THE PARADIGM SHIFT
MarkTreadwell.com

Learning to Learn

The Evolution of Creativity

Requests & Feedback:
Mark Treadwell mark@work.co.nz
www.MarkTreadwell.com

Alongside the complex and wonderfully varied relationships we form with each other, our greatest capacity as human beings is our capability to make complex predictions that provides us with our capacity for creativity and innovation.

Recent research seems to imply that humans have three interdependent learning systems that provide us with a unique set of learning capabilities. While a number of species have the capacity for episodic learning (rote & experiences) no other species appears to have the capacity to form new concepts 'on the fly' or apply those concepts in creative and innovative ways as we do. We may share 99% of our genome with Chimpanzees and 97% with Gorillas but that additional 1-3% makes an extraordinary difference to our capacity to think, learn, remember and apply this capacity in innumerable creative ways.

The learning process contains innumerable feedback and feed forward loops and there are some essential capabilities that are embedded in any learning process that results in understanding:

1. The setting of effective prompts
2. Clever Questioning
3. The Inquiry Process
4. The ability to constantly 'Reflect, Review & Iterate

The human ability to learn is extraordinarily complex but we are coming closer to understanding how the human brain learns and it is nothing like we expected. From that new neuroscientific basis we are now beginning to discover how we can make the learning process in schools far more efficient and effective for all learners.

What follows is what seems to be 'best practice in teaching and learning taking into account the requirements for lifelong learning, personalized learning and importance of being able to understand ideas, concepts and concept frameworks so that our brain can manipulate those via creativity to be innovative and ingenious.

Stage 1. Knowledge: Experiences

Knowledge elements are discrete 'data sets' that may be experienced or remembered by rote, and they can include sensory, emotional or factual content. The naturally occurring learning journey that happens spontaneously for billions of people every day begins with a prompt that causes us to become curious. Something happens; we sense something, we experience a feeling and we become intrigued. In schooling we would like to replicate that natural process as far as possible so that the learner owns the learning process and therefore have a greater motivation to understand what they are experiencing through the 'prompt'.

In order to replicate the natural prompt that initiates learning, educators now have to become increasingly creative in developing prompts that appear to be natural. Educators need to strategically place, introduce, incite, insert, prompts into the learning environment that encourage students to feel an emotion and a desire to learn more about the questions that the prompt promotes. Emotions are what drive our curiosity and curiosity drives learning. In learning, what we feel when we are learning has a lot to do with how well we engage in the learning process and how well and how quickly we understand what we are attempting to learn.

Curiosity sparks the release of a range of emotions within us. When you say; "That is amazing!" - what you are really doing is asking a raft of questions all at once such as - "How can that be?" - How did that happen?" - "How did they do that?" - "Can we keep that?" - "Why have I never realized that before?" In the classroom we want to encourage these emotions in learners that then drive learning. We should not have to make people learn; people are innately curious but the problem is that most teachers steal the opportunity to be amazed from the learner by giving them the answer or giving them a textbook with the answer in it. Learners do not want answers given to them, they want to find answers and preferably they desire to do that via collaborating with their friends; going on a voyage of discovery and experiencing the emotional reward of the 'aha' moment. Even teenagers love this learning stuff. Have a look at any teenager on almost any YouTube clip and they are choosing to learn in their own time, using their own resources and their peers are marking their work with 'likes'! That is so cool. The trouble with schools is that we teach using a traditional learning process and the result of that is that many learners think that they are not that intelligent – which is simply not true.

In order for learners to engage in learning with passion then educators have to initiate a prompt that engages the learner emotionally. By appropriately using a prompt to start the learning the learner wants to learn. Choosing the prompt and how it is used is critical. Younger learners are easier to apply prompts to but older learners should have a greater set of learning competencies and therefore they should be more autonomous and capable of applying their lifelong learning skills independently and at their own speed.

An example: A teacher of a group of year 5 students was about to do a traditional three week unit on food chains and biological communities when, while in a pet store with her daughter she had an 'aha!' moment. She made an additional purchase at the store and then next day set up the prompt in the classroom when the students were out at their morning break. She shut the door but left it unlocked and went to the staff room and had a long break and then sauntered back to her room 120 minutes late to class.

By the time she arrived the children had found the green tree frog she had purchased the day before and all at once they started pleading with her to keep it as a class pet. Initially she said no as they had other work to do but they promised to all manner of things. Finally she relented but said they could keep the frog but only if they found out what it ate and what sort of environment it needed – they would need to ask the right questions and then do their research. She told them that she was busy with important work for the principal so she would not be available but as they discovered things they could come and tell her. But in one hour there would be other work that would need to begin. To cut a long story short in the one hour they had researched and learned all the knowledge that they needed to know.

What the students had done was the first stage of the learning cycle. The prompt set of a series of emotions and the learners were then curious enough to find the **minimum knowledge set** required to keep the frog alive! The teacher had prompted some questions but they owned the journey.

The critical issue here is that the students did not need to know the biological details of the frog, its anatomical structure, its correct scientific name or evolutionary history – they just needed to know what it ate and what sot of environment is lived in. Herein lies one of the fundamental pedagogical changes required in education. We traditionally 'front load' each unit of work with a huge amount of extraneous knowledge that is simply 'stuff' that has little value or relevance to the immediate need the learner has. Too many new words, facts and labeled diagrams just overwhelm most learners. The reason fort his is interesting:

Interestingly, 500 hundred years ago we did not have to remember much rote learnt knowledge as for most people there were no letters, numbers and words to learn, write or read and we did not need to remember addresses, passwords, phone numbers, hundreds of names or the capital cities of numerous countries etc. As a result there were few evolutionary or genetic drivers to improve our capacity for rote learning other than what we required to support our oral capacity. Accordingly our capacity for rote learning is very poor.

