching takes account of what you know in each of them.

Teaching information  ----->	<ul style="list-style-type: none"> <li>• existing content knowledge ?</li> <li>• what the outcome of learning might be like ?</li> <li>• how to get there ?</li> <li>• how useful are the ideas once they have been learnt ?</li> <li>• is worthwhile embarking on the learning ? Are they likely to be successful</li> <li>• how will the teaching - learning be managed; what will they be expected to do to learn, what will they expect their teachers to do ?</li> <li>• what do they know about actions to take to learn; learning strategies, cognitive strategies ?</li> </ul>
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When we learn we change our existing knowledge.



- **Students differ in HOW they know** Different forms for storing existing knowledge

Question	Jan	Tom	Peter
What is 'winter'.	<i>Winter is a season. It's a time of the year when it is cold. It lasts for a few months. It's opposite to summer.</i>	Did actions that occur in winter; rain falling, put on raincoat	<i>It's cold outside in winter. I have to put warm clothes. It rained lots of days last winter and I got a cold</i>
Names two states other than the one you are in now	correct response		didn't answer but named states when asked " Have you been on holidays recently ?"
What does 'strenuous' mean ?	<i>When you are doing something, it is hard work and you get tired</i>	<i>Let me show you.</i> He did actions that show being strenuous	<i>You get hot and tired. You work hard. I saw a man riding a bike fast</i>
	Jan linked with other concepts that were either more general or more specific than winter.	Tom's knowledge was largely procedural	Peter links ideas that occur in the same place at the same time. He recalled personal experiences

**Episodic or experiential knowledge** Formal teaching frequently ignores students' episodic knowledge. Show that it is valued and can be used for learning. Students need to be intuitive about the topic, to talk about their 'feel' for it, possible 'hunches'. Useful teaching procedures include

• <i>What do you see in your mind/ think of when you hear ...?</i>	
• <i>When did you learn about ... ?</i>	
• <i>A feel for the ideas</i>	
• <i>Collect pictures of what you know about ...</i>	
• <i>Select the episodes</i>	
• <i>What can I draw / act out about the topic ?</i>	
• <i>What is it usually like ? Pupils show what they know of summary or 'prototype' images</i>	
• <i>Make a picture of it</i>	

**Abstract knowledge** To stimulate this knowledge, encourage students to talk about some of the assumed concepts. Useful teaching procedures include:

• <i>What do they mean ? Check students' word-meaning readiness.</i>	
• <i>Suggest synonyms and antonyms for key terms in the teaching.</i>	
• <i>Brainstorm the topic .</i>	
• <i>Students interview each other about the topic</i>	
• <i>Ask students questions about the topic</i>	
• <i>Draw a network map</i>	
• <i>You write the article .</i>	
• <i>What can I say in 1 minute ?</i>	

**Procedural knowledge** Useful teaching activities to stimulate this knowledge include

• <i>What am I doing ?</i> Say the actions in words	
• Brainstorm the topic for actions	
• <i>What would you do when you hear ?</i>	
• <i>How would you do it ?</i>	
• <i>How would you say ( actions the students see done ) ?</i>	

**Our knowledge is integrated.** Semantic, episodic and procedural aspects we know about a topic are linked into broad structures called 'schemata'

- **Brainstorm episodes, abstract ideas, procedures** For topic on *Elections*..

	<i>idea 1</i>	<i>idea 2</i>	<i>idea 3</i>
episodes	<ul style="list-style-type: none"> <li>• read Letters to Editor</li> <li>• collect policy pamphlet</li> </ul>	<ul style="list-style-type: none"> <li>• see candidate on TV</li> </ul>	those who can vote <ul style="list-style-type: none"> <li>• in Council election</li> <li>• for class captain</li> </ul>
abstract ideas	<ul style="list-style-type: none"> <li>• campaign platform</li> </ul>	<ul style="list-style-type: none"> <li>• candidate</li> </ul>	voters
procedures	<ul style="list-style-type: none"> <li>• debate, argue</li> <li>• say opinions, promises</li> </ul>	<ul style="list-style-type: none"> <li>• stand for election</li> </ul>	<ul style="list-style-type: none"> <li>• draw map of electorate</li> <li>• collect names of voters</li> </ul>

- prioritise ideas, identify the more important aspects
- infer or anticipate other ideas using their schemas.

List down 3 ideas you will expect students to know in a class you will teach next week. Note episodes you will assume they know, key actions and the abstract ideas.

