

APPLYING LIGHT LOGIC TO PROBLEM-BASED LEARNING

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One of the goals in PBL is to make the learner an independent thinker. To be a better thinker, problem identification and thinking skills play key roles in this new method of learning. While there are several thinking skills such as critical thinking and creative thinking, there has been no integrated model for human cognition. This paper proposes that as far as thinking is concerned, light logic can be applied to PBL and that the logic based on a 3-D cognitive model sheds light on a unified approach to human cognition. This light logic gives rise to synergetic thinking which leads us to a more realistic and holistic view of the problem-solving world, eschewing cognitive pitfalls such as excessive fragmentation and excessive categorisation. Moreover, this paper presents more simplistic ways of problem identification and thinking by introducing the significance of mind-settings to thinking. Subsequently, this will provide us with a clearer visualisation of dualistic/non-dualistic thinking distinctions as well as balanced thinking and equilibrium in mind, which will help us to solve current issues and problems in our society and the world. Finally, some intriguing consequences and implications for Problem-Based Learning will be shown in the paper.

KEYWORDS

Thinking, synergy, 3-D cognitive model, light logic, proprioception, mind setting, non-dualistic, equilibrium

INTRODUCTION

One of the goals in PBL is to make the learner an independent thinker. To be a better thinker, problem identification and thinking skills play key roles in this new method of learning. While there are several thinking skills such as critical thinking and creative thinking, there has been no integrated model for human cognition.

As pointed out in Kubo (1999a), it is observed that there is a synergetic relation between language and brain. This is quite straightforward because the brain governs all our cognitive activities in many ways regardless of our consciousness and adopting Yoro (1982)'s view of brainism. a cognitive model is represented in terms of synergetic.

A 2-D representation is popular among mind-mapping advocates and indeed it is fairly useful and effective. Having kept in view these advantages of the flat representation, we can consider a mechanism of thinking from the point of a more holistic view that all the cognitive functions are influenced by the functions and the structure of the brain. To attain this goal, a 3-D representation based on synergy will be introduced.

The 3-D representation model shows similarities between structures of language and brain. The language must reflect upon cognition. The cognition itself has to be affected by the structure of the brain. According to McLean (1990), it is said that the brain has a three layered structure of reptilian, paleo-mammalian and neo-mammalian. The details will be touched later.

COGNITIVE MODEL

The cognitive model proposed here on the basis of Kubo (1999b) is based on Backminster Fuller's Synergetics (1975). The model is made out of one three layered tetrahedron that consists of ten smaller tetrahedrons. The cognitive model encompasses the basic constituents of linguistic perception in tandem with macro function of the brain.

The synergetic model shows that language structure is interrelated with brain structure. The bottom level has six basic information constituents of a sentence, that is, what, where, why, how, when and who. The middle level comprises three kinds of mind setting, that is, state, process and result. The top level is occupied by focus which is essential in relation with language as well as brain processing.

What is represented in the model is that the top, middle and bottom levels are considered to be equivalent to the reptilian, paleo-mammalian and neo-mammalian brains, respectively, in McLean's triune brain hypothesis.

In addition, the middle level represents LeDoux(1996)'s Emotional Brain. Thus, this model can neatly exemplify the structures and functions of human cognition.

LIGHT LOGIC

On top of the above 3-D cognitive model, one very important function must be added. That is perception of the world. In relation to this, Ramachandran and Blekslee (1998) reconsider how visual and sensory systems work in the brain and explain such cases as phantom limbs and blind spot in terms of his wonderful insight and innovative interpretation of the various cases of ordinary and extraordinary cognitive behaviours. What is worth noting here is that he suggests that blind spot and perceptual completion can be explained by a Darwinian view of how the visual system evolved. One of the most significant principles on vision is to economise on visual processing on the basis of statistical regularities in the world. That is to say, to get the job done, it tries to get away with as little processing as possible.

Bohm (1994) maintains that cognition can be governed by proprioception that is reinforced by thinking and feeling, as we have developed body movements through deliberate coordination of nerves and muscles. The term, proprioception, refers to the brain's unconscious awareness of the sense of the body in space. Bohm applied the term to an unconscious thinking activity and added the reason why we do not have the word, felts, in our

dictionary in comparison with thoughts. In the pursuit of simplicity, de Bono (1998) proposes ways of how to simplify things and suggests we improve ourselves by re-examining and re-evaluating rationales of existing systems in this world, in connection with de Bono (1983). The world is hoping for a simple but not heavily theory-laden logic.

With these in mind, we can elaborate on the significance of the structure and function of the 3-D cognitive model. Metaphorically speaking, the middle level functions as lighting up whereas the bottom level functions as painting what one sees. Because mind setting greatly affects intellectual activities by avoiding what one fears or abhors. It is like a searchlight or spotlight. If one does not shed light on a target in the darkness, one cannot see it at all. In line with this, mega star singer, Madonna sings in the song titled Frozen as follows: you only see what your eyes want to see. It seems this expression succinctly captures human cognitive tendency.