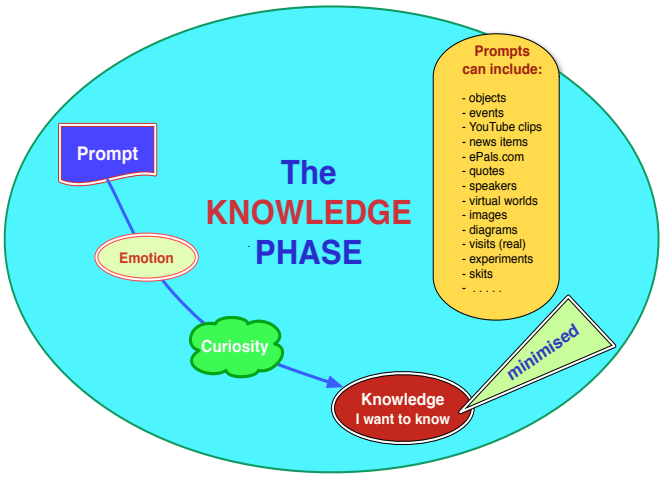
The sounds and shapes of the letters of the alphabet are random and they have to be learned by rote as those shapes and sounds cannot be predicted by what they look like. The same is true for words. Once we have learned these and we have built up a written vocabulary then we can start playing around with words creatively and apply concepts such as how to predict what a word may be by looking at the words we do know that are in the same sentence. Unfortunately not only is our capacity for learning via rote poor but it would also appear to be mostly inherited via our parentage. As a result, it is very important that we choose our parents very carefully if we want a high level job that requires a university course of study as that process will definitely require a lot of reading or writing.

It is a different story though for concepts; our second learning system. 500 hundred years ago we required an understanding of numerous concepts such as hunting, relationships, understanding and managing risk, navigating around the space we inhabit, judging time, interpreting body language, recognising social status, express our faith, build structures to live in, as well as celebrate events, processing food, keeping warm, protecting the tribe/town/city etc. We required concepts to enact these capacities as they provided us the power to predict possible courses of action and this capacity provided a greater chance of a successful outcome.

So here is the break point in learning: If you want a child to learn a concept, keep the initial body of knowledge to a minimum!

The second stage of the learning process is developing a comprehension/understanding of the idea of the food cycle. Later in the day the teacher spoke to the class and told them there was no money to buy insects and the holidays were coming up so the students would need to work out how to create a sustainable system that could produce enough food for the frog. They had only two weeks before the two-week school break would begin.

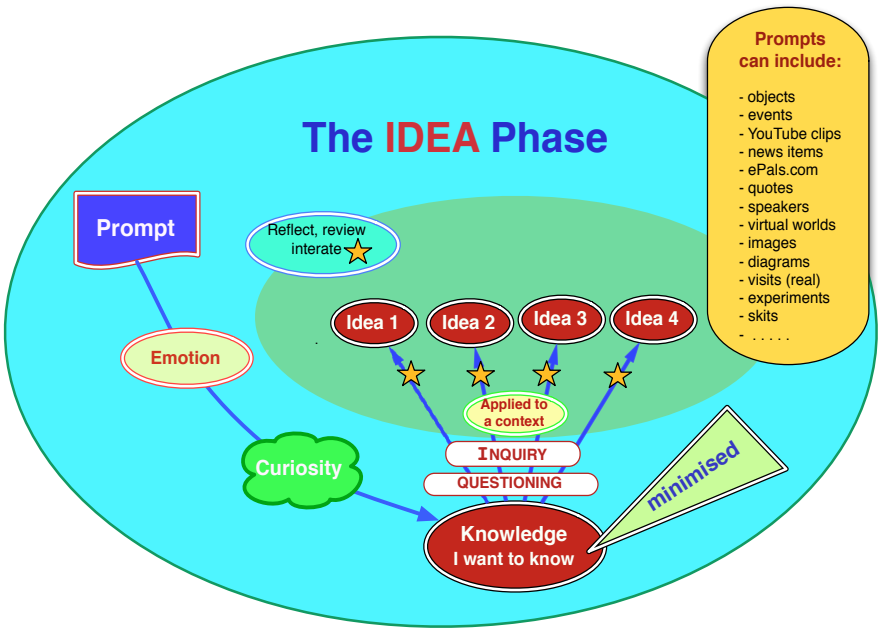
Context 2: In learning to dance there are a number of knowledge elements that need to be learned in terms of the sequence and placement of the feet in order to be able to learn a particular dance.



Stage 2. **Ideas:**

The ‘reflect - review – iterate’ process [shown as a star in the diagram], is momentarily applied to check if the right question(s) have been asked A brief inquiry process may be carried out at this point in order to find the required information and verify its validity. From here the learner carries out a brief reflect, review and iterate process to check that the developing knowledge does indeed provide the first level of knowledge required by the questioning and what they were originally curious about. As the learner draw on that existing body of knowledge and apply the new experience to a new context the learner creates new knowledge on a ‘need to know’ basis rather than a ‘just in case’ basis. This entire process may take anything from a few seconds through to hours or more.

Back to our exemplar: The next morning the students all arrived with lots of plans and schemes and they were keen for the teacher to tell them which was the best solution. She reneged and said that she was busy and that it was not her problem. The students eventually realised they would have to experiment with the ideas to see which was the best. They stayed in through their breaks and began breeding insects, learning what the insects ate and by the end of the week were happy with their result. This is the second stage of the learning process: The creation of an idea.



Our sense of curiosity and wonderment can lead us to interrogate our observations and our existing knowledge using our capacity to ask clever questions. Asking clever questions will set the learner on the path to developing clever understanding. The teacher in this case had already spent time developing the student’s capacity to ask clever questions. One of the key competencies in order for learners to become lifelong learners is the capacity to ask clever, (rich, open/closed, Socratic, or high-order thinking) questions. This strategy is critical to the success of the students in becoming independent lifelong learners.

We differentiate between knowledge and ideas by defining ideas as being formed when we form a relationship between two or more knowledge elements within a singular context.

This stage in the learning sequence is achieved by asking clever questions to interrogate the knowledge elements via the ‘reflect-review iterate’ process and subsequently applying the ‘inquiry’ process where required. Inquiry can range from chatting with colleagues, friends or acquaintances, practicing or experimenting with the relationships between a range of sporting knowledge elements or applying a range of knitting ‘stiches’ to make a sweater using a pattern. The reflect-review-iterate process is carried out whenever the star appears in the diagram.

It should be emphasised that the reflect-review-iterate process may take moments and be an almost passive process and sometimes it is more time consuming and formal. It is possible that once clever questions are asked and then answers are sought within a single context that a new idea (new to self) may be established.

Ideas are an extension of knowledge and by definition they do not allow us to predict how the idea may be expressed in another context. What can happen next is the development of additional ideas; the same knowledge but applied to new contexts. It is not uncommon for a number of ideas to be created in a very short period of time.

