

Knowing, learning and teaching

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The knowledge enhancement framework applied to learning

Learning involves changing what you know in one of more of the following aspects of knowledge:

Conceptual aspects : <i>What facts/ relationships comprise the topic ?</i>	<i>Identity as a knower aspects</i> : What is your identity as an knower of the topic ?	Attitudinal aspects : What attitudes do you have to the topic ?
Experiential aspects: <i>What experiences, imagery are part of the topic ?</i>	Topic you know	Emotional aspects : What feelings do you link with the topic ?
Procedural aspects: What actions are part of the topic ?	<i>Cultural identity aspects</i> : How do the different cultures to which you belong value /prioritize the topic ?	Thinking aspects : What ways of thinking characterize this topic ?

Approach to teaching :

- Scaffold the thinking students need to use to learn the new ideas you want to teach. Focus on gradual knowledge enhancement for the topic.
- Begin with what the students know
- Use a developmental sequence that matches how the brain processes information.

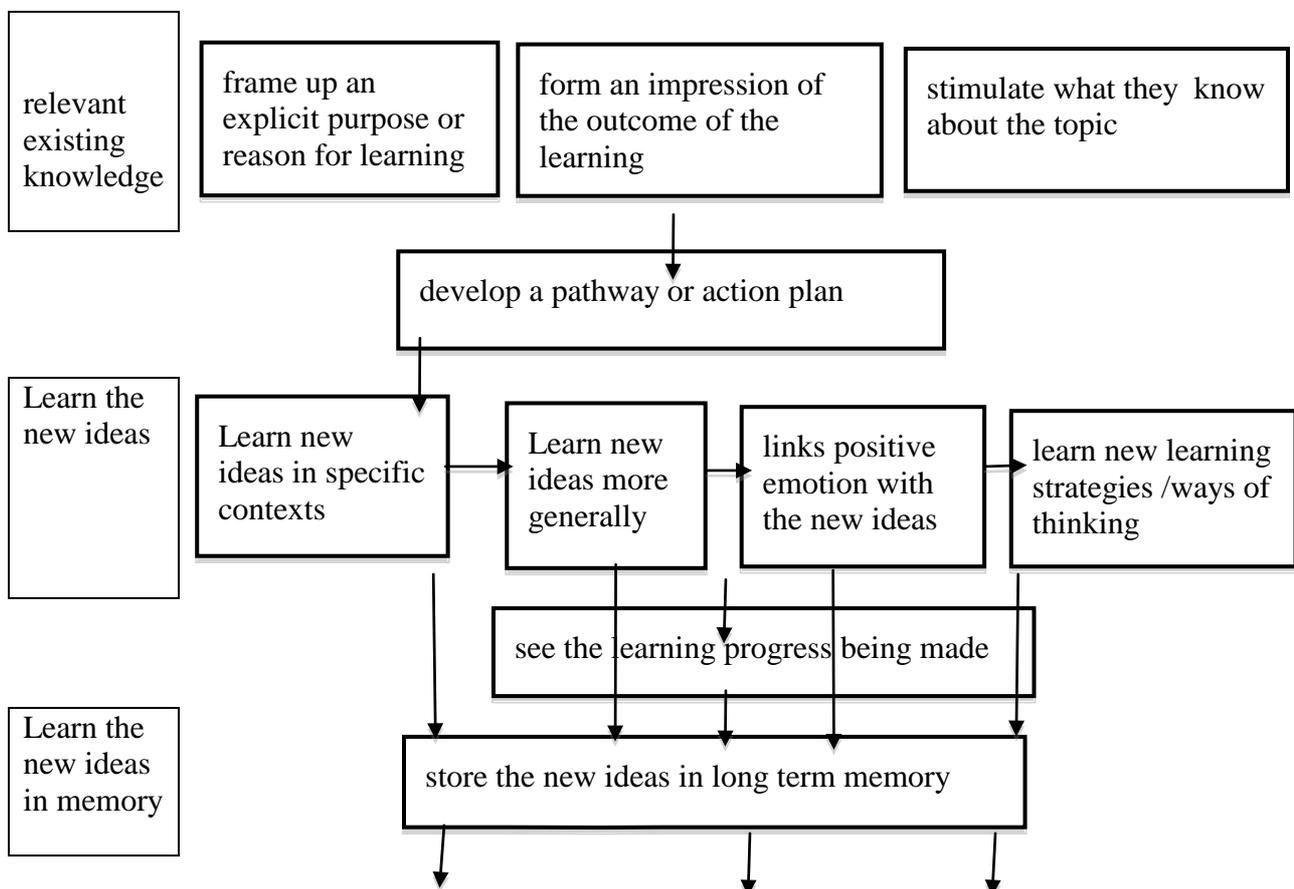
The knowledge change process involves the learner using a number of key thinking-learning actions: learners

