

CONCEPT MAPPING AND VEE HEURISTICS: A MODEL OF TEACHING AND LEARNING IN HIGHER EDUCATION

Jacqueline Vanhear

Directorate for Standards and Quality in Education, Training and Professional Development Unit, Malta
jacvan@gmail.com

Abstract. This paper will present a model of teaching and learning in Higher Education through the integrated use of Vee Heuristics and Concept Mapping. This research will suggest that when using Concept Maps, Vee Heuristics and an awareness of how students prefer to learn, learners will go through a metacognitive learning process which will eventually lead to meaningful learning. Using the productions of University students, 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 yielded on student achievement and transformation.

1 Introduction

We are living in a world which is changing relentlessly at a breathtaking rate. In order to address these rapid changes, Malta is at the moment going through a wide-ranging reform in education. It is calling for a paradigm shift from a situation where teachers are disseminators of information and students are passive recipients to a scenario where teachers facilitate and empower students to become active lifelong learners by equipping them with the necessary tools to embark upon a meta-learning journey leading to success. We are, however, facing a huge dilemma; a dilemma mirrored in Fullan (1993:3) "*On the one hand, schools are expected to engage in continuous renewal, and change expectations are constantly swirling around them. On the other hand, the way teachers are trained, the way schools are organised, the way the educational hierarchy operates, and the way political decision makers treat educators results in a system that is more likely to retain the status quo.*"

Prevalent literature (Moon 2010, Fullan 1993) suggests that one way of bringing change within an educational system is through teacher education. According to UNESCO "*teacher education institutions serve as key change agents in transforming education and society.*" Nonetheless, having pursued the Bachelor of Education course besides recently mentoring student teachers during their teaching practice, I have observed that often, after a four year course at University, student teachers end up teaching the way they were taught therefore reproducing the status quo in our educational system. This situation is apparently not novel or unique to Malta (Hartman, 2001). One of the reasons for this perpetuation may be because student teachers are adopting ineffective and inappropriate learning practices during their training and "*thus, existing misconceptions about learning are perpetuated through automatic adoption*" (Gamache 2002:279). Another reason could be that teachers are not aware of developments in pedagogical tools which now vary from those they encountered while they themselves were being taught and educators need the tools to engage in change productivity (Fullan, 1993). However, if the 'new' teachers are not going through a change themselves how shall this change be brought about in our educational system? If four years of Higher Education are not producing reflective and innovative teachers, how can we expect teachers to change their vision towards teaching and learning? How can we expect the change many stake holders are calling for in our educational system to take place? If educators are to be agents for meaningful change, then this must be initiated in initial teacher education (Senge, 1990).

This study will investigate and present a model of the integrated use of Concept Maps and Vee Heuristics, paired with an awareness of the students' own learning processes, in teaching and learning in Higher Education. The implication is that students are encouraged to go through a process of reflection and to embark on a journey of transformative learning. Mezirow & Taylor assert that to promote transformative learning, education should be a practice "*predicated on the idea that students are seriously challenged to assess their value system and worldview and are subsequently changed by the experience*" (Quinnan, 1997:42 in Mezirow & Taylor 2009:3). Similarly, Gamache believes "*that what struggling university students need are practical, specific activities that will lead them toward an alternative conceptual framework within which they can **re-create themselves as active learners.*** [My emphasis] *Rather than just absorbing theory, students actually engage it through a process of active self-reflection and self-direction*" (Gamache, 2002:291).

Gow & Kember suggest that "*Tertiary education must challenge students enough to develop their powers of independent reasoning. Teachers*[Teacher trainers- my addition] *need to develop in their students an academic approach to their study, that is, an interest in what is learnt for its own sake and an active attempt to understand what is being studied*" (Gow & Kember,1990:320). Learning meaningfully is crucial within any

educational sector, let alone in Higher Education. Kinchin (2001) identified *dialogue* as a fundamental contributing component to meaningful learning. Similarly, Richards (2007) reveals that *student/teacher interaction* is an important factor affecting the level of learning. And not just in primary and secondary education. Ramsden (2003) suggests that separating learning and teaching within Higher Education is a false myth: Various authors propose that in order for students to become agents of their own learning they need metacognitive strategies (Gamache, 2002; Bruer, 1993). Active self-reflection and self-direction are two kinds of metacognition (Gage & Berliner, 1998).