Back to our exemplar: Once the students have identified the idea the teacher asks the class. “What if we found a lizard in the classroom – how different would the food chain be? How different would the environment need to be?” Prompted by this new question the students now realize they would need additional knowledge – some specific to the lizard and some that would be borrowed from the frog context. The teacher then broadens the question to list five different small animals and each inquiry group in the classroom will work on gathering the required information and modifying their undersatnding of the frog example.

Each of the inquiry teams reported back to the rest of the class via their news desk on their animal. The students now have six contexts for this one idea. Increasingly the students are building an increasingly generic knowledge set that applies to an increasing number of animals (contexts).

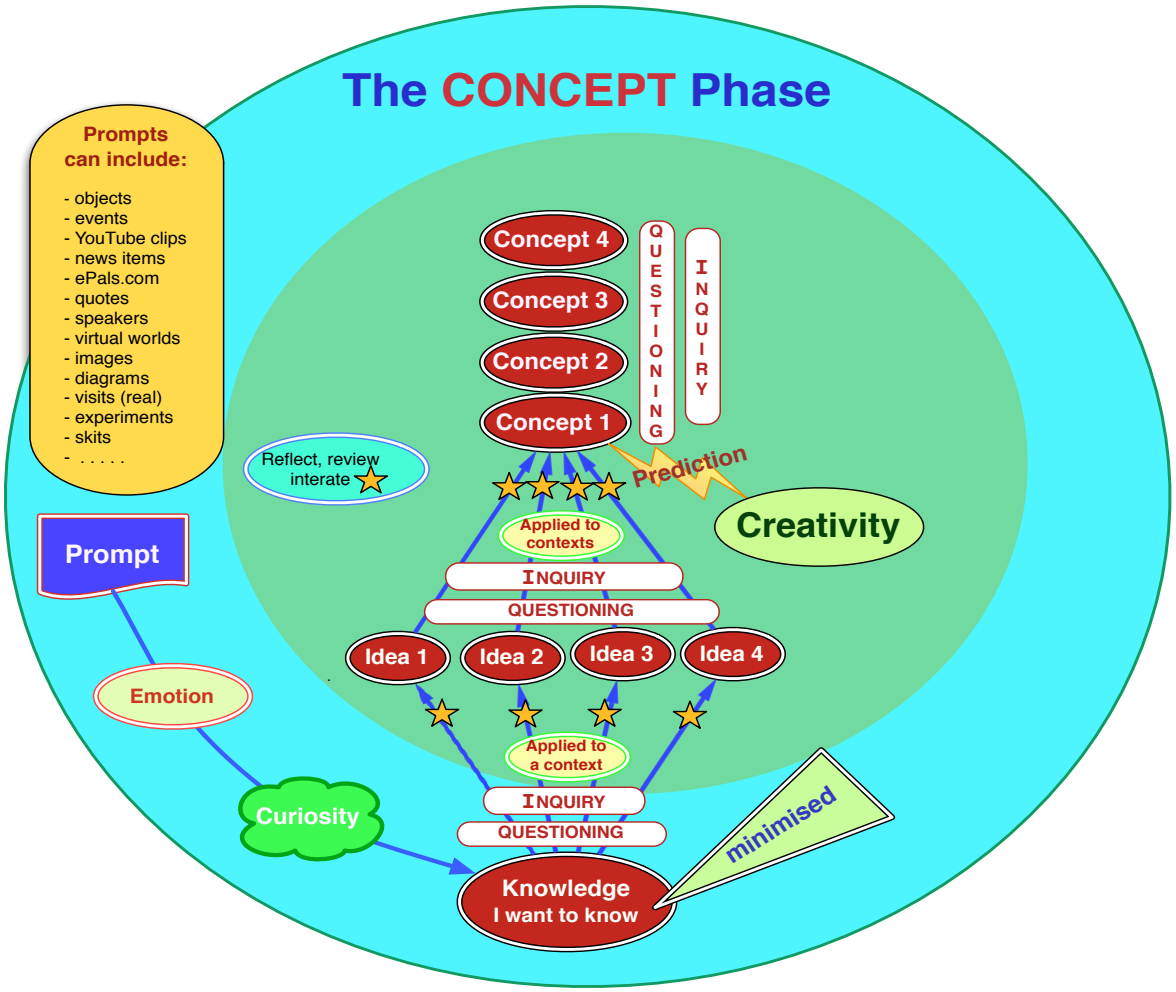
Context 2: In learning to dance an example of forming an idea is when the dancer links the remembered dance steps (knowledge element 1) into a relationship with the speed of the steps to match the music (knowledge element 2). It is this relationship between the two knowledge elements that generates the idea but ideas do not allow us to predict how we would adapt those steps to another piece of music with a different tempo.

By definition ideas are the intermediary stage between learning knowledge elements and being able to create a concept around this particular style of dance and successfully predict how to adapt the speed of the steps to a different piece of music. Forming an idea is making the connection between discrete pieces of knowledge and applying that relationship successfully. In this emerging model of learning this process is carried and out and managed by neurons in the brain.

Stage 3. **Concepts:**

The next stage is critical and it is the one that is most often ignored or not made explicit via current teaching practices. It is important that the educator prompts the learner to take the ideas and apply clever questioning and then, subsequently the inquiry process. This is done in such a way that it prompts the learner to synthesise and distil the new ideas that have been developed across a range of contexts into a single 'meta-idea'. This interrogation process (inquiry) should lead the learner to the development of a generic 'meta-idea' that could be applied to any context. This is how we define the notion of a concept.

Via the learning process the learner has now created a concept in their mind. At the point of understanding the concept the first time we experience an 'aha' moment. The 'aha' moment is the most powerful learning event a learner can experience, generating an emotional 'high' and it immediately sets in place a permanent long-term memory of that concept architecture in the brain. The development of a concept also enables the learner to be able to predict outcomes for that idea and how it would be expressed in other contexts that may never have been previously experienced. As a simplistic example: you develop a concept of sitting down on a chair at about 10-16 months old. This means you do not have to learn how to sit down on every different type of chair – you just sit down without thinking. The same applies for navigating round-s-bouts in a car. You do not have to learn every one of these via rote because after having navigated 5-6 round-a-bouts your brain crates a concept of a round-a-bout and you can navigate any round-a-bout without thinking. Developing concepts is an extraordinary way of increasing the efficiency and effectiveness of learning.