	<i>idea 1</i>	<i>idea 2</i>	<i>idea 3</i>
episodes (experiences)			
abstract (semantic) ideas			
procedures			

- **What episodic, abstract, procedural questions can you ask about...?** The topic could be Living in Antarctica, factorising quadratic equations, 'Hamlet is really mad'

Type of question	Question	Existing knowledge
abstract	What abstract ideas are linked with 'really mad'	insane, illogical, depressed obsessive, paranoid, not thinking sensibly, unbalanced, mentally unsound
procedural	What would Hamlet do if he were really mad ?	<ul style="list-style-type: none"> <li>• Act illogically, not sensibly</li> <li>• Do unpredictable things</li> <li>• Do things without good reason</li> <li>• Say things that don't 'follow'</li> </ul>
episodic	What episodes in play show Hamlet is really mad	<ul style="list-style-type: none"> <li>• Hamlet- "I am essentially not in madness but mad in craft"</li> <li>• drives Ophelia mad, fights with her brother over her grave</li> <li>• in Act III is the only one to see the "ghost",</li> <li>• driven by his madness to the brink of matricide</li> <li>• takes the life of the "unseen good old man"</li> <li>• seems insane to his closest, most trustworthy friends</li> </ul>

- Tell your partner all you know about .... Write a newspaper article

- Knowing how to use existing knowledge

### Students recode what they know to match the format of the teaching information

Student A knows anticlines and synclines in verbal way	Student B has images, episodes of anticlines and synclines	Student C understands anticlines and synclines as actions
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students need to listen to discussion about anticlines and synclines and then read

Students B and C know the ideas in forms that are hard to match with the teaching information.

recode into verbal form by talking  
 experiences -----> say ideas in sentences, say main idea, draw in network  
 episodes recode into action form  
 -----> do the actions, procedures in sequence

- What does this picture remind you of ?
- What do these mean to you ? Give the same 10 topic words to groups.
- How well students use each code

### Getting your knowledge ready to change

- Students' knowledge is ready to change when it is in a form that matches the teaching information.
- they are aware of what they do and don't know about the topic.
- What do / don't I know about this topic .

Types of questions	Application to the eight times table : Can they
Do they know conceptual aspects of the idea ? Can they link it with other ideas ?	<ul style="list-style-type: none"> <li>• use synonyms to talk about the eight times table ?</li> <li>• explain the pattern on which the eight times table is based, link table with counting in steps of eight ?</li> </ul>
Can they do the procedures that go with the idea ?	<ul style="list-style-type: none"> <li>• say how to work out the eight times table ?</li> <li>• recall some of the eight times table items ?</li> </ul>
Can they recognise episodes of the idea ?	<ul style="list-style-type: none"> <li>• recognise real life instances of the eight times table ?</li> <li>• say word problems base on the eight times table items ?</li> </ul>

### What students know about how to learn

Most students know how to learn. It is useful to identify two types of learning actions

how to act on ideas	visualise, say, reason by analogy, infer, summarise, question
how to direct / manage learning	deciding to visualise, monitoring how close we are to our goal, planning how to tackle task.

Do students have the required self-scripts to

keep themselves on task ?	plan how they will learn ?	link ideas, to monitor the effectiveness of their learning progress ?	recognise when they find learning difficult and take alternative actions ?
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Show students similar familiar learning tasks to those to be used in the teaching and have them

- say how they think / learn them, what they know about doing them.
- describe how they might manage and control their thinking and learning, how will they



- plan their way through a learning activity,
- decide how to learn the ideas
- monitor their progress through the activities, see how close they are to their goals
- review, consolidate what they have learnt.

Different tasks have their own scripts. To write a narrative, students may tell themselves

- First I'll think the topic. What do I know about it ? What images do I see in my mind when I hear it ? I need to write down the key ideas.
- Have I said where and when the event happens, who the main people are ?
- What will happen first ? What will happen second ?....
- How will I say each part in sentences ?

### **Let students see they can learn it**

Learners have beliefs about how successfully they can learn a topic (their 'self efficacy' ). They make this judgment quickly and unconsciously and independently of their actual level of ability. It is based on how they interpret their past performance.

Performance history	<ul style="list-style-type: none"> <li>• Can they be successful</li> <li>• whether and how to pursue the learning</li> </ul>	<ul style="list-style-type: none"> <li>• level of engagement, perseverance on the task, how likely they remain challenged</li> <li>• the ways of thinking and learning they will use</li> </ul>
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### ***What teachers can do***

- develop positive judgments of past history (past failure reduces self efficacy), let them see that what they already know is useful and relevant to what they are learning.
- vicarious experience,
- their emotional arousal *How have I felt about these ideas previously*
- verbal persuasion. *How will you go about learning ?*

**Let students see where they will end up**

We are also more likely to learn if we know where we might end up, what we will learnt what the outcome will be / can do for us, how it can help us, its value. Learning outcomes can be either convergent or divergent. Have students