With this in mind, Concept Maps and Vee Heuristics will be explored in this study as two tools which a wide body of theoretical evidence is confirming as being intrinsically metacognitive. (Vanhear, 2008). Concept Maps and Vee Heuristics will be presented as two entirely innovative tools to our educational system, which, without any pretensions to being a quick fix, sure tool, can definitely serve as a stepping stone to challenging the prevailing transmission model of education. Using them in initial teacher training will hopefully lead to the use of these tools in our school classrooms.

2 Research Question and Methodology

The path that this study pursues is not to seek absolute truths or promote the pedagogical tools as sure quick fix learning tools but rather to shed light upon a pedagogical process which captures personal structures of knowledge and their development so as to generate meaningful learning. This study will also explore whether the use of these tools could lead to enhancing student/teacher interaction which goes on within the context of Higher Education. The main focus question will therefore revolve around the question *“In what ways can teacher-student interaction influence meaningful learning?”*

Using students’ productions from the Bachelor of Education course at the University of Malta, this study traces the effect of learners’ mental operations on the learners’ use of Concept Mapping and Vee Heuristics as the learners embed and retrieve new and scaffolded knowledge. By analysing productions constructed by the students before and after the learning programme, as explained hereunder heading 4, this study will reveal a tangible transformation in the ideas held by students about a specific issue which is: *What is Education for Sustainable Development?* This question will be the vehicle through which data will be collected so that the learning development of the students can be observed and recorded.

The nature of this study calls for a qualitative research since qualitative researchers *“often espouse a commitment to demonstrating the viability of truly alternative educational approaches”* (Schulman in Jaeger 1997:18). In line with one of Dewey’s principles about educational research, this research is experimental and conducted within a natural setting. Furthermore, *“If we can create and sustain a particular instructional innovation in a real school, we have demonstrated the possibility that it can exist”* (Schulman in Jaeger 1997:19).

In this scenario, the tradition which best suits this qualitative research is Action Research. Corey argues that action research *“is a process in which practitioners study problems scientifically so that they can evaluate, improve and steer decision-making and practice”* (Corey, 1953, as cited in Cohen, Manion & Morrison 2000:227). Action research allows educators to systematically and empirically address topics and issues that affect teaching and learning in the classroom. McNiff regards action research *“as an approach to education that encourages teachers to be aware of their own practice, to be critical of it and to be prepared to change it”* (McNiff, 1992 in Rearick & Feldman 1999:345).

An in-depth study of specific case studies is one of the overwhelming approaches in Action Research. The productions of case stories show how researchers improved their own learning and situations for the benefit of themselves and others. They provide undeniable evidence that Action Research is a form of learning that has insightful implications for the future society and that it could lead to transformation (McNiff, Lomax & Whitehead, 1996).

In this light, Action Research can also be called a form of self-reflective practice. It is also concerned with ‘*praxis*’ – the process of reflection and action, with the aim to emancipate; *“the claim is made that action research is strongly empowering and emancipatory in that it gives practitioners a ‘voice’”* (Cohen, Manion & Morrison 2000:30). Moreover, since Action Research is built upon collaboration between the professional researcher and the local stake holder, it integrates praxis with theory (Denzin & Lincoln, 2005).

3 Merging metacognitive tools for use in Higher Education

Learning is about change and changing oneself (Ramsden, 2003; Zull, 2002). Higher Education must nowadays highlight the quality of education and not just certification. Learning should be about “*changing the ways in which learners understand, or experience, or conceptualise the world around them*” (Ramsden, 2003:6). This research is intended to clarify the mechanisms by which Concept Maps and Vee Heuristics support meaningful learning. It will also raise awareness of how students’ mental processes work most effectively leading to conceptual transformation for both the teacher and the student. These two tools merged together present a process of praxis which is “*an activity that combines theory and practice, thought and action for emancipatory ends*” (Kincheloe, 2005:22).

