Vee Heuristics, Concept Mapping And Learning Patterns: Merging Metacognitive Tools And Learning Processes To Improve Facilitation Of Learning With Primary Children

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Abstract. This paper describes the merging of two learning tools, Vee Heuristics and Concept Mapping, with an advanced learning system, the Let Me Learn Process, to capture the learner uses of metacognitive skills during an extant learning event. Using student interviews and work product, this study traces the effect of a learner's mental operations on the learner's use of Vee Heuristics and Concept Mapping as the learner embeds and retrieves new and scaffolded knowledge. The data collected reveals the powerful effect which this combination of learning tools and learning processes yielded on student achievement. The significance of this study lies in the manner in which it lays open for the teacher the mind operations of the learner thereby equipping the teacher to better mentor and coach the growth and development of the learner rather than shape the learner through a one-size fits all learning environment as is too often the case in traditional schooling.

1 Introduction

Education is a journey and a very personal experience which may be enlightening for some but "merely an unengaging rite passage into adulthood" (Pinar ed., 1998:135) for others. Rousseau's writings emphasized the importance of making sense of the world in our own way "Childhood has ways of seeing, thinking and feeling peculiar to itself: nothing can be more foolish than to seek to substitute our ways for them" (Rousseau in Boyd's translation, 1956:38-39).

Nonetheless, the transmission model of education is still prevailing in many schools with children being lost to us. Even if students make it academically, Pinar argues that they "graduate, credentialized but crazed, erudite but fragmented shells of human possibility" (Pinar ed., 1995:519).

In view of this reality, one starts to ask "How can we help the children experience a journey of education which instills a desire to learn, reflect and act critically? As educators we need to reconceptualise pedagogy and modify the often conventional and restrictive practices in the classroom to a pedagogy where: "the child (is) aware of her own thought processes… and aware of how she goes about learning and thinking as she is about the subject matter she is studying" (Bruner, 1996:53).

But when and how does learning occur? While there are many who have contributed to our understanding of how learning occurs (James, 1904; Snow & Jackson, 1992; Sternberg, 1996), there are few who have developed a connected explanation of an individual's mental operations (cognition, conation and affectation) and resulting learning processes, i.e., how an individual takes in the world around him/her, makes sense of it, and responds to it in appropriate ways.

2 The Let Me Learn Process: An Advanced Learning System

The LML Process® is an advanced learning system whose theoretical basis is the Interactive Learning Model developed by Johnston, 1996. The Interactive Learning Model proposes that learning is a process occurring through the use of three mental processes: Cognition, Conation and Affectation and that these processes are the internal operations of our learning patterns namely: Sequential, Precise, Technical and Confluent and the degree to which each pattern is used varies from person to person. To measure the degree to which each learner uses each of the patterns, Johnston & Dainton (2005) developed the Learning Connections Inventory (LCI) which has withstood empirical and theoretical testing for more than ten years in different countries around the world. The LCI scores reveal whether one uses a learning pattern at a "Use First level, "Use as Needed" level or seek to avoid it altogether.