Initially the development of a concept can be a formal process and takes some time. The teacher may have to get the learner to initiate a discussion around this process requiring the learners to brainstorm the similarities and differences across the ideas and search out relationships between the variables. Given sufficient practice learners get very good at this process. Students do need to be introduced to strategies in order to carry out the brainstorming, synthesis and distillation processes as well as understanding these the strategies underpinning these processes. Practicing these strategies and realising when a particular strategy is more likely to yield better results is also critical.

Experiencing the ‘aha’ moment is one of the most important learning outcomes in any learning environment. The feeling of elation is due to the hormones that are released in the brain when a concept is first mapped. The release of those hormones results in a pleasurable feeling being associated with learning and the learner will feel a desire to experience that again. This is the addiction we call learning. This process will require the new or existing idea to be practiced in a number of other contexts or pondered on when considering more theoretical ideas. Once we have applied the initial idea to a number of contexts and built a concept we are able to predict what might happen in new and as yet unexperienced contexts. For unknown contexts, the more well understood the concept then the more powerfully and exactly the outcomes of the predictions can be predicted.

Back to the prompt: Taking the six different contexts and forming a concept requires the students to investigate the similarities and the relationships between variables that exist within the six contexts. General trends/ideas can be established such as:

- The larger the animal the more food it eats
- Larger animals eat larger insects or smaller animals
- Larger animals had larger and sharper teeth and stronger jaws
- Herbivores ate more food for their size than carnivores/omnivores
- Smaller animals seem to be herbivores and larger ones carnivores/omnivores
- Carnivores/omnivores had sharp teeth while herbivores had flatter/grinding teeth

Context 2: In dancing the understanding of a concept is achieved when the dance moves have been applied to a number of different musical arrangements (contexts) to the point now where the dancer is able to predict how to apply those steps to any piece of appropriate music. The dancer also now has the capacity to be creative with those dance moves and add impromptu and appropriate moves.

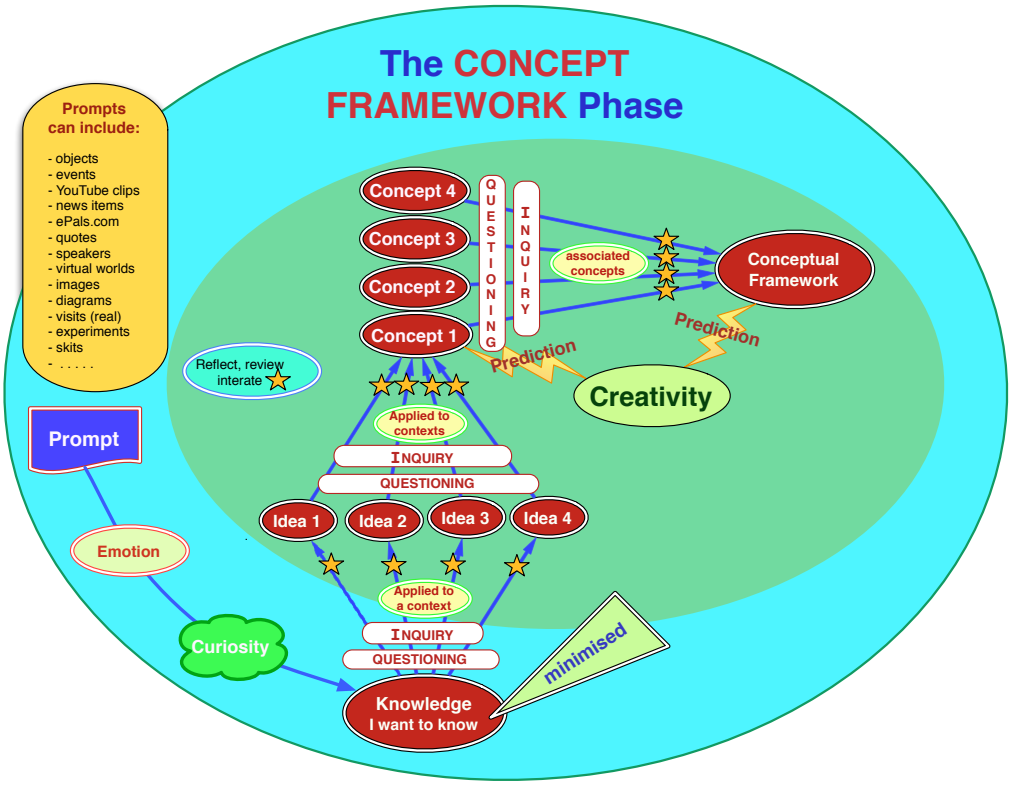
A concept is a generic understanding that is context independent. What this means is that once the concept is formed, the learner can apply the newly formed concept and predict how that concept will play out in numerous new contexts without relearning that knowledge. The power of being able to predict outcomes that may be unknowable via any other means is extraordinary. The ability to form new concepts ‘on the fly’ in this way s unique to the human species

Stage 4. **Concept Frameworks:**

When you drive a car you are applying numerous concepts in order to be able to drive safely and most of these are completed without any conscious thinking! Driving can include concepts such as hill starts, 3-point turns, navigating round-a-bouts, changing lanes, calculating stopping distances . . . The sum of all the concepts and their interactions between each of them (often applied non-consciously) is called a concept framework.

You will use some of those concepts such as judging distance or opening the car door etc. in many other non-driving situations (contexts). Concept frameworks contain a number of different concepts that all work together to manage a complex operation. Interestingly, in this emerging model of learning, numerous iterations of each concept are not stored in the brain for each context but rather a single generic concept is stored and re-used when necessary with modifications made 'on the fly'.

Most of these concepts will be automated into non-conscious processes through the astrocyte-neuron relationship in the brain. This is the reason you can drive across town and arrive at your destination having very limited memory of the actual journey. By having the tripartite relationship between the neuron-synapse-astrocyte this arrangement takes over the management of the concept and concept frameworks liberating the neural sequencing process to 'think' about another process or action. This capacity is what provides humans the ability to multi-task, a capacity managed equitably by both genders!