<ul style="list-style-type: none"> <li>• imagine the learning outcomes,</li> </ul>	<i>This is what you will know / be able to do when you have learnt .. Visualise your project on the solar system. What will it look like ? What will it have in it.</i>
<ul style="list-style-type: none"> <li>• estimate the usefulness of the outcomes</li> </ul>	<i>You will have finished reading and summarising this topic / able to factorise these types of tasks</i>
<ul style="list-style-type: none"> <li>• develop a learning pathway or action plan</li> </ul>	
<ul style="list-style-type: none"> <li>• periodically negotiate the next part of the 'journey' with them</li> </ul>	
<ul style="list-style-type: none"> <li>• show them where new ideas are on their journey as they learn</li> </ul>	
<ul style="list-style-type: none"> <li>• show how each idea is an extension of ideas learnt, how it fits in with them</li> </ul>	<i>"You already know about .. / how to do ...Now you are going to learn .... / how to ..</i>

Students, alone or on groups, develop their own 'learning pathway or journeys' through topics they are learning. Use this to help students see that their learning programme is consistent and predictable.

## Learning the new ideas in particular contexts

The first step in learning a new idea is to learn it in specific contexts or situations. Real-life contexts are useful because students' existing knowledge of the context can scaffold the learning. Gradually students can learn to generalise from these.

• ***Allow students to learn the new ideas first in the episodic or action codes.***

Teach a new idea first in the episodic code ( in a real-life context). To teach about prejudice in *To Kill a Mocking Bird*. Students explore prejudice in specific contexts today. They identify

contexts in which prejudice occurs. Students <ul style="list-style-type: none"> <li>• visualise specific episodes of prejudice.</li> <li>• draw their imagery, describe it to others,</li> <li>• make poster or snapshot of the ideas, experiment with ideas in different contexts.</li> </ul>	words that indicate/ suggest prejudice, <ul style="list-style-type: none"> <li>• suggest ways of talking about it , write news-paper article about it,</li> <li>• imagine interviewing someone about prejudice.</li> </ul>	Feelings that occur with prejudice.	actions that suggest prejudice; students do actions that show it, model them
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• ***Allow students to learn the new ideas by questioning their existing knowledge and the new ideas***, by re-analysing their past episodes, trying out what they think, debating aspect of the ideas with peers. This is a process of negotiating understanding through discussions. A key aspect of this involves students asking and responding to questions, for example,

- search questions such as "*What does this remind me of ? What did I do when I had similar learning tasks in the past ?*"
- linking questions such as "*How is this like .....? How it is different from ... ?*"
- clarifying questions such as "*But what about .. ? Do you mean.. ?*"
- cause-effect questions such as "*Why did ..... ? If .... happens then will .... happen ?*"

They may need to have the risk taking and questioning behaviours modelled and be encouraged to think aloud, share their impressions and thoughts with other, change their minds, look at ideas in different ways, engage in group problem-solving.

For some content areas you can use question sequences that lead them along a path from their episodic knowledge to the new idea. Example : helping students to use their existing knowledge of energy conversion by the muscles during exertion to link aspects of existing knowledge:

Type of knowledge	Students' learning activity	Example
specific episodes, analyse each, identify shared features, (existing episodic knowledge)	think of particular relevant experiences. What do they share ?	<i>You run 10 km, you cycle for 40 km, you carry a heavy load up stairs. What do all of these experiences have in common ?</i>
link existing episodes in cause-effect	make explicit the causal links in the episodes	<i>When you physically exert yourself strenuously, how do you usually end up feeling ? (tired, thirsty, hot, sweaty, etc).</i>
link experiences in new way (new awareness from existing episodic knowledge)	look for new links, possibilities in existing knowledge, think intuitively	<i>How do your muscles feel while you are using them during exercise ? (Tight, taut, tense) How do they feel when you are not exercising them, not using them ? (looser, not so tight).</i>
existing episodic----> abstract knowledge	analyse examples / instances for shared concepts / ideas	<i>When you exercise, your body feels hotter. Your body produces heat. What do people do to produce heat in their homes ? (Burn wood, oil, use electrical energy, etc). What do we call materials that we burn to produce heat ? (fuel)</i>