More importantly, these two metacognitive tools lay open what is going on in the learners’ mental processes so as to empower them to embark upon a meta-learning journey. Consequently, it is anticipated that they will be better equipped and trained in decision making, reflective and problem solving skills (Ramsden, 2003; Biggs & Tang, 2009 Novak & Gowin, 1984; Gamache, 2002). Furthermore, these two tools do not occur in a vacuum but they build on the learner’s prior knowledge (Novak & Gowin, 1984). They take into consideration the diverse and personal experiences therefore making learning more meaningful. This is manifested in the following paragraphs which present the students’ responses in the Vee Heuristics, their Concept Maps and their written reflection about this reflective educational journey.

The choice of setting – the Bachelor of Education course at the University of Malta – was dictated by the fact that this happened to be the only Higher Education Institution in Malta which caters for teacher training. Lectures took place at the University of Malta and were held once a week for seven consecutive weeks during the first semester of the academic year. Each lecture had a duration of two hours. The programme was offered as an optional credit to B.Ed students who were in their second, third or fourth year of the course. As a result, the group of participants in this pilot study is self-selected since they attended at their own free will. It is also worth mentioning that in this way the students participating were following different subject specialisations.

4 Data Analysis and discussion

The following paragraph includes the whole process of the Vee Heuristics along with Concept Maps that were generated throughout the whole credit. This paper shall be presenting a sample of only two different learners. During the first lecture the students were asked to reflect, answer and write about the three steps found on the left hand side of the Vee (Figure 1). Their responses were collected at the end of this lecture, analysed and the learning programme was planned so as to accommodate the learners’ different learning preferences. All the lectures were presented through Concept Maps where prior knowledge and new knowledge construction was negotiated through active discussion and participation. During the last lecture the students were asked to complete the right hand side of the Vee (Figure 2). Finally, they were asked to organize and compare and contrast all the steps in the Vee Heuristic by presenting, as an assignment, the left and the right hand side of the Vee, the first Concept Map depicting their prior knowledge and the second Concept Map illustrating their new knowledge construction. They were also asked to write a final reflection about their own personal growth during the programme, if any, and how they thought that this process had helped them to become more effective teachers, if they considered that it had done so at all.

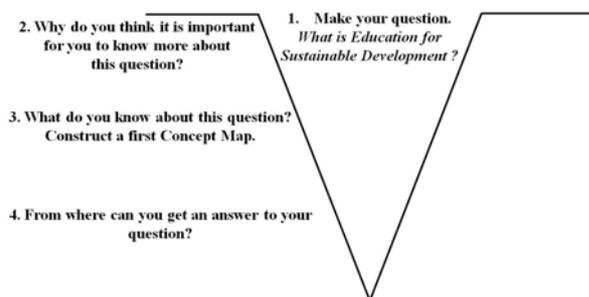


Figure 1: Vee Heuristic presented *before* the learning programme.

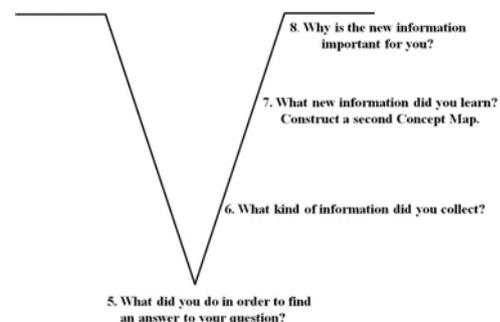


Figure 2: Vee Heuristic presented *after* the learning programme.