Back to the prompt: Taking the six different contexts and forming a concept framework requires the learners to investigate the relationships between multiple variables across a range of domains. Those domains may be food, defense, movement, body shape that exist across the six contexts that have been investigated. General trends can be established such as

- The smaller the animal the quicker it seemed to move
- Flat animals lived under things and fatter animals 'roamed'
- The larger the animal the more food it ate
- Larger animals ate larger insects/other animals
- Larger animals had larger and sharper teeth and stronger jaws
- Larger animals protected themselves by running fast while smaller animals hide in crevices/holes
- The smaller the animal the more predators that could eat them
- Herbivores ate more food for their size than carnivores/omnivores
- Carnivores/omnivores had sharp teeth while herbivores had flatter/grinding teeth

Concept frameworks are created when more than one concept is required to tackle a particular process. Much of our everyday thinking is done via conceptual frameworks. The reusable nature of concepts in forming numerous concept frameworks means the brain economises on how many new contexts it has to learn for every concept and concept framework. Concept frameworks are an excellent example of the hyper-efficiency of the brain.

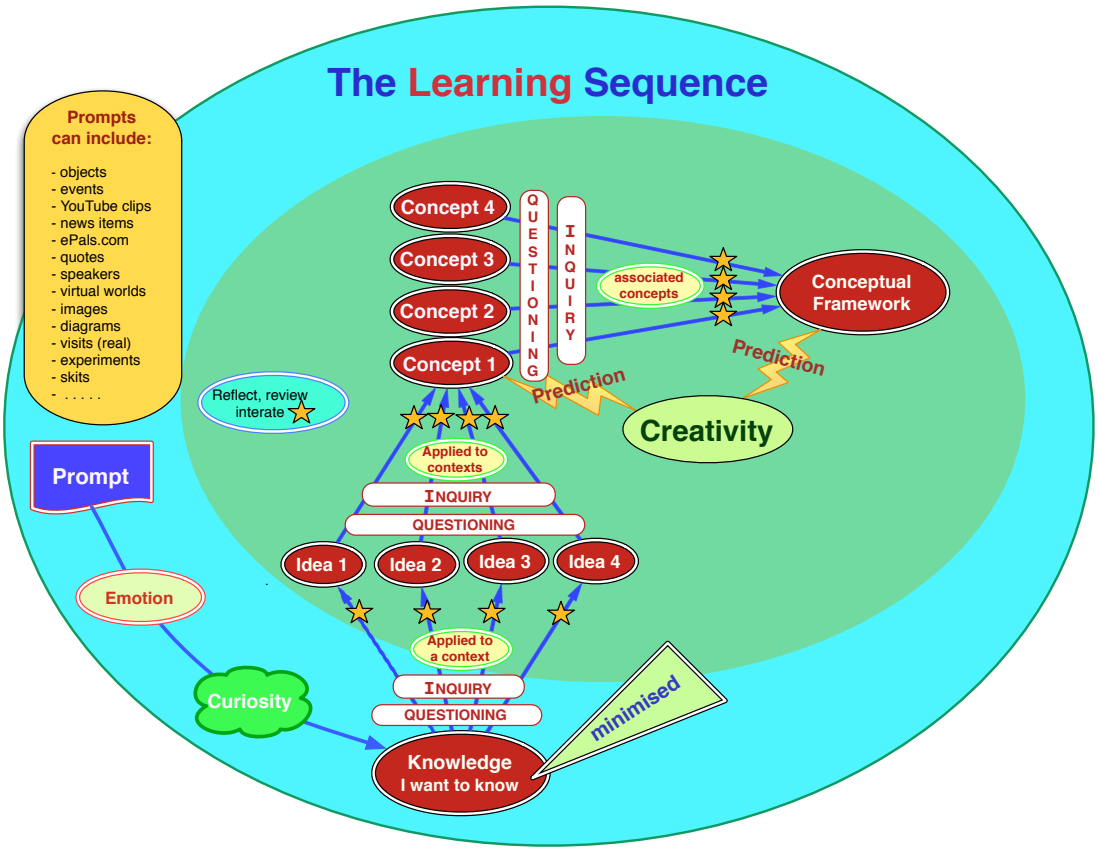
Context 2: Dancing is a collection of concepts including everything from timing, foot sequences, following the lead of a dance partner, adapting to the tempo of the music. Every moment we are dancing we are making numerous predictions and what makes this even more amazing is that we are largely doing this in a non-conscious manner. These concept frameworks consist of many contributing concepts, ideas and knowledge that all work together in a dynamic tumult of potential for the generation of new knowledge, ideas and concepts Current research indicates we are the only species that has this ability.

Stage 5. **Creativity:**

The innate human capacity for creativity has been surrounded by mystique for the entire of history. Recently society has come to terms with the strategic importance of creativity and our resultant perchance for ingenuity and innovation but it is still remarkably difficult to explain to someone '**how** we can be creative'. In the emerging new model of how the brain learns we see creativity as the result of resonance and/or interference[1] of brain waves. Creativity requires a baseline of conceptual understanding but it is a far more powerful process if we have many conceptual frameworks already established. The more concepts and conceptual frameworks that the brain has developed the richer the library of resource the brain has to be creative with.

Brainwave 'profiles' are generated within the brain for every idea, concept and concept framework that we create due to the electrochemical activity of the neurons (7% of brain cells) and astrocytes (76% of brain cells), along with other brain cell activity within the matrix of cells that constitute those ideas, concepts and concept frameworks. These brainwave profiles can then resonate and/or interfere with other brainwave profiles that may be similar, slightly different or very different and the result is that the brain can develop new completely new ideas, concepts and concept frameworks.

The interaction between these brainwave profiles results in a range of resonance/interference patterns being created. In this emerging model these patterns are [possibly] mapped (by the amygdala within the brain, in concert with the hippocampus) for suitability as solutions to the problem being thought about. As a result a new neural circuit does not need to be created as the concept framework 'pattern' can simply be iterated and adapted to a new context. As a result we do not have to re-learn via rote how to navigate each set of traffic lights. Instead we are able to predict how to navigate each set of traffic lights as we have a generic concept map of how to navigate sets traffic lights that we can adapt to each context.