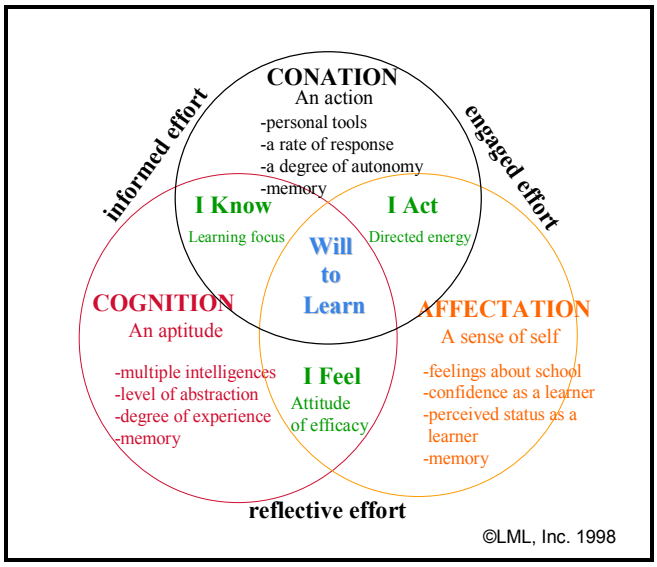

Figure 1: The Interactive Learning Model

The Sequential interaction is that aspect of our learning which needs to follow step-by step directions; organize and plan work carefully; and complete the assignment from beginning to end free from interruptions. The Precise interaction is that aspect of our learning which needs to process detailed information carefully and accurately; take detailed notes; ask questions; know exact answers; and write in a highly specific manner. The Technical Reasoning interaction is that aspect of our learning which requires practical application and relevance to any learning task. It is our non-verbal process which sees the mechanics of operations, the function of pieces; and needs to work "hands on", unencumbered by paper and pencil requirements. The Confluent interaction is that aspect of our learning which has us avoid conventional approaches; seek unique ways to completing any learning task; gives us permission to start before all directions are given; and permits us to take a risk, fail and start again (Johnston, 1996).

Let Me Learn Process does not categorize or place a learner into a single quadrant but instead emphasizes that every learner uses each of these interactive processes in concert and to varying degrees. These learning patterns, as presented in Fig. 2, serve as filters through which a stimulus moves from the brain's processing of it to the mind's action upon it. Such action includes translating the stimulus into symbolic representation (words, numbers, musical notes, etc), sorting and storing it within declarative and non-declarative memory, and retrieving it for later use. The Interactive Learning Model is based upon research conducted in cognitive science, brain science, and multiple intelligences (Allport, 1961; Bruer, 1993; Gardner, 1983; Johnston, 1996; Keefe & Ferrell, 1990; Snow & Jackson, 1992; Sternberg, 1996).

The Let Me Learn Process is based on the assumption that taking control of how one learns is powerful and positive (Flavell, 2000) and it provides a lexicon of learning terms and teaches metacognitive/reflective skills (Osterman & Kottkamp, 2004; Johnston, 1998). The LML Process helps learners take responsibility for making learning work for them by using carefully developed activities including a student designed, metacognitively-driven strategy card that guides the learner through various types of learning tasks. Unlike measures of personality, multiple intelligences, or learning styles which leave the learner informed but unequipped to use the information, the LML Process invites the learner to use these processes with intention. This is what makes the LML Process a truly advanced learning system.

The LML Process suggests in Fig. 2 that when stimuli enter the brain, the brain sends neuro impulses to the mind which translates the impulses into symbols that it can store, process and retrieve while at the same time it checks its prior experience and where it belongs within the declarative or non-declarative memory. This is where metacognition comes into play.

Bruer defines metacognition as "the ability to think about thinking, to be consciously aware of oneself as a problem solver, and to monitor and control one's mental processing" (Bruer, 1993:67). It is an intrapersonal communication where time is given to quietly think and reflect on what one is learning and on regulating how we go about learning (Vanhear & Borg, 2000). Metacognition challenges the transmissive view of learning and teaching held by certain teachers and the passive views of the role of the learners. While not dismissing the fact that metacognitive tools may be helpful, Georghiades (2000) reveals that primary school children who received metacognitive instruction performed better.

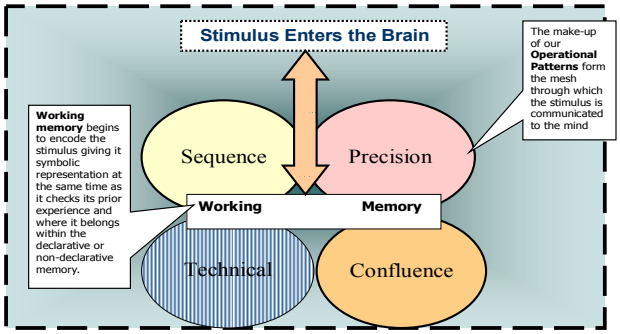

Figure 2: The LML Representation of the Architecture of the Brain and Mind. ©Let Me Learn, Inc. (Johnston, 2004)

3 Merging Two Tools with an Understanding of Our Learning Processes

This paper emanates from a Masters research carried out with six year old children, in which the following major research questions were constructed: How can I make new meaning relevant and meaningful to the learners? How can I know what's going on in their heads? Has meaningful learning really taken place?

The aim of this research was to focus on the process and technique of Vee Heuristics and Concept Mapping so as to improve meaningful learning. This process and development was captured through semi-structured interviews carried out with selected learners in order to observe details of the diverse children's knowledge, feelings and actions related to a specific focus question. Concept Maps and drawings related to a particular focus question were constructed from the data obtained **before** and **after** the project. Furthermore, all of this was put within a context of the different learners' learning patterns.