recall other relevant aspects of abstract knowledge	recall /review other relevant information re the concept	<i>How do fuels work ? Fuels work to produce heat. They use oxygen. The fuel gets used up.</i>																				
new definition of fuel (new abstract knowledge)	broaden abstract knowledge of key concepts	<i>How is this like what our muscles do ? Our bodies also burn up fuel to produce energy. Where does the body's fuel come from ? (The food we eat, chemicals in our body/ stored in the muscles). The knowledge change can be shown as</i> <div style="text-align: center;"> <table style="margin: auto;"> <tr> <td style="text-align: center;">fuel</td> <td style="text-align: center;">-----&gt;</td> <td style="text-align: center;">fuel</td> <td style="text-align: center;">fuel</td> </tr> <tr> <td style="text-align: center;">coal</td> <td></td> <td style="text-align: center;">in house</td> <td style="text-align: center;">in body</td> </tr> <tr> <td style="text-align: center;">wood</td> <td></td> <td style="text-align: center;">coal</td> <td style="text-align: center;">comes</td> </tr> <tr> <td style="text-align: center;">electricity</td> <td></td> <td style="text-align: center;">wood</td> <td style="text-align: center;">stored in</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">electricity</td> <td style="text-align: center;">from food muscles</td> </tr> </table> </div>	fuel	----->	fuel	fuel	coal		in house	in body	wood		coal	comes	electricity		wood	stored in			electricity	from food muscles
fuel	----->	fuel	fuel																			
coal		in house	in body																			
wood		coal	comes																			
electricity		wood	stored in																			
		electricity	from food muscles																			
new abstract knowledge requiring intuitive links and scaffolded by existing episodic knowledge	think of possible new experiences that may be linked with changes when you use fuel	<i>When we produce energy, how does the fuel change ? (The chemical changes / it uses up oxygen..). When you exercise, does anything suggest you use up oxygen ? (You pant, you are out of breath). Does your panting stop immediately after you stop the exertion ? What does this tell you about the chemical change ?</i>																				
new abstract knowledge requiring intuitive thinking about episodic knowledge	Intuit about possible cause and effect	<i>What does the weak feeling you have when you exercise strenuously mean? (... that you have used up chemicals stored in your muscles). What foods are supposed to give you most energy ? (glucose.....)</i>																				
generalise new experiences (existing episodic----> abstract knowledge)	Explore abstract cause and effect	<i>When you exercise, your body feels hotter. Your body produces heat. What do people need to do to produce heat in their homes ? (Burn wood, oil, other fuels, use up electrical energy, etc).</i>																				
new abstract knowledge with intuitive links and scaffolded by existing episodic knowledge		<i>When we use up fuels in heating our houses we produce waste products. How do we get rid of them ? When we produce waste products from our muscles using energy, we also need to get rid of them ? How do you think we do it ? Danger to the body in not getting rid of wastes from exertion ?</i>																				
new abstract knowledge is consolidated		<i>When you exert yourself, your muscles tighten or contract. To do this they need energy. The energy comes from particular chemicals that act as fuels. Part of the chemical change involves using up oxygen and water.</i>																				

From this type of questioning in different areas of knowledge, students can work in small groups, briefly tie the various strands together and consolidate them:

*When you exert yourself strenuously, your muscles tighten or contract. To do this they need energy. The energy comes from particular chemicals that act as fuels. Part of the chemical change involves using up oxygen and water.*

This discussion and consolidation can provide the basis for teaching the particular chemical reactions involving chemical changes during exertion.

Analysing personal experiences lead to a more abstract version of the idea:

episodes	analyse each episode	abstract understanding
Tasmanian holiday episode; a large area of Australia with its own laws and a border	----->	States of Australia
Queensland holiday episode; a large area of Australia with its own laws and a border	identify shared features	<ul style="list-style-type: none"> <li>• Tasmania</li> <li>• Queensland</li> </ul>
	decontextualize	fit into networks, categories

**Allow students to build ideas in each way** You can integrate these different ways of learning an idea into a framework. You can use the following template to design activities that develop the idea in each way; begin with episodes and actions and re-code it in verbal and decontextualized ways.

<b><i>Learn new idea in particular cultural, social or historical contexts</i></b>	<b><i>Link new ideas in scientific-mathematical ways</i></b>	<b><i>Link emotions/feeling with new ideas</i></b>
How has evaporation been used in history ? (to obtain drinking water, for refrigeration) How is evaporation used in different cultures ? What problems does it cause ? How can communities control it?	Is there the same amount of water in a room when a dish of water evaporates? How has it changed? - same amount, change of state What causes evaporation ? What matches evaporation for solids ? Why / when do things evaporate ?	What feelings would you have if you evaporated (light-headed) How might liquids that are evaporating feel ?

### EVAPORATION

<b><i>Link new ideas in words, in sentences, in more abstract ways</i></b>	<b><i>Link new ideas in particular contexts and in images</i></b>	<b><i>Learn the actions that go with the new ideas</i></b>
Brain-storm ideas -- concept map ---->network map Paraphrase, summarise text that explains evaporation. An evaporating liquid is interviewed. What would it say ? Ask 6 hard questions about evaporation. Write a story / play "Adventures of a liquid evaporating" When else would you use the word 'evaporate' Discuss situations involving evaporation, what happens.	Imagine, draw, collect situations in which evaporation occurs * water on a dish * clothes drying on a line * petrol on the body of a car * vapour rising from sea * dry ice foaming. Draw a comic strip of petrol evaporating from body of a car Useful icons for evaporation ? Classify instances of evaporating.	Make an action model of evaporation (for example, corks flying out of a shaken jar). Small groups of students act out a gas evaporating. Is there a reverse action to evaporating ? Acting out a gas evaporating; rising up, stretching, spreading out.