4.1 Learner 1 Maryanne

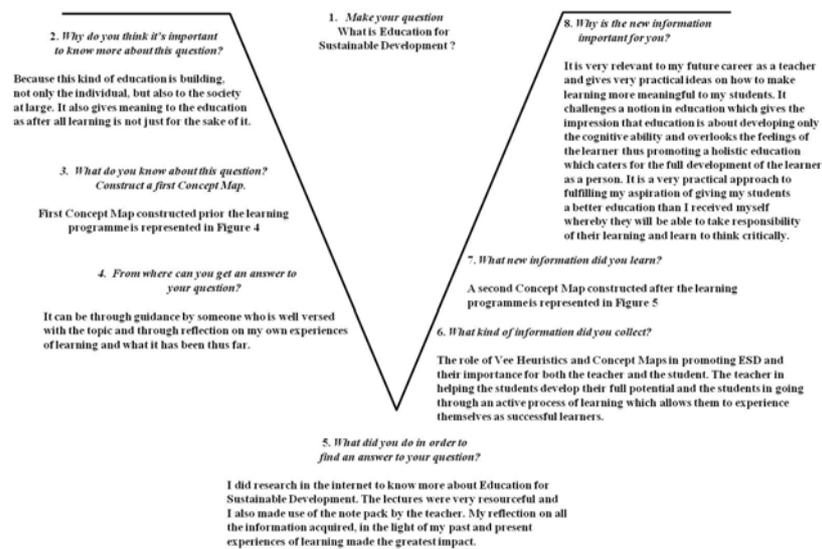


Figure 3: Maryanne's Vee Heuristic

This Vee Heuristic illustrated in Figure 3 reveals this learner's development in her thinking process. A very clear difference can be observed between the left hand side of the Vee, which was completed during the first lecture, that is, prior to the learning programme, and the right hand side of the Vee, which was completed during the last lecture, upon completion of the learning programme. The information given for question No.2 reveals that this learner had few ideas of what ESD is all about and this is corroborated by the first Concept Map she constructed before the learning programme, as represented in Figure 4. It is worth noting that this question also tries to capture the learner's feelings about the issue in question and one can deduce from the learner's response that this learner was very much interested in wanting to know more about the focus question. The reply to question No. 2 reveals Maryanne's level of motivation and interest in studying this topic and one can observe that this learner found this topic interesting and relevant to what she was studying.

The replies given to questions No. 4 and 5 illustrate how this learner planned to learn more and what this learner actually did to learn more. This learner planned to learn through "guidance by someone who is well versed with the topic" and she carried out research on the internet and read the reading pack which was given so as to have more information and all of this reflects the learner's preferred way of learning. However, it is worth noting that she also planned to learn through reflecting on her experiences. From the responses given on the right hand side of the Vee one can easily observe how this learner developed her knowledge related to both ESD and the learning process. This learner gave specific details to answer questions No. 6 and 8 and the new knowledge constructed is also illustrated in her second Concept Map constructed after the learning programme as represented in Figure 5.

When observing the first and second Concept Map represented in Figures 4 and 5, one can easily note that the number of concepts and propositions has increased, **revealing that learning has taken place**. The first Concept Map clearly depicts a linear way of thinking and it contrasts with the second Concept Map showing a change even in the way of thinking. Furthermore, Maryanne not only increased the number of concepts but also changed and developed the original concepts constructed in the first Concept Map.

The fact that this learner was eager to expand her knowledge reflects that she enjoys having more detailed information about what she is learning. This is present not only in her Vee but also in her four page detailed reflection where clear references to related literature were made. In this reflection she discusses how she looked at herself as being "a product of a system of education which promotes transmission of knowledge regardless of the process of learning" and how she changed and developed herself throughout this credit: "This has opened my eyes and mind to a way of teaching and learning which are new to me and which I have found to provide a better teaching and learning as compared to other traditional methods of teaching which feed students with information rather than allowing them to go through a process of learning."

She also refers to the ‘bigger picture’ when discussing teaching and learning: “I will make use of Concept Maps in my teaching. This is because they give learners the opportunity to be active participants in the learning process.” She also suggests that the Vee Heuristics helped her to “give a true picture of who the students really are as learners. This will help me to cater for the needs of the students’ in my classroom, appreciate them more with their diversity and help them to develop to their fullest potential. The Vee Heuristics and the Concept Maps build on the students’ prior knowledge. As proposed by the constructivist theory, students learn best when information is based on what they already know.”