4 Methodology

The Vee Heuristic presented by Novak & Gowin (1984) was too complex to tackle with six to seven year old children. Therefore, I opted to make use of Ahoranta's adapted version of Åhlberg's improved Vee Heuristics which have withstood theoretical and empirical testing from 1993 to 2006 and have been applied to Environmental Education in Finland for several years (Åhlberg, 2002; Åhlberg in Cañas et al 2004; Åhlberg & Ahoranta, 2002; Åhlberg & Ahoranta in Cañas et al 2004) Nonetheless, considering that Ahoranta's work was with 11-12 year olds, the wordings in the eight steps presented by Ahoranta were adapted so as to facilitate the learners' understanding and application.

In Fig. 3 one can note that the first step in this process is to select a focus question. In order to capture the children's curiosity and empower them to become 'choosers' (Novak, 1998:51) while also encouraging them to actively take part in their own learning, one of their own questions was used as a focus question.

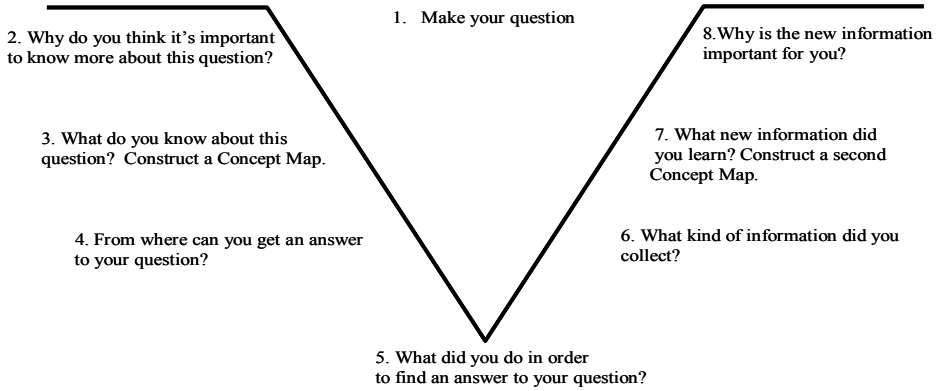

Figure 3: Ahoranta's Vee adapted by Vanhear

5 Data Analysis

From the data collected it was very clear that besides revealing that children come to class with prior knowledge and experiences, children process incoming information in different ways,. Vee Heuristics and Concept Maps facilitated an awareness of what children already know and how each of them actually processes new information. My prior knowledge of different learning patterns was value added to the process of Vee Heuristics and Concept Mapping. The path that this study has pursued is not to seek absolute truths but rather to shed light upon a pedagogical process which captures personal structures of knowledge and their development. Therefore, I preferred to make use of the same processes used throughout this research, i.e. Vee Heuristics and Concept Mapping for analyzing the data collected. Here are two examples from the collection of data.

5.1 Learner 1. Her LCI score was Sequence 17; Precision 18; Technical 23; Confluence 27 (7-17= Avoid; 18-24=Use as Needed; 25-35=Use First)

This learner uses Confluence first, avoids the use of Sequence and uses her Technical Reasoning and her Precision only when needed. This means that detailed instructions and directions do not make sense to this learner; she prefers to learn in a creative and entertaining way, she likes to do things in her own way and differently each time, and she doesn't feel the need to follow any rules.

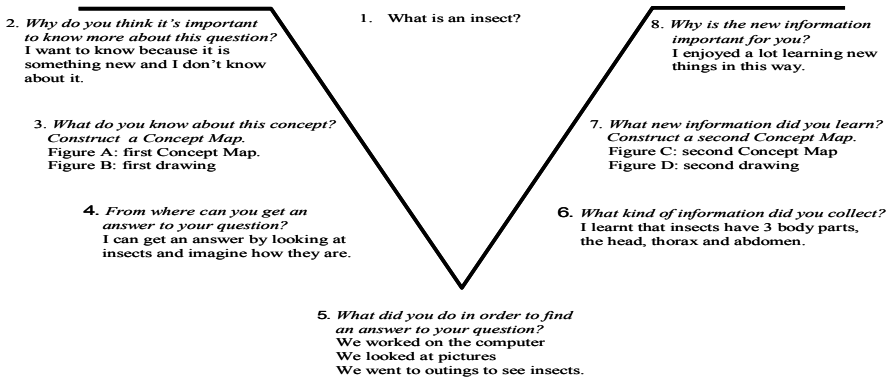

Figure 4: Learner 1 Vee Heuristic.