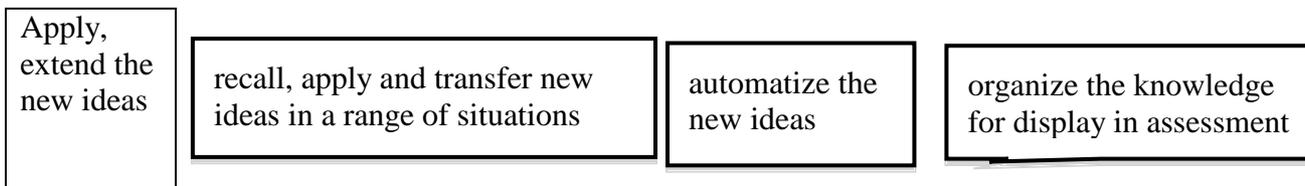
1. frame up an explicit purpose or reason for learning; they identify an idea, situation or an issue as a challenge or problem. Piaget called this a state of 'cognitive conflict'.
2. form an impression of the outcome of the learning. They form an impression of what the outcome could 'look like' . This is their vision of the goal of the learning.
3. stimulate and use their relevant existing knowledge. This involves the range of aspects of knowledge discussed above. They learn new ideas by making new links in what they know.
4. develop a pathway or action plan. Learners see possible pathways to their goal; they know there are 'things they can do'. The pathway may not be fixed or 'set in concrete'.
5. change what they know, first in particular contexts. They can question what they know about a topic. They may be scaffolded to make the new links in examples or particular contexts. This matches Vygotsky's concept of the 'zone of proximal development'.

¹ Munro, J. (2007). A knowledge enhancement perspective on learning. This paper was contracted by OECD in July 2007 as part of the Alternative Models of Learning project for OECD Centre for Educational Research and Innovation.

6. decontextualize the new ideas. They reform their new understanding so that it is not embedded in particular situations. They recognize and apply the ideas more broadly to other situations, use them more independently and understand them in more general, transferable, abstract ways. Key actions are reviewing, analyzing and synthesizing and summarizing.
7. respond emotionally to the ideas learnt. They links positive emotion with the new understanding. They may be interested in them, value them and see them as useful of ideas. They need to see themselves as successful learners of the ideas (their self efficacy for the topic).
8. learn the new strategies they used to learn the new ideas. They reflect on and say the learning and thinking actions they used. This helps them use the ideas more independently..
9. see their learning progress. They review their progress and add to their self efficacy.
10. store the new ideas in long term memory. They use (are scaffolded to use) memory encoding and retrieval strategies.
11. recall, apply and transfers the new ideas in a range of situations. To do this, they may need to take ideas apart, analyze them, ask questions from different perspectives and re-organize them.
12. automatize the new ideas. Students need to practice parts at a time, automatize links between ideas, speed up recall and use.
13. practice organizing the knowledge for display in assessment contexts. They may convert ideas to questions, make up mock tests, questions, practice organizing ideas for test group questions for peers.

The sequence of learning interactions is shown in the following:





A one-directional linear sequence is not intended here. While the three phase knowledge model largely describes how the transformations occur, learners can move between the phases in less restricted ways. They can, for example, retain their episodic conceptual knowledge in long term memory; they don't need to wait until they have transformed it to an abstract conceptual form and to retain that.

Within each phase, two or more of the relevant types of learning activities can occur at once. What does change during each phase and across the various phases is how learners allocate their learning attention or thinking space. At one time a learner may invest most of their working memory in learning about two or three specific episodes, then use it to identify what they share and then return to individual episode thinking by analyzing another episode to check their hunch. Learners may think about more than one aspect at a time and can also return to 'earlier aspects' to check and validate their current thinking.

A major limitation on the learning capacity at any time is the automaticity with which a learner can manipulate ideas; the greater the number of related or linked ideas a learner can handle automatically at once, the more thinking space the learner can allocate to learning and thinking about the ideas. As the complexity of a learner's knowledge increases, they can accommodate more knowledge in their thinking space and have greater capacity for learning and thinking about it.