• ***Which ways of learning does our teaching support ?***

code	Does the teaching encourage students to
Verbal	think about the ideas in words, paraphrase or summarise them, to work on links between verbal concepts ?
Math/ scientific	learn ideas in symbols, abstract, ideas, to think about them in a general way ?
Episodic	think about ideas in real-life contexts, to visualise them ?
Action	use actions to represent ideas, to imagine the ideas changing ?
Interpersonal	take account of the cultural backgrounds of students, help them learn in groups ?
Affective / mood	understand their feelings when learning ideas and foster attitudes to them ?
Rhythmic	learn ideas by using rhythm, rhyme or rote ?

This analysis reduces the possibility of a mis-match between teaching and preferred ways of learning.

- ***Cue students to think about the idea in different ways*** for example, remind students to visualise, verbalise or to represent ideas as actions to do so.
- encourage students to cue themselves to use the various codes.
- ***Teach students to switch ways of thinking about ideas.*** Students writing a review of "To Kill a Mockingbird" can make a mental 'videotape' and then re-code it to a verbal form to show their understanding in connected prose.

*"What is the capital city of New South Wales ?"*

verbal code; network links NSW, Sydney and capital city
--

episodic code; capital city may not be in episode with Sydney and NSW.
---

action code; capital city not in episode
---

Students can recode ideas when the new code is sufficiently well developed to accommodate the ideas. They need

- to learn how to use each code, its features
- to know that it is acceptable to recode, that they are allowed to do this
- to learn how to recode, for example, how to talk about nonverbal images of an idea
- to have time to recode and to gradually automatise the recoding.

**Learners act on the ideas in each garden bed using 2 types of strategies**

***What teachers need to know.*** Learners think about ideas in two main ways:

Serial - analytic strategies	Synthetic-global strategies
Work on bits of information	Look for overall patterns, scan,
Learn step by step, delay giving answer	Leap in and answer quickly, guess impulsively
Focus on detail and specific facts	Focus on overall idea, miss or ignore detail
Think in one direction provided by teacher	Think by moving in several directions at once
Take things apart, work on the parts	Think in wholes; don't take things apart
Follow other people's directions well	Prefer to direct, manage their own learning flexible in their thinking, unanswered questions.
Prefer less flexible convergent learning	Prefer flexible, open-ended learning contexts
Learn other's explanations, procedures	Prefer to work out own explanations
Analyse, sequence ideas in learnt ways	Arrange, sequence ideas less predictably.
Reflect about an idea often for a long time	More likely to 'guesstimate'

***What teachers can do*** Take account of and foster both types of strategy in our teaching:

- Teach the broad, overall idea first and then the specific details and analyse ideas. Students may have difficulty beginning a large task that requires them to identify components, such as a research project, conventional science report. They need to practise planning their way through these types of tasks.
- allow students to put ideas together in unusual creative ways and reach personal solutions quickly, link ideas in new ways, give opinions, look at ideas in novel perspectives, think flexibly
- 'get above' the detail to see the 'big picture'
- include open-ended tasks
- allow them to manage aspects of the learning.
- let them see it is acceptable to take risks

**Encourage intuitive learning** Intuitive thinking involves making novel links between ideas.

- the connections are not rationally-based and non-analytic.
- terms for intuitive thinking; hunch, gut-feeling, 'just know', intelligent guess, possibility.
- comes out of sets of experiences (episodic knowledge).
- allows learners to integrate 'big' ideas, make large steps in learning, think creatively.

***What teachers can do***

- Allow students to operate intuitively at the beginning of a learning unit, for example, to suggest what they think are possible outcomes, explanations, ways of doing something. Having worked through the ideas, they can compare their intuitions with the outcomes. While they can explain their intuitions to others, they should not be expected to argue them rationally.
- Help students learn the value of intuitive thinking and when it is useful.
- Discuss with students earlier intuitive discoveries made in the area of study. In science and maths related subjects, these can be drawn from the history of science.