She also indicated how she could eventually implement all that she had learnt in her own classroom and finally she described the relevance of this credit to her experiences as a University student and as a future educator: “My experience during this unit was a very positive one. I feel that this unit was helpful to me beyond my expectations when I chose it as an optional credit. I have found it to be one which touches my present life as a student and my future career as a teacher. I feel that I have been challenged and encouraged at the same time.”

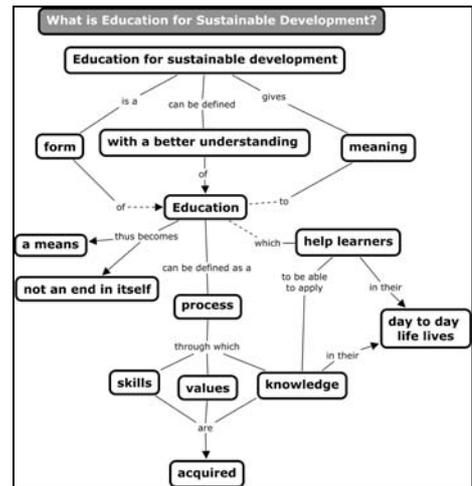


Figure 4: Maryanne’s first Cmap, constructed *before* the learning programme

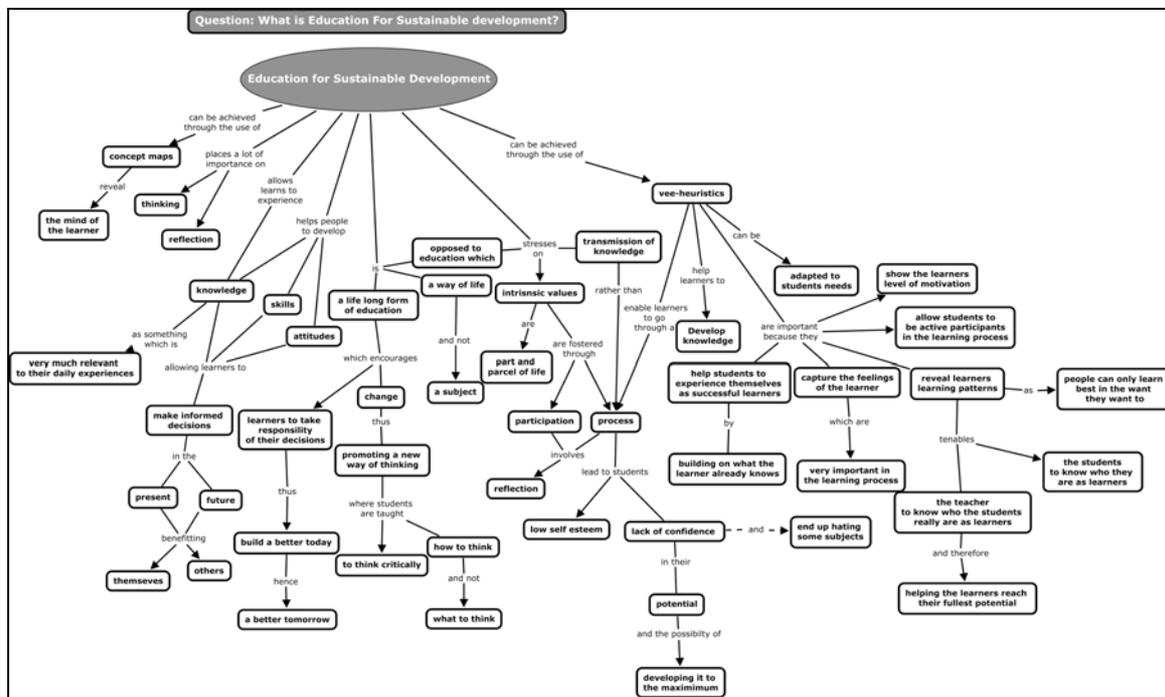


Figure 5: Maryanne’s second Concept Map constructed *after* the learning programme