The left hand side of the Vee Heuristic presented in Figure 4 reveals that for this learner the primary reason for wanting to know more about the focus question was because it presented something completely new to her (confluence). From reply No.4 one can observe the different way how this learner planned to learn about this question. She didn't refer to learning from books or detailed information but she referred to imagination (confluence) and observation instead. This is substantiated in reply No. 5 where although in this learning programme specific lessons and books were available, this learner didn't mention these at all as the primary sources for her learning, but on the other hand she mentioned the computer, pictures and outings. The right hand side reveals the new knowledge constructed and how she integrated it within her pre existing cognitive structure. This learner expressed that she enjoyed learning new things in this way thus suggesting an increase in her motivation.

By analyzing the two Concept Maps presented in Figures A and C, one can easily conclude that the number of concepts and propositions have increased drastically. More concepts and propositions indicate that learning has taken place. The learner also detected her misconceptions and missing information in the first Concept Map and made the necessary changes and additions in the second Concept Map. Being a learner who scores high in confluence and low in precise and sequence, she usually looks unmotivated to learn in the classroom setting. Consequently, this second Concept is amazingly impressive. She was able to demonstrate a high ability for learning new concepts and she also mentioned details, which would have probably passed unnoticed through the traditional way of teaching. I am referring to details such as the word "arthropods" and its meaning, what insects eat, the concept of pollination etc…. This Concept Map evidences that this learner really enjoyed learning and was motivated to learn in this way.

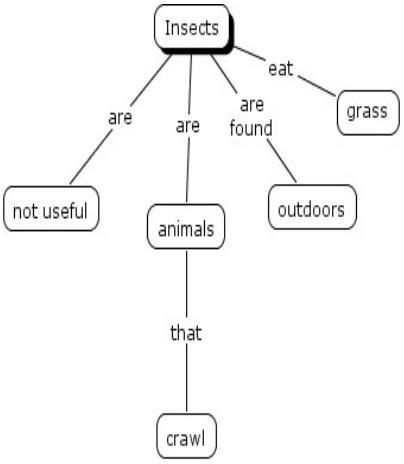

Figure A: First Concept Map

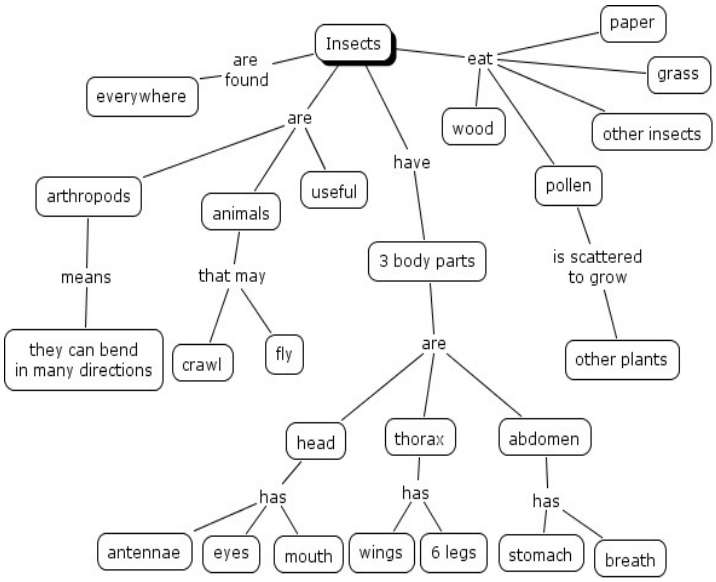

Figure C: Second Concept Map

Figure B: First drawing before the learning program

Figure D: Second Drawing after the learning program

From the difference in the two drawings one can note some of the new concepts that the learner developed. The first drawing is lacking detail while it represents exactly what the learner's cognitive structure of knowledge was about insects and which is similar to her first Concept Map before the learning project. It also reveals the misconception, present in this learner's cognitive structure, related to the number of legs. On the other hand, the second drawing reveals the development of new concepts and the correction of the previous misconception about the legs. One has to note that in the second drawing the three body parts and the six legs are very distinct. On the head one can see the eyes and the mouth and the antennae which are labelled. These were all new concepts which were also present in the second Concept Map.