Encourage students to use rational knowledge to build intuitive knowledge (imaginal episodes)

**Learners manage / control how they use their thinking spaces and remain focused**

The thinking / learning space, where learning occurs has limited capacity. Adolescents can handle between 5 and 9 items of knowledge. Ideas that are handled automatically take up least space. To help students use their thinking spaces most effectively

- present ideas in an organised way, make links clear and salient , avoid heavy load on the thinking space
- teach students to organise the ideas in various ways, for example to
  - break the tasks into smaller sub-tasks, decide how they will 'take bites' of the information at a time, scan over the data and look for patterns in the input, look for the main idea
  - rehearse the knowledge : say it over and over to themselves
  - elaborate it, by linking items to be remembered in a sentence or image, for example, *The colours of the rainbow are Roy G Biv*
  - *My very excellent men, just show us nine planets.*
- build links between ideas so that one idea stimulates others, for example, "If ... happens, it means ....."
- avoid filling the thinking space with unnecessary information, the effect of "*I know I won't be able to do it. Everyone will think I'm a fool...*", worrying about tomorrow's maths test
- use advance organisers for organising information. Students can ask and answer sequences of questions about the ideas, for example, *We're learning about how sharks eat. What questions might we learn the answers to*

What do they eat ?	When do they eat ?	How do they catch food ?
	<i>feeding habits of sharks</i>	
How much do they eat ?		How are young sharks fed ?

- build ideas into a visual imagery mental videotape / narrative, put all of the ideas into a single picture in a meaningful context, make the items as concrete and as 'imaginable' as possible, use imagery or actions as mediators,
- say the items to be remembered in a jingle; this helps encode it in the rhythmic / rote code
- have students record in notes, drawing, the key ideas as they encounter them, for example, jot down the key words as they read text, listen to or watch a presentation they can . This reduces the load on the thinking space, as long as the act of writing is automatic.

**Learners show their change in knowledge in different ways.**

Allow students to show what they are learning first in the least attention-demanding ways and then the conventional ways as a second step. To show what they know in writing, they can

- talk about what they know and record it in a diagram.
- work in small groups with each member of the group talking and then writing a part.
- look at each student's writing attempt, make suggestions about ways of improving it (in expression, spelling, accuracy, etc).
- write a group outcome by combining the outputs of the individual students.

- each student uses the group contribution as a model for writing her / his complete outcome.
- the group compares its group output with a written 'standard' teacher or text version.

***Proceduralise what they know.*** If students need to do things as a result of having learnt, for example, make an item, apply or use the new idea in particular contexts, make sure that they can convert their knowledge to a procedure.

**Use cooperative, collaborative learning where possible** in which students

- co-operate to solve problems, build word definitions,
- write problems and mock tests for other groups of students,
- share their ideas about a topic, discuss ideas with peers, work in groups to decide what questions might be useful to ask about a topic to be learnt,
- take turns to be the teacher in explaining or justifying an idea, writing problems, suggesting how the ideas occur in everyday life or in hobbies,
- discuss how they might solve a problem or a task, share with others strategies they used,
- discuss what were the main ideas in a topic, the best ways of studying it
- use puzzles, games and related activities, develop their own games that give them the opportunity to apply their knowledge
- engage in reciprocal teaching procedures for learning new maths ideas .

There are several related attitudes that we can model in our teaching. We can show them that

- (1) at the beginning of a task, we don't have all of the answers, but that, by discussing, trying out ideas, deciding what questions to ask, together can solve the task.
- (2) we are keen and motivated to change our knowledge of the topic and that the working together is not only for our students' benefit but is also helping us.

Particular co-operative learning contexts include

- scripted cooperation procedure; students take part of the content and practise teaching it to the rest of the group.
- reciprocal teaching; students work through the teaching information in small groups and each take responsibility for teaching a part of it. As the group works through the ideas, each student takes turns to lead the others to
  - summarise the topic
  - ask questions about its main points,
  - identify difficult parts and work on them by re-reading, etc,
  - make predictions about what might happen next .
- Jigsaw procedure



**Abstract ideas you are teaching**

*Teach students to analyse and generalise the ideas*

<ul style="list-style-type: none"> <li>compare episodes, generalise across them, note what they share, how they differ, identify their essential aspects</li> </ul>	
<ul style="list-style-type: none"> <li>use them in making analogies</li> </ul>	If this is how you write a letter of complaint in Australia in 1997, how would you have written one in England in 1897 ?
<ul style="list-style-type: none"> <li>summarise the ideas</li> </ul>	<ul style="list-style-type: none"> <li>Suggest a headline / title for this set of ideas ?</li> <li>What subject area do this fit into ?</li> <li>Say the main ideas in three sentences</li> <li>What are the key words here / underline key ideas</li> <li>Write a summary / a table</li> </ul>
<ul style="list-style-type: none"> <li>make a general prediction or expectation about the ideas, a procedure or formula</li> </ul>	

**Help students categorise their knowledge** Help them add new ideas to existing networks by linking with more general / specific ideas. Include classifying activities in the teaching. They can

- categorise instances of each type.
- decide how instances of each type are alike and differ , discuss shared properties,
- describe what they will look for when classifying instances of each type
- produce their own examples of each type.
- make the key aspect stand out as salient as possible (using colour, a shared name or action).