4.2 Learner 2 Stefan

From this learner’s Vee Heuristic, presented in Figure 6, one can easily observe a significant difference between the left hand side of the Vee which was constructed during the first lecture before the learning programme and the right hand side of the Vee which was compiled after the learning programme. It is also worth noting the response given to question No. 2 in the Vee. This response is quite vague and surely reveals the low level of motivation which the student had for this credit. Actually, during discussions with this learner, he confessed that he had registered for this credit simply because it was the only one which did not clash with his time-table. This is also manifested in response No.4 where we see this learner’s uncertainty in going through this programme. This learner was not at all planning to learn from the lectures. However, it is important to note that he planned to do his learning only through real life experiences. Nowhere did he mention that he planned to read or do research to find more information.

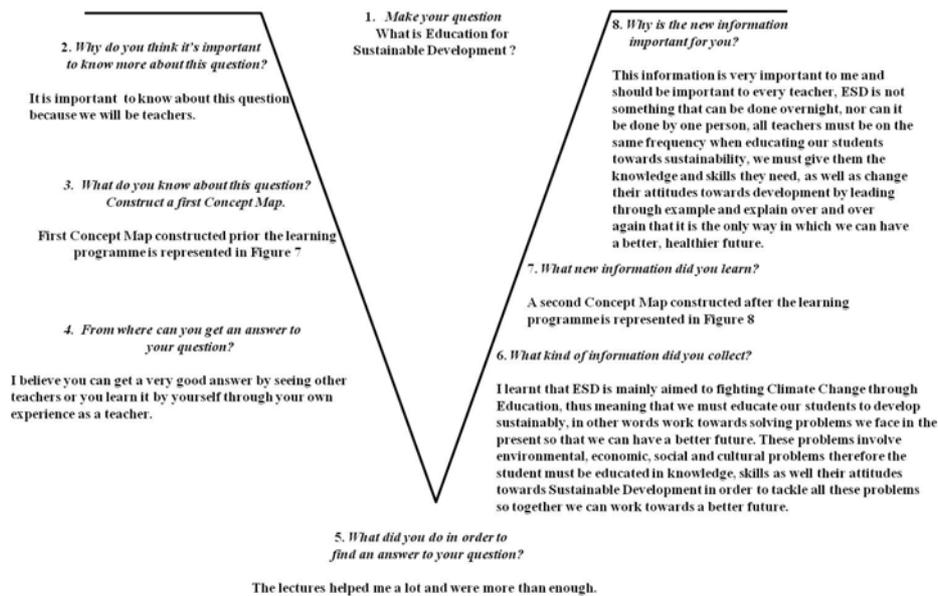


Figure 6: Stefan's Vee Heuristic

The information gathered from Stefan's Vee was very important to me as the teacher: I took it into consideration when planning the credit and I ensured that the student's preference for learning from real life experiences, as well as his avoidance of detailed information, was taken into account. This analysis of the Vee is critical if the teacher expects meaningful learning to take place. Coffield (2004:17) states that "*teachers who understand their own styles and those of their learners can reduce the harm they may otherwise do*" and consequently they will develop more effective skills to interact with and respond to students.

The reply to question No. 5 "*The lectures helped me a lot and were more than enough*" suggests a few things. First, that this learner found the lectures helpful and interesting but on the other hand the latter part of the comment indicates that I must have overdone it with information from this learner's point of view. It also tells me that this learner did not feel the need to go and look up more information because what I delivered in the lecture was '*more than enough.*' This contrasts sharply with the Vee Heuristic as presented by Maryanne since that learner thoroughly enjoyed the extra information I provided.

The responses given on the right hand side of the Vee clearly contrast with the responses given on the left hand side. This reveals that through the learning programme this learner's motivation to learn increased, he also found this unit quite meaningful as his answer to No.8 reveals: "*This information is important to me and should be important to every teacher.*" As we can observe from the first Concept Map represented in Figure 7, this learner did not have a clue of what ESD meant, however, the response given to question No.6 reveals that he has grasped the meaning behind ESD and this is also corroborated in his second Concept Map illustrated in Figure 8. In the response given to question No.8 one can note a sense of determination and commitment in this learner's tone revealing once again that this programme left its mark on this learner who initially found himself doing this credit just by chance. It is worth noting that this learner's preferred way of learning through real life experiences is also mirrored in question No. 8 where he suggests a change of attitude towards sustainable development "*by leading through example and explain over and over again.*" Actually, one finds more information in the Vee Heuristic and Concept Maps than in the ten line short paragraph presented as the written reflection. Although all the information given in these ten lines was correct, the sentences were very short and straight forward.