Creativity requires our brain to look for a mixture of tight and loose connections between groups of ideas, concepts and concept frameworks. One thinking outcome of this process is what we refer to as 'lateral thinking'. There is no rational process for 'knowing' which connections between ideas, concepts or concept frameworks will be fruitful (or not) and it is a stunning tribute to our intelligence in that we can process hundreds, if not thousands of possible connections and all the while the only ones we acknowledge or remember are the ones that prove fruitful.

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[1] The stochastic resonance and/or interference of brain waves.

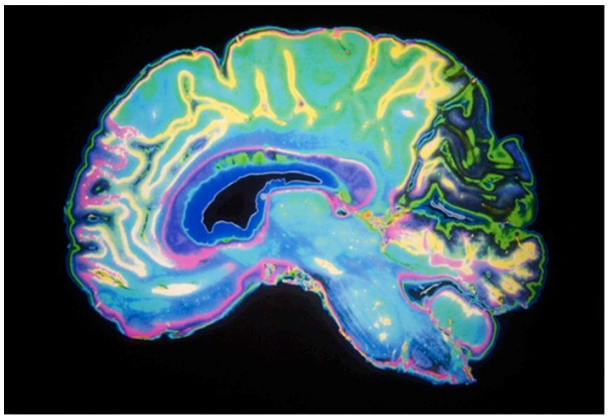
Back to the prompt: The creative process relies upon the capacity of the brain to use its collective intellectual treasure of knowledge, ideas, concepts and concept frameworks to predict possible new outcomes. The teacher than suggests to the class that they each find a creature they had not heard of before and present that to their inquiry group to see if the other members of the group can predict where the animal lives, what it eats and what might eat it.

As a fun exercise the teacher follows this up with the idea that each student invents a new animal from a range of body parts (legs, mouth, body shape, antennae, protective skeleton, claws, fingers etc.) and then their group describes the food chain and the environment that they may be a part of.

One test of understanding and the demonstration of creativity is the capacity to predict based on their knowledge, ideas, concepts and concept frameworks.

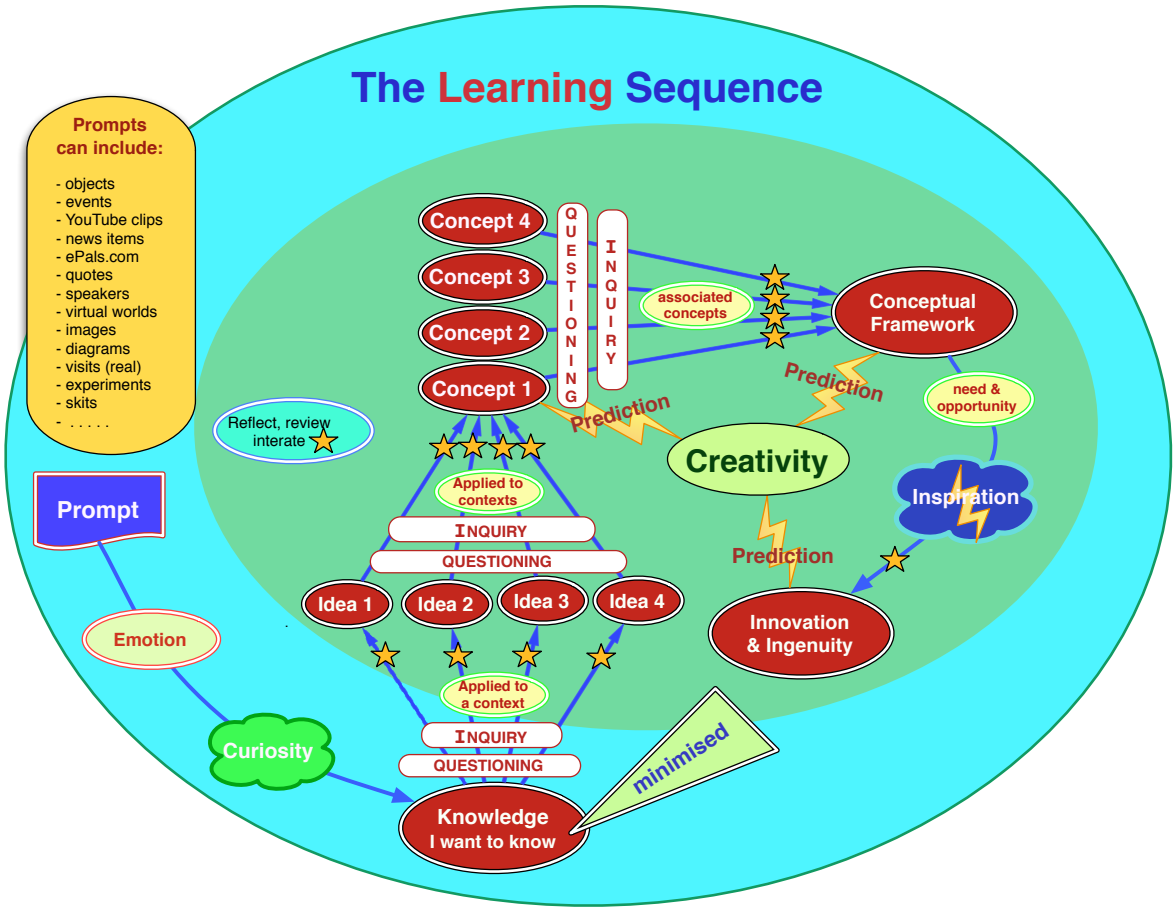
The creativity process can also benefit from the power of metaphor, simile and analogy. Metaphor can also assist lateral thinking (linking disparate ideas, concepts and concept frameworks), by creating literary or pictorial stories through making use of these thinking tools. The power in metaphor is that different people will read their understanding into the story and the result is a personalised learning experience relevant to their context and experience. The great historical teachers over the past millennia used this set of tools to communicate with large numbers of people with each person leaving with their own customized version (context) of the story.

To have the capacity to be creative requires a number of ideas, concept(s) and/or concept frameworks to be interrogated through a combination of reflection and active manipulation. It is important to note that creativity is a process and not a product and that the creative process is akin to the inquiry process but a lot less structured but with practice it is possible to fine-tune the management of our brainwaves to be increasingly more productive in this realm. The creative process is not a formal or structured process, but rather it requires the mind to wander and consider thousands of potential new connections. This ability to daydream is fundamental in seeking the inspiration of new ideas, concepts and concept frameworks.