5.2 Learner 2. Her LCI score was Sequence 16; Precision 22; Technical 27; Confluence 20.

Here we have a 'dynamic' learner (Johnston, 2005) who makes use of Technical Reasoning at a Use First level. She uses her Confluent and Precise processing as needed while she avoids Sequence processing. From this learning pattern, one can deduce that this learner doesn't like to write in detail, she makes use of very few words to express herself, she prefers to work by herself and needs to see the purpose for what she's doing. Furthermore, she tends not to read directions since she finds following directions quite confusing if not even frustrating.

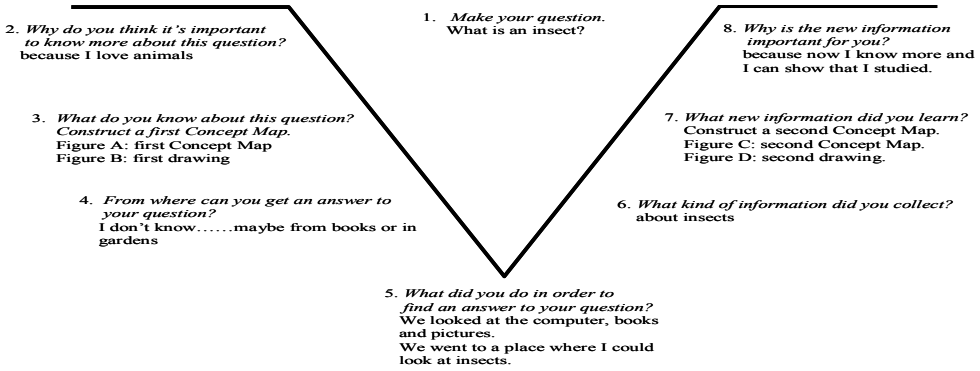

Figure 5: Learner 2 Vee Heuristic

In this Vee Heuristic it is very interesting to note the difference in the answers on each side. On the left hand side, which reveals responses given before the learning programme took place, one can note this girl's uncertainty in going through this programme. Reply No.1 is quite vague whereas reply No. 4 shows that she isn't sure from where she can get an answer. This clearly conveys the message how lost this child felt before going through this learning programme.

On the other hand, the right hand side reveals a difference in this girl's confidence. Her response to question 5 was quite immediate, detailed and sure, thus showing that her sense of security and motivation increased along the learning programme. Furthermore, it is quite appealing to note the response to question 8: *"because now I know more and because I can show that I studied"*. One of this learner's main concerns is not what she learnt but how she's going to show it. In fact, this learner's learning patterns reveal that she finds it difficult to express what she knows especially through tests since she doesn't like writing in detail besides following too many sequential directions. It is no wonder that she is concerned about this, she is aware that she knows but she finds it difficult to express it. From reply No. 8 one can conclude that she was satisfied to be able to show what she learned. Concept Mapping offered her another way of expressing what she knows. When asked what she thinks about her second Concept Map, she replied: *"it shows that I have studied"* something a learner high in the use of technical reasoning is often accused of not doing because they do not see it as important to tell others what they know!