From the first Concept Map generated during the first lecture as presented in Figure 7, one can easily observe a Concept Map presented as a chain revealing little or no knowledge about ESD. This kind of Concept Map also reinforces the answers given to question No.2 and No.3 in the Vee illustrated in Figure 6. In the second Concept Map constructed after the learning programme one can observe a change from a linear train of thought to a net of thoughts and ideas. Although this Concept Map may have a few flaws in Concept Mapping skills, what is more important is that it reveals how this learner's knowledge has developed. There is a marked increase in concepts and propositions and therefore learning has taken place.

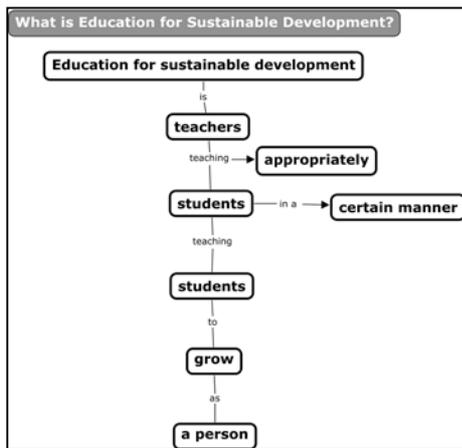


Figure 7: Stefan's First Concept Map created *before* the learning programme.

Stefan's Concept Maps differ from the other Concept Maps presented in this study because they lack details and this could be related to the fact that the dominant learning schema of this learner is typical to this learner who avoids details and likes to go straight to the point. However, the most salient points relating to what ESD is all about are present: the differences between Stefan's two Concept Maps reveal that this learner has learned meaningfully although he started off on this programme with a lack of interest and motivation. It also stands to be said that although this learner purportedly avoids details, his second Concept Map exhibits more details than the paragraph he presented as a reflection. It is also worth noting the way in which the first Concept Map (Fig. 7) was constructed and the way in which the second Concept Map (Fig.8) was created. There is a difference in colours and even in the arrowed lines showing that this learner enjoyed constructing the second Cmap more than the first one and put more time and effort into the process. The way in which this learning programme was presented and experienced may have helped in increasing this learner's interest and motivation.

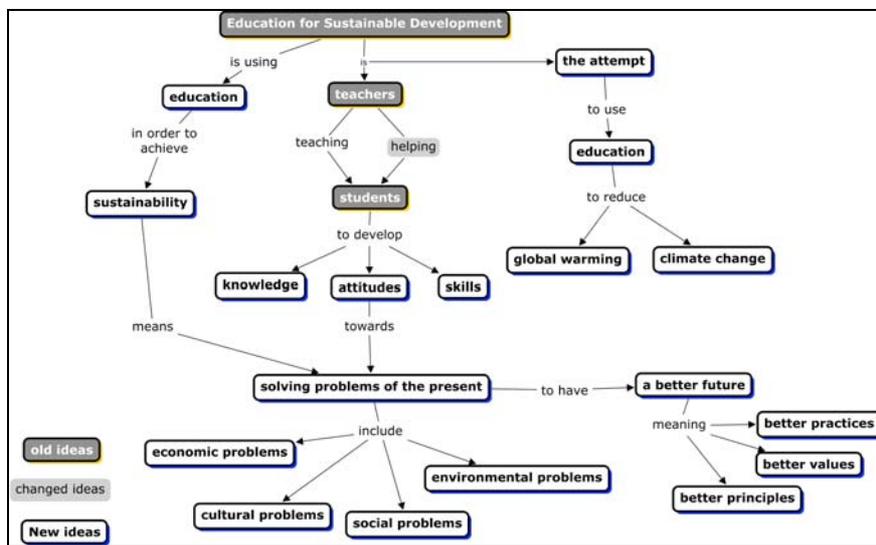


Figure 8: Stefan's second Concept Map constructed *after* the learning programme.