Different topics have their own categorising systems. They can draw diagrams showing how it is linked with related categories they already know. Students learning about

- prejudice might categorise it as a type of hatred, a type of discrimination or a type of unfairness and draw it as

narrow-minded

biased

prejudice, intolerant

**Integrate episodic, abstract, procedural and emotional aspects of an idea.** Make sure students can answer the following types of questions:

<ul style="list-style-type: none"> <li>episodic: <i>In which real life contexts does it arise ? What ideas occur with it ? When is it used ? What images / icons can I use to remind me of it ?</i></li> </ul>	
<ul style="list-style-type: none"> <li>abstract : <i>What are more general / specific ideas is it linked with ?</i></li> </ul>	
<ul style="list-style-type: none"> <li>procedural : <i>What actions go with the set of ideas ?</i> Convert new ideas to procedures and action sequences.</li> </ul>	

Diagnose and remediate difficulties in student learning; when students have

- abstract without procedures they can explain why but not show how
- procedures without abstract they can show how but not explain why

- abstract without episodes - they know 'why' but can't use or transfer ideas
- procedures without episodes - they know how to but not when to.

***Teach the conventional ways of communicating the knowledge*** and have students gradually automatise these. Depending on the subject this may include

- learning new symbolism and ways of writing it, saying it.
- learning new writing conventions.

Useful activities may include

- transcription-dictation activities; students translate their knowledge into the new conventions.
- practise reading the new conventions.
- selecting situations in which they are used and evaluating how successfully they are used.
- analysing how the conventions are used to communicate ideas.

***Practise new knowledge, procedures, skills.***

**Students see themselves making progress in learning**

*Useful teaching procedures*

- *What have you learnt ?* Say, write, draw, demonstrate. Students record in a diary or log.
- *What can you do now that you couldn't do earlier ?* They tell each other .
- They tick off on their journey where they are now.
- Use devices such as the following format. New tasks are written on cards. Learners gradually move cards across as their proficiency improves.

New task	Not sure	More sure	Really sure	Do task perfectly
		$3(x-1) = 4$		$2x+3= 9$

Learners manage and control this system; they decide when a type of task is ready to be moved.

## Students examine what helped them to learn

'think aloud, learn to talk about how you think and learn, what you do as you work through tasks	
<i>How do you use reflecting on how you went about learning ?</i>	
<i>What did you do to learn the new ideas ?</i>	
keep a record of your learning actions, the learning actions that work for you	
share what you do as you work through tasks, try out other people's actions	
<i>What learning actions worked best for you ? When will you use each in the future ?</i>	
<i>How did you direct your learning / thinking ? How did you plan , monitor, review ?</i>	
What can you do when you have difficulty getting started, deciding what to do, 'get lost' while applying a procedure ?	
How can you speed up the time that it takes them to solve problems	
How can you see your way through problems,	
How can you see possible 'danger areas, dead-ends' etc.' coming up	

Ask students *What did you do to learn the new ideas ? What have you learnt about how to learn ?*  
To help students become aware and keep track of the strategies they use, have them

- discuss whether visualising or verbalising helped
- use a 'thinking journal' or a comic strip format using 'balloon thinking'
- learn the language for talking about their thoughts
- improve their strategy knowledge. There are two aspects you can work on here
  - knowing when and why to use particular cognitive strategies
  - given typical or possible tasks, having students
    - say what they believe about the tasks
    - suggest the cognitive strategies they might use

To teach new strategies,

- model, demonstrate the ways we learn
- student share what they do as they work through tasks and trial each other's actions, see how and if these help, add to their set of 'ground rules for learning

**Students respond emotionally to the ideas that they have learnt**

Students are more likely to be motivated to learn a set of ideas in the future if they link positive feelings with them now. When their knowledge is retrieved later, you want it to tell them that

- the ideas are useful and / or interesting to learn
- they can successfully learn the ideas
- learning the ideas will help them along their journey

Having learnt a set of ideas, have students

<ul style="list-style-type: none"> <li>• comment on how interesting / useful they found the ideas</li> </ul>	
<ul style="list-style-type: none"> <li>• value themselves as learners, see that their activity led to learning.</li> </ul>	
<ul style="list-style-type: none"> <li>• give themselves positive feedback "<i>Praise yourself for a job well done</i>"</li> </ul>	
<ul style="list-style-type: none"> <li>• comment on how they feel, it is acceptable to say "<i>This isn't bad; I feel I am making progress</i>", they are doing things they couldn't have done earlier</li> </ul>	
<ul style="list-style-type: none"> <li>• develop positive attitudes to learning; show you value               <ul style="list-style-type: none"> <li>• curiosity and preparedness to enquire</li> <li>• students reflecting on how they learn.</li> </ul> </li> </ul>	
<ul style="list-style-type: none"> <li>• attribute success and failure functionally</li> </ul>	

Make sure that students link positive emotional values with ideas they are learning and that they believe they have a reasonable chance of learning them.