Stage 6. Innovation/Ingenuity: [product – process – environment]

Ingenuity requires a composite set of qualities and strategies that a learner needs to be aware of and practice in order to take the creative activity and turn the emerging new idea, concept or concept framework into a tangible reality in the form of products, systems or environments. The set of human qualities that bring definition to creativity and make it real include vision, self-confidence, lateral thinking, collateral, the ability to synthesise along with being able to distil that synthesis process to create a product, system or environment that meets a social and/or economic need or opportunity. Added to this we must include the critical quality of perseverance, including knowing when to give up on an idea or change the approach to the problem. Thinking requires significant perseverance, accompanied, of course by wisdom. Additional qualities such as being analytical, resourceful and having the willingness and capability to ask for assistance (collaboration), as well as the ability to leverage a range of technologies and 'business' connections are also instrumental capabilities within being successfully innovative and ingenious.



Ingenuity and Innovation also require a set of strategies including the application of time and project management tools along with the ability to motivate and manage other specialists to work and share collaboratively throughout the ongoing inquiry and 'reflect - review – iterate' processes. This effective combination of qualities and strategies allows the results of the creative process to get off the ground and become new products, processes or environments.

Back to the prompt: Innovation is the output mechanism for displaying creativity whether than be artistic, engineering, dance, scientific discovery/application, social development, sporting, mathematical modeling, poetry, marketing, teaching . . . . The list of possibilities is endless and the list of combinations of these is infinite. In the classroom the teacher presents a series of prompts around how new diseases, insects, animals and plants are introduced into new environments and the devastation this can potentially cause.

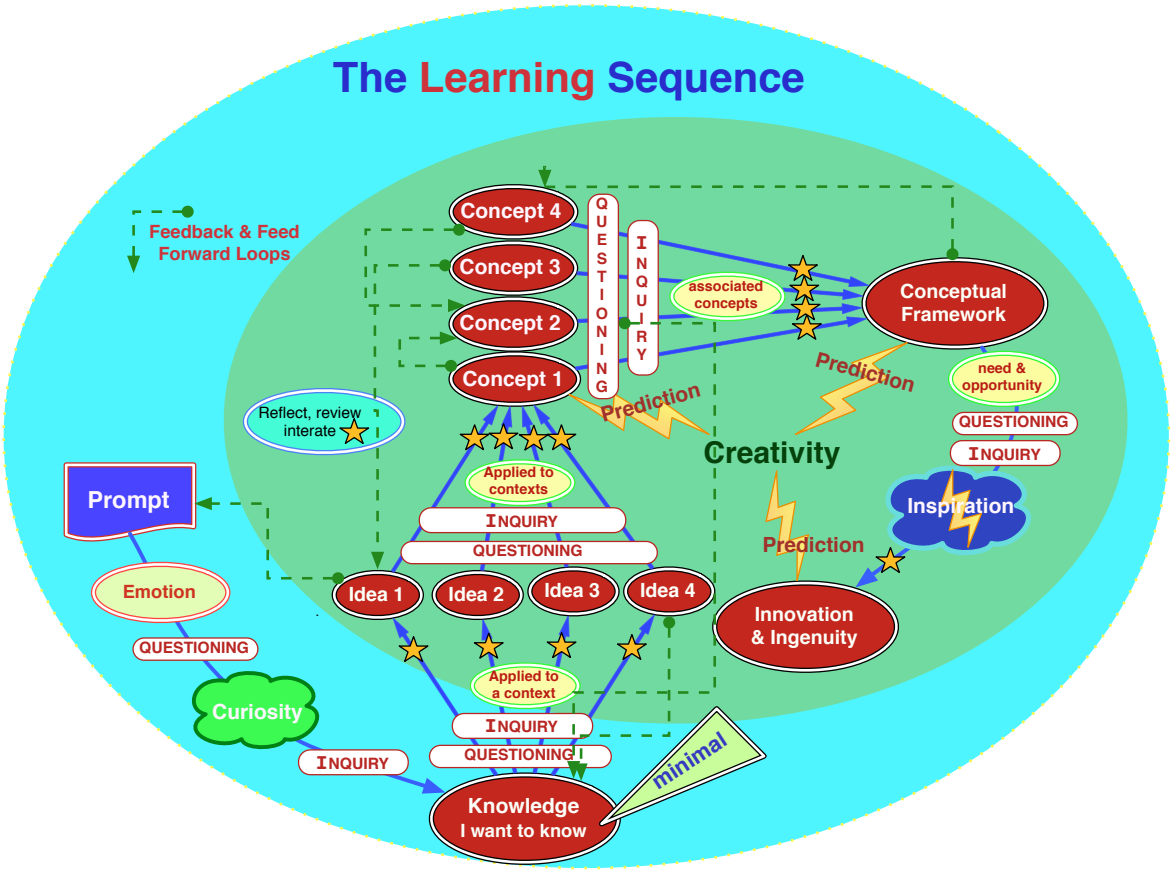
The teacher then suggests to the learners that develop a series of innovative marketing campaigns increase awareness of the fragility of food chains and ecosystems within their region. The teacher then suggests that will need to be innovative in the way they get that message across to their community. The teacher indicates that this is a real issue and that the each strategy will need to be applied and evaluated. The learners will be responsible for both the design of the campaign and the way in which its success will be appraised. The process will be evaluated by those that my potentially use the and/or apply the outcome.

Creative people understand that creativity is 99% perspiration and 1% inspiration. But that is only 50% of the complete equation. Ingenious people realise that that innovation is also 99%perspiration and 1% inspiration. To be productive, creativity and Innovation is more successful as a collaborative enterprise where teamwork is 99% perspiration and the remaining 1% is inspiration.

Having the brilliant idea, concept or concept framework is not the end of the journey. The last part of the journey is often referred to as the 'technology process'. This is the art of bringing the idea, concept, concept framework and its outcome into an actual reality in the form of something people want to use, will purchase and will then recommend to others. This is a critical process in any economy within any society and the process should be explicitly taught in every classroom. Our economy and each citizens self worth can be realized if they are working in a field that is rewarding to both self and our world. The learning sequence contains all the critical elements required by a 21st century society and each learner that comprises that society desires.