Moreover, the lighting magnificently affects colours in vision. If the lighting is not strong enough, the colour looks darker than it is. If the lighting is coloured, the colour looks different from its true colour. Thus, we need to be careful about the lighting, in other words, mental power of mind setting. To make the light colourless and strong, we have to pay full attention to the balance of three primary colours (blue, green & red), to put it differently, three mind settings of state, process and result. Note that they have additive colours so that the addition of the three turns out to be colourless light. What this entails is that unless two persons have the same mind settings, they cannot see the relevant event or object in perfectly the same manner. Therefore, there must be some discrepancy in visual colour perception. This is common sense.

Now we can consider the bottom level of the model, which has a painting function. The painting colours are subtractive and by mixing the colours, we can get black. The painting colours also have the three primary colours as well as complimentary colours such as yellow, magenta & cyan. What is intriguing here is that in the 3-D cognitive model, the mind setting of the middle level represents colourless white (light) and the six basic constituents of a sentence in the bottom black. These two colours seem to be contrasting and distinct, but they can be interrelated in the cognitive model. As the model demonstrates, the structure of the model is very synergetic. It is interesting to see that there is a synergy in the mental level and the intellectual level. This suggests that synergetic thinking will be attained through balancing dualistic views and values.

APPLICATION

First of all, the 3-D cognitive model will help us construct a holistic theory to language teaching and learning in line with cognitive development and functions. The theory focuses on what, where and why in the intellectual level in relation to the three kinds of mind setting, state, process and result. This shows that there are three thinking flows in the model. That is, focus-state-what, focus-process-where and focus-result-why. From a semantic point of view, these flows are observed in our linguistic strategies. Furthermore, generative semantics proponents proposed theories by assuming tripartite semantic elements. Among the three mind settings, 'process' re-evaluating plays an important role because the process mind setting affects the other two, namely, 'what' identifying and 'result' logical reasoning. It is added that the use of adjectives and verbs must be scrutinised since adjectives and verbs are associated with mental impressions and descriptions.

Secondly, this model foresees that a finely grained thinking programme will put great emphasis onto knowing oneself and striving oneself in creativity on the basis of equilibrium in thinking flows. Being aware of balance and harmony in thinking and action leads us to a bona fide world of symbiosis, more specifically, ecology. For, a holistic view is apt to consider unifying rather than diversifying matters. More importantly, this synergetic view will keep a pendulum in theories from swinging from one extreme to the other, which implies that there will be a paradigm shift from dualistic world view to non dualistic world view. Self-improvement will be a key word in future.

Thirdly, this cognitive model will help us to lead an innovative life through continuous reflections and improvement. The key lies in the loop relation of the mind settings which can trigger changes in one's views and perception. The 'process' mind setting and the understanding and maximising of mind mechanism enable us to literally shed light on new and different angles for seeing things to re-evaluate one's knowledge and experience. What is important here is that so called common senses will be re-examined by re-evaluating implicit meanings of adjectives, presuppositions and assumptions in scientific fields as well as daily life.

Fourthly, the model will assist us in re-interpreting philosophical questions and statements such as Zeno's paradox. They can be regarded as presenting cognitive pitfalls. It is recommendable to be philosophising to some extent when it comes to innovative thinking because we need to think carefully not only without falling into unconscious habits of holding onto social trends and existing measurements of values but also without blindly justifying current systems in the world. This casts a question to the de facto governing value systems, especially, from a holistic point of view.

Lastly, the model here can encompass geometrical meanings and their significance. This synergetic representation itself is considered as a manifestation of balance and harmony. This structure is the simplest and strongest 3-D architecture on Earth. The simplicity and strength of the cognitive model is neatly symbolised as a tetrahedron. We can maximise the underlying potentiality of the 3-D model by applying the light logic to thinking simply and innovatively.

CONSEQUENCES

To begin with, if we see the 3-D model upsidedown, it is referred to as a simplified brain model where why-result-focus and where-process-focus are considered as left and right hemispheres, respectively. The cognitive model is compatible with Ramachandran's explanation of denial and neglect. As well known to the world, the human brain consists of two cerebral hemispheres and each of the two specialises in specific mental activities. As far as language is concerned, the left hemisphere functions not only for sound production but also for syntax and much of semantics whereas the right hemisphere functions for more subtle aspects such as metaphor and ambiguity. It can be said that an over-result-oriented view gives rise to denial since the past accumulated data are regarded as more trust worthy and to avoid such a consequence, a process oriented view is necessary to balance the two functions. To get it right, it is essential to bear in mind that this thinking habit of attachment to microscopic compatibility in belief system must be protected by denying new findings and values coming up, and a malfunction or lack of process oriented-ness causes neglecting what

must be changed in the system. Thus, we can think in a balanced way towards fragmentation and unification for the benefit of PBL.