5 Concept Maps

One of the main focuses of this research revolves around the learning process as an interaction of thinking, feeling and acting. Although Concept Maps in themselves do not reveal the affective side of learning, the actual process of constructing a Cmap **does involve these three mental processes**. In contrast with "traditional" teaching and learning where the students are asked to represent their knowledge through ways which rely mainly on memory, in order to regurgitate chunks of information (surface learning), when students are asked to represent their knowledge by constructing Concept Maps, they are going through a process of metacognition (deep learning). Metacognition entails mulling, connecting, rehearsing, expressing, assessing, reflecting, revising and learning. Actually, when one is constructing a Concept Map, one goes through these processes and this is the reason why Concept Maps facilitate meaningful learning and challenge rote learning. Furthermore, when one is constructing a Concept Map one is not simply reproducing chunks of information which are totally irrelevant to one's own experience (because it would have been studied by heart). When the learner is constructing a Cmap, since he/she is presenting knowledge according to his/her own cognitive structure, the learner is creating knowledge according to his/her own perspective and this will automatically be related to the individual's own personal experience. This is why learning becomes more meaningful.

6 Vee Heuristics

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 has been developed; misconceptions have been altered while new knowledge has been constructed. It is in this way that the transmission model of education is being challenged, since the learner is learning on autonomously, with the teacher only facilitating this process by providing the necessary tools. If rote learning does not impart meaningful learning, the way forward must lie in 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). Therefore, this process facilitates more teacher/student interaction. An added value is that 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

The integrated use of Vee Heuristics and Concept Maps along with an awareness of how students prefer to learn may promote the reflection and action that is required to stimulate change in education, in this case Higher Education. Implementation of these teaching and learning tools will hopefully lead to the development of creative and reflective practitioners in our society, empowered to become agents of transformation.

8 References

- Fullan, M. (1993). Why Teachers Must Become Change Agents. *Educational Leadership* 50, 6.
- Gage, N.L. & Berliner, D.C. (1998) (6th Ed.) *Educational Psychology*. USA: Houghton Mifflin
- Gamache, P. (2002). University Students as Creators of Personal Knowledge: an alternative epistemological view. *Teaching in Higher Education* 7 (3).
- Gow, L. & Kember, D. (1990). Does Higher Education Promote Independent Learning? *Higher Education* 19 (3).
- Hartman, H.J. (2001) *Metacognition in Learning and Instruction: Theory, Research & Practice*. Netherlands: Kluwer Academic Publishers.
- Jaeger, R.M. (1997). (2nd Ed.) *Complementary Methods for Research in Education*. Washington, DC: American Educational Research Association.
- Kinchin, I. M. (2001). Can a Novice Be Viewed as an Expert Upside-Down? *School Science Review*, 83(303).
- Mezirow, J. & Taylor, E.W. (2009). *Transformative Learning in Practice: Insights from community, workplace and Higher Education*. USA: John Wiley & Sons.
- Moon, B. (2010). Time for Radical Change in Teacher Education. *Connections*. Feb. Vol.15, No.1
- Novak, J. D. (1998). *Learning, creating, and using knowledge: Concept Maps as Facilitative Tools in Schools and Corporations*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Novak, J. D., & Gowin, D. B. (1984). *Learning How to Learn*. New York: Cambridge University Press.
- Ramsden, P. (2003). (2nd Ed.) *Learning to Teach in Higher Education*. London: RoutledgeFalmer.
- Senge, P. (1990). *The Fifth Discipline*. USA: Doubleday.
- Vanhear, J. (2008). Concept Mapping, Vee Heuristics and the Learning Process: Towards a Metalearning Experience. In J. Sánchez, A. J. Cañas, J. D. Novak (Eds