Stage 7. Feedback and Feed forward

The learning process is not a linear process as the previous diagrams may imply. There are innumerable feedback and feed-forward loops within any stage of the learning process. It may be that new knowledge, concepts, reflections, iterations, processes etc. may be required or be applied at any stage of the learning sequence. There is an endless number of feedback and feed-forward thinking loops in the learning sequence. The diagram shows just a few of the possible permutations of this complexity. In practice the a web of interactions are cast over the entire learning sequence.



Summary:

In summary we can articulate the learning process as a set of interdependent processes.

Using the abbreviations:

- **Clever Questioning (Q)**
- **Inquiry (I)**
- **Reflect – Review – Iterate (R-R-I)**

1. **Curiosity** is stimulated by an event or prompt and we then apply **(Q) - (I) - (R-R-I)** in order to
2. Build a **knowledge** set and then via **(Q) - (I) - (R-R-I)** we can
3. Form an **idea** and then via **(Q) - (I) - (R-R-I)** we
4. Apply that idea to a number of contexts to form a **conceptual understanding.** This allows us to **predict** new possibilities and it is then, via
5. Synthesis and distillation processes, combined with **(Q) - (I) - (R-R-I)** of our knowledge, ideas and concepts provides the capacity to form **conceptual frameworks**
6. This capability can then be melded into **creative** ideas, concepts and concept frameworks via **(Q) - (I) - (R-R-I)**
7. That can then, via **(Q) - (I) - (R-R-I)** give rise to the potential for the qualities underpinning

ingenuity to be applied which can

8. Then, via identifying possible needs & opportunities combined with **(Q) - (I) - (R-R-I)** can give rise to **innovation**. The result of which then creates a demand for the product, systems and/or environment.
9. By applying **(Q) - (I) - (R-R-I)** at any point during the process this generates a new demand for new knowledge, ideas, concepts, concept frameworks, (return to the step one)
10. At ant point in the process it is almost certain that it will be necessary to research and learn new knowledge, develop new ideas, concepts and concept frameworks and then apply creative processes to any or all of those elements. Sometimes it is sufficient just to know, feel or sense something or have an idea or concept that stands on its own but this is rare in practice.

The learning sequence is the theoretical framework that is underpinned by the inquiry learning process By mapping the learning process what become obvious is the critical importance for learners of all ages to be able to apply:

- **Effective prompts to initiate learning**
- **Clever questioning**
- **Inquiry processes**
- **The constant application of the thinking process - Reflect – Review – Iterate**

Above all, this process requires creative educators who can stimulate curiosity through the imaginative and creative application of prompts that encourage the student to want to learn. That does require a substantive change to the pedagogy of practice of most contemporary teaching and learning but the consequences of not making those changes will be tragic.

Increasingly the economic future of countries now belongs to those citizens who have the capacity to be creative and innovative and who are capable and willing to take the risks surrounding the investments or the obtaining of capital to develop those products, systems and environments through to operational and saleable commodities.

When everyone has to be Creative & INNOVATIVE!

There was a time, not so long ago, when people hated Mondays and loved Fridays and we even sung songs about it because most work people did was dreary and boring. We were so desperate to be creative that we resorted to knitting and stamp collecting as creative pursuits to balance what was on offer in most workplaces. Increasingly we now have to encourage people not to work as much, take more time to be with their families and enjoy the world outside of work. One of the reasons we now have to do this is due to workplaces becoming increasingly creative, innovative, challenging and exciting places to be in. Being challenged and working in creative and innovative environments is fundamental to the spirit of being human and despite the tensions and frustrations that are often associated with our workplaces we are increasingly enjoying them. Human beings love to be creative and innovative, especially if that is somehow is helpful to other people.

As well as this aspect another change in the ntuare of work is emerging. In general, creating Individual solutions to individual problems creates more problems. What we need now is to be able to synthesise a more complex understanding of the world we live in, drawing on the science and technology we have access to, and comprehending the social and the passionate nature of being human. We now wish to craft complementary and integrated solutions to the problems we face as local, regional, national and global communities. It is important that we draw from the collective human character and principles that we value in order to take our creative ideas and be innovative and ingenious in their application for the long term betterment of our multiple communities we live in. This is one of the greatest challenge of the 21st century. The majority of people in all communities now need to act as independent and interdependent lifelong learners so that can contribute tonthee processes. These lifelong learners must be willing to take a running jump and leap across the chasm, adopt the new learning paradigm and leverage the resultant efficiencies and effectiveness gains that are on offer in order to build an entirely new future, based on something more than just hope and happenchance.

An **Example:**

An example of the creative interface between these capacities can be seen in development of the flyboard. This extraordinary concept was a lateral application of the jetski but it took a lot of knowledge, and a stunning number of concepts that were then wedded into a concept framework and then an almost innumerable series of modifications were required (initiated by the reflect, 'review – iterate – process'. The result required a number of people working collaboratively to pool their expertise to develop a truly stunning result. You can link from the image below or go to http://www.youtube.com/watch?v=Cd6C1vIyQ3w

The revolution in the status and need for creativity is not just an evolutionary one that has taken place over millennia but it is also a personal journey where we must build capacity by explicitly teaching the learning sequence to all learners of any age. To be successful in this process; to become a lifelong learner, every learner in or out of school must take ownership and responsibility for increasing their own learning capability firstly over the 12-13 year learning apprenticeship within school and then over our post school years of learning. School must now be formally considered an apprenticeship process in learning to learn. Learners begin school with the explicit learning intention of building an understanding of this process and leaving school with the capacity to manage their own learning independently and collaboratively. Our challenge as educators is to let learners learn how to learn and not do their learning and their thinking for them and rob them of the opportunity of experiencing the 'aha!' moment!

Consultancy: Mark Treadwell mark@work.co.nz - www.MarkTreadwell.com

Mark has worked with school systems, jurisdictions and schools to increase their capacity to meet the needs of 21st century learners. Mark has worked with educators on the implementation of technology infrastructure, transitioning pedagogical practice or acting as a critical friend. Mark also works in conjunction with CIRCLE (www.circle.org.au) in Australia and Watchdog (www.watchdog.net.nz) in New Zealand in order to provide a comprehensive executive service to schools.

Mark has also presented keynote addresses to numerous international, national and regional principal and teacher organisations and associations. To get an overview of the presentations Mark is available to speak on see http://www.marktreadwell.com/Mark_Treadwell. For a list of recent conference addresses you can visit http://www.marktreadwell.com/presentations