Secondly, language teaching and learning will be considered as one set. The language teaching plays a role of inducing learners to be aware of their cognitive abilities and make the best use of them. The teaching contents have to be re-arranged on par with cognitive development rather than descriptive grammar which is based on intellectual fragmentation and categorisation. The descriptive grammar is result oriented whereas cognitive development is process oriented. PBL can support language teaching and learning via providing learners with the ownership of learning in terms of their interests and purposes.

Thirdly, mental equanimity will help us think innovatively because the balanced view, in other words, colourless light can shed light on relevant problems and issues in a system. Without proper lighting, we could never know the true colours of matters and events of the system. Thus, we can be engaged in bona fide problem identification. Needless to say, this is applicable to PBL.

Fourthly, the recognition of mind setting can raise the awareness of equilibrium in thinking flows in daily life. Thus, we can improve ourselves, companies and countries only by starting to conscientiously improve oneself on the individual basis, because individuals form the very social base unit. Without the humanistic foundation of the country, the country and companies would not attain success, prosperity and happiness. That is why life long education is inevitable for people according to their needs and interests. This is very basic in the application of PBL to daily life.

Fifthly, the synergetic model can solve one of the philosophical puzzles of Pythagoras, that is, the meaning of the emblem of School of Pythagoras which must be answered to enter his school in those days. The emblem symbolises the cognitive functions in a 2-D representation. That is why ten dots in the shape of a triangle like positions of ten bowling pins are used for this entrance examination to check whether applicants realise human cognitive functions and their pitfalls.

Lastly, as pointed out in Takahashi (1999), we will be able to solve some of the most serious problems in environmental destruction such as deforestation and water pollution, only through individual understanding and cooperation. Ecological campaigns will help us people realise a holistic view of preserving nature for next generation and encourage them to put into action what they can do no matter how small the individual's contribution is. This will be one of the biggest tasks for the next generation to tackle in their real life in terms of PBL. This is clearly pointed out in Krishnamurti and Bohm (1999).

CONCLUSION

The light logic based on the 3-D cognitive model can help us understand the importance of balanced thinking flow and the way to achieve it through process mind setting. The process orientedness is not easy to conceptualise and visualise. The tetrahedron of the proposed model implicitly indicates the significance of equilibrium in cognition. With the help of this synergetic model, we can figure out the synergetic relation of mind setting in the loop of state, process and result. The mental loop is closely related with adjectives and verbs in linguistic expressions. Once we achieve the vivid visualisation of the mind setting, we can

balance thinking flows to attain proper lighting. The mental light sheds light on the pitfalls of left cerebral hemisphere functions such as excessive fragmentation and excessive categorisation. The simplest and strongest architecture of cognitive model represents minimal fragmentation of linguistic perception as well as simplest categorisation. The geometrical significance of the tetrahedron implies not only a non-dualistic relation from a holistic viewpoint but also a balanced relation and equilibrium in matter and mind. As a consequence, as far as the application of PBL is concerned, the mental colours in the light logic can relate to the coordination of thinking flows and the four facets of the 3-D cognitive model can be utilised in some ways for the combination of cognitive elements in thinking.

REFERENCES

- Bohm, D., (1994) *“Thought as a System”*, Routledge
- De Bono, E., (1993) *“Water Logic”*, Viking
- De Bono, E., (1998) *“Simplicity”*, Viking
- Fuller, B., (1975) *“Synergetics: Explorations in the Geometry of Thinking”*, Macmillan
- Krishnamurti, J. & Bohm, D., (1999) *“The Limits of Thoughts: Discussions”*, Routledge
- Kubo, Y., (1999a) *“Synergy in Language and Brain: Towards Holistic Linguistics”*,
Paper presentation at the 12th World Congress of Applied Linguistics, Tokyo, Japan
August 1-6, 1999. To appear in *AILA99 CD-ROM publication*
- Kubo, Y., (1999b) *“A 3-D Cognitive Model for Language and Creativity: Towards Light Logic”*, in Cumming, G. et al. (Eds.) *Advanced Research in Computers and Communications in Education Volume 1*, pp.236-239 IOS Press
- LeDoux, J., (1996) *“The Emotional Brain: The Mysterious Underpinnings of Emotional Life”*, Touchstone
- McLean, P.D., (1990) *“The triune brain in evolution: Role in paleocerebral functions”*, Plenum
- Ramachandran, V.S. & Bleakslee. S., (1998) *“Phantoms in the Brain: Probing the Mysteries of the Human Mind”*, Quill
- Takahashi, S., (1999) *“Kagakugijutsu no shotai”* Unpublished Monograph
- Yoro, T., (1989) *“Yuinoron”*, Seidosha