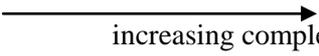
Automatizing what has been learnt. The new knowledge can continue to be re-organized so that learners use it more automatically. Ideas are re-prioritized and meaning networks elaborated and differentiated. Learners

- re-organize their knowledge around core concepts or "big ideas" that guide their thinking about the topic and that allow them to recognize features and patterns that others would not see.
- build more extensive differentiated and elaborated conceptual clusters around the core concepts that represent more complex meaningful relationships.
- use the clusters rapidly and efficiently to interpret and to think about information at a higher conceptual level; they chunk information relatively "effortlessly and automatically."
- organize their knowledge so that they can search it and retrieve selectively what is relevant to a particular problem; they build into it "conditional tags" that allow them to retrieve specific aspects when they are needed.
- manage and use their knowledge competently, for example, they monitor how they use it during problem solving and readily change direction or re-question what they know.
- move between multiple forms of it very easily (for example, between symbolism, logic and imagery), direct how they use it, possibly construct multiple interpretations and be prepared to make subjective judgments about these.

As well, the quality or form of each aspect can vary as learners change how and what they know about a topic:

1. A newly learnt topic may be understood in an attention-demanding, non-fluent way. Learners may
 - understand its parts, but not integrate them.
 - understand it in specific contexts rather than as a generalized proposition
 - understand a proposition superficially and not see its implications or inconsistencies.
2. With further learning of the topic, learners transform the knowledge to a more abstract, integrated form and may use established symbolic conventions. They can apply its more broadly and see analogies with other topics.
3. Further transformations of the knowledge, so that it is more like that of the expert knowledge, are described in the next section Review and Consolidation.

These gradual changes in the aspects of knowledge of a topic and how it is known are shown in the following diagram:

Aspect of knowledge	Form of the new knowledge		
			
	Known in a partial, non-fluent way	Known in abstract, integrated way	Known in an 'expert way'
experiential conceptual			
abstract conceptual			
strategic procedural			
dispositional and attitudinal			
contexts for learning the ideas			
how to learn both cognitively and metacognitively			

Each unshaded cell is potentially an up-dated aspect of knowledge. As a learner's knowledge a topic gets closer to the 'expert' form, the aspects of knowledge become more integrated and the relevance of separate cells decreases.

Teaching that drives this transformation may be necessary.

Knowledge in this form makes less demand on the thinking space. Topic knowledge in this form allows individuals to think much more effectively about it because they can use their thinking spaces much more efficiently. They can

- use it to construct 'creative' or 'innovative' ideas. They can see its possible use in unusual situations; they can make 'far transfer' of the ideas and 'think divergently' about it.
- use it to interpret, describe and solve problems and to resolve issues.
- see that it is, in some ways, incomplete.

Learners are more likely to form this type of knowledge when the teaching has them :

- explore, analyze, reflect on aspects of the new ideas from multiple perspectives and synthesize new understanding, for example, by applying the 'higher order' thinking

strategies conventionally identified by thinking tools such as Bloom's levels of questioning.

- explore the transferability and generalizability of the ideas in both near and far transfer analogic thinking, reflect on the analogy process as a means of generating creative knowledge.
- learn to engage in 'possibilistic enquiry' and thinking, ask "What if..." type questions and think in options ways in open-ended creative problem solving.
- create new episodes for the ideas using creative imagery thinking.

Mapping learning into effective teaching

The 'phases of learning ' and their implications for teaching.

Key learning functions	Teaching procedures
Stimulate what the learner knows	
have an explicit purpose or reason for learning, be in a state of 'cognitive conflict'	Introduce idea to be learnt as a challenge or problem
have an impression of the outcome of the learning, having a goal of the learning	Visualize the learning outcomes, develop a pathway or action plan
use what they know	Stimulate relevant existing knowledge
Learn the new ideas	
change what they know, first in particular contexts	Question existing knowledge, build new ideas by making new links
decontextualize the new ideas	Review, abstract, ideas learnt
respond emotionally to the ideas learnt	Invest emotion in ideas learnt; interest level, value, usefulness of ideas, students as successful learners of ideas
learn the strategies used to learn successfully	reflect on learning actions used
see learning progress being made	Students review progress
Review and consolidate what they learnt	
encode the new idea in long term memory	Encoding and retrieval strategies
recall and apply ideas in a range of situations	Take ideas apart, analyze them, ask questions from different perspectives, transfer ideas
automatize it	Students practice parts at a time, automatize links between ideas, speed up recall and use
practice organizing the knowledge for display in assessment contexts	Students convert ideas to questions, make up mock tests, questions, practice organizing ideas for test group questions for peers