**Store ideas in long term memory**

Remembering key ideas long-term involves two aspects;

- storing the information in memory by linking it to knowledge already there, and
- retrieving it by gradually reconstructing the information.

There are different types of long term storage; storing ideas in

abstract relationships	episodes in which the ideas were experienced, often in visual images in space and time	action sequences; kinaesthetic or procedural memory	emotions
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To store ideas in long term network memory students can

• say what they will remember as concisely as possible	
• link ideas to existing knowledge	<i>What do these ideas remind me of ? How are they like / different from what I know already ?</i>
• draw picture of main ideas, use concrete model, represent them in actions, use memory prompt or 'mnemonic	
• draw semantic or network map of the ideas, show links with existing knowledge.	
• describe when ideas might be used in future.	
• imagine themselves remembering the idea and say what is helping them do so.	

To facilitate review of ideas, teachers can write the following types of prompting questions

- *How will you decide what to memorise ?*
- *What things might make it difficult for you to remember this ?*
- *What things can you do to help you to remember these ideas ?*
- *When was the last time you had to remember something like this ? How did you do it ?*
- *Work in pairs. Come up with a strategy for remembering it .*

## **Automatize aspects of ideas learnt**

Once you have identified the key aspects of a set of ideas you intend to have students automatise, you can design activities in which students

<ul style="list-style-type: none"><li>• speed up recall and decide when to use ideas, for example, in matching games</li></ul>	
<ul style="list-style-type: none"><li>• practise repetitively parts at a time</li></ul>	
<ul style="list-style-type: none"><li>• automatize links between ideas, for example, in rapid quizzes, card games</li></ul>	
<ul style="list-style-type: none"><li>• recall ideas by using a few key words to cue the ideas</li></ul>	
<ul style="list-style-type: none"><li>• include automatizing activities into teaching<ul style="list-style-type: none"><li>• regular revision of key ideas</li><li>• rapid exposure to and processing of ideas</li></ul></li></ul>	
<ul style="list-style-type: none"><li>• emphasise links between ideas so that one idea stimulates related ideas<ul style="list-style-type: none"><li>• build links between ideas "If ... happens, it means ....."</li><li>• draw network diagrams of related ideas, hierarchies, concept trees</li></ul></li></ul>	
<ul style="list-style-type: none"><li>• practise recalling links between ideas</li></ul>	

**Apply, transfer ideas to novel contexts**

Learning how to transfer knowledge can be developed through small group co-operative learning activities. Students can learn to transfer the ideas gradually first with the support of models and then without their support. Develop activities in which students

- suggest situations to which they can transfer the ideas ? Where else might ideas be used ? They distinguish between situations in which the ideas could/ couldn't be used.
- suggest how they can decide where the ideas can be used ? They can suggest, draw, describe new situations in which the ideas could be used.
- note how far they can transfer with / without model ?
- create new episodes for the ideas.
- categorise problem solving contexts in terms of whether the ideas are useful and how.
- answer higher-level Bloom-type question sequence;

apply the ideas in other situations	
analyse the ideas	
put the ideas together in other ways	
evaluate the ideas	

- look at ideas from various angles, for example,

the positive aspects of the ideas	negative aspects of the ideas	how ideas might be used in the future
emotional aspects	<b>Topic</b>	
factual aspects		

- suggest questions the new ideas answer. Students
  - invent, ask and answer questions about the ideas,
  - convert ideas to question form, say the questions the ideas answer.
  - make up mock quiz for peers.

ideas	what	why	when	where	how	what if

- Develop open-ended aspects of the ideas, problems to be solved, use group problem-solving. Bring together all the thinking strategies students have learnt.



**Evaluate, assess learning outcomes**

Students are required to display their knowledge for assessment purposes. To do this most equitably, they need the opportunity to

- align their knowledge of the ideas with the assessment format. If the assessment tools
  - are identifying small 'bits' of knowledge at a time as in short answer tasks, students need the opportunity to organise their knowledge into matching bits.
  - are in verbal form, students whose knowledge is largely in nonverbal-imagery form need the opportunity to recode their knowledge into verbal form by talking about it.
- learn the characteristics of the formal assessment formats in which they will show what they know; in tests, extended essays and projects.

Teachers can have students

discuss how they believe they will be expected to display the ideas in the future.	
work in small groups to write assessment tasks for peers, make up mock tests	
practise recalling the ideas in different assessment tasks.	
analyse possible assessment tasks, discuss how well they assess knowledge	
suggest possible questions given the answers to questions	