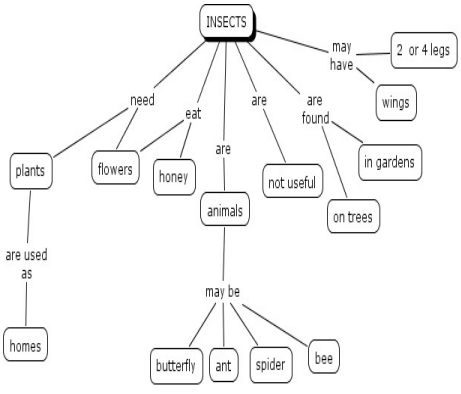

Figure A: First Concept Map

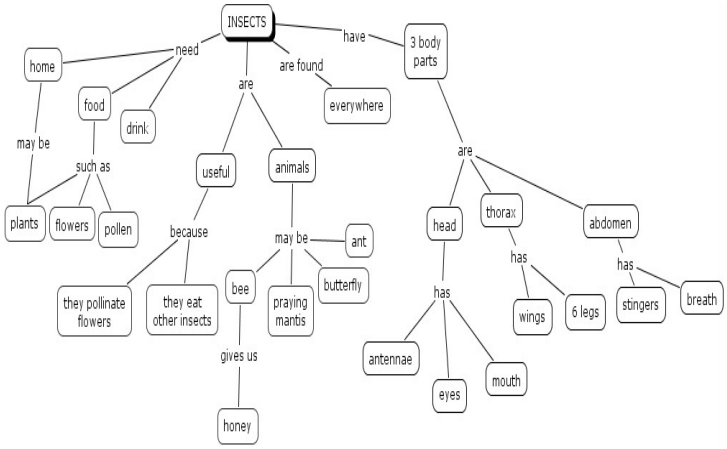

Figure C: Second Concept Map

When one compares the two Concept Maps, presented in Figures A and C it is very easy to deduce that the number of concepts and propositions has increased thus indicating that learning has taken place. From the interview with this girl I noted how quickly she was changing and adding on to her map. This revealed her confidence and eagerness to show what she has learnt besides showing how easy it was for her to externalize her cognitive structures in this way. She was enjoying watching her map expand. We can note that she was able to correct all the misconceptions present in the first Concept Map such as *"insects have 2 or 4 legs"*, *"insects are not useful"* or *"insects eat honey"*. She was also able to make changes to the concept of honey.

Referring again to this learner's learning patterns, we are aware that she finds difficulty in expressing what she knows and that she avoids sequence. This is maybe why the misconception *"insects eat honey"* occurred in the first Concept Map. Nonetheless, she was able to adjust this misconception and relate to it appropriately in the second Concept Map. In fact, we can see that this concept appears again in the second Concept Map only this time in the proposition *"bee gives us honey"*.

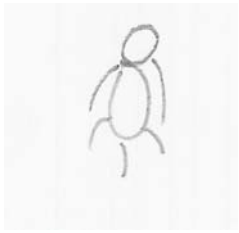

Figure B

This learner's motivation through this kind of process of learning is also very explicit in her drawings. Figure B shows the drawing before the learning project and it is clear to see her motivation and lack of confidence at this stage. Figure D reveals the radical change that took place within this learner's motivation to learn. In fact, the second drawing, gives precise details.

The changes present in the Vee, in the Concept Maps and the drawings clearly demonstrate that learning in this way increased the learners' motivation thus affecting positively on their learning. Moreover, Concept Maps seemed to offer a practical way to exhibit what they learned, though I have to remark that they needed prompting while constructing their second Concept Map.

Figure D

6 Discussion

Novak (1998) reveals that the shape of a Vee was chosen above other shapes because by using this format, one can clearly recognize and differentiate that both thinking (concepts and theories) and doing (methodology) are implicated in the process of constructing knowledge. The right hand side of the Vee, reports the action part of knowledge construction taking place. One can, in fact, visually see what the learner is doing to develop his/her own knowledge. In addition, the learner can reflect and observe the development of the new knowledge taking place as opposed to his/her prior knowledge on the left hand side of the Vee. In this way, prior knowledge was developed; misconceptions were altered while new knowledge was constructed. Thus, the transmission model of education is hereby challenged since the learner is learning on his own, the teacher is only facilitating this process by providing the necessary tools. It is argued that rote learning does not impart meaningful learning and one way of taxing this approach is through the use of metacognitive learning. Research in this study and elsewhere prove that Vee Heuristics promote metacognitive skills. Similarly, Novak argues that *"giving learners the correct information does not displace their faulty conceptions! It takes a lot of negotiation of meanings, a lot of shared experience to help learners reconstruct their internal concept Maps to be congruent with the expert's knowledge"* (Novak, 1998:118). This is where the knowledge about Let Me Learn becomes most fruitful, since with an awareness of the diverse children's learning patterns one is in a much better position to negotiate meanings and experiences in a way which make sense to the learners. The cognitive structures represented in this way made it relatively easy to follow the development of new knowledge and the specific changes in the learner's knowledge structure since Concept Maps give a specific picture of what the child has in her/his head (Kinchin, Hay & Adams 2000, Cañas et al 2004).

Moreover, this whole process makes the teacher stop and reflect on his/her own practice. In order to bring about transformation one must be ready to transform oneself first and foremost and the starting point should be to reflect critically for "If we want pupils to learn meaningfully and reflectively, then their teachers ought to first learn how to learn meaningfully and reflectively" (Åhlberg in Cañas et al 2004:39).

7 Conclusion

My prior knowledge of the Let Me Learn Process and my newly acquired awareness of Vee Heuristics and Concept Mapping led me to study the effects of merging these tools. Through the Let Me Learn Process, I could better understand how the student learns while Vee Heuristics and Concept Mapping visually represented the learners' metacognition throughout their acquirement of new and related knowledge.

When teachers understand what students think about concepts or events under study and are aware of how they learn, they are better able to formulate a partnership in learning based on the learner's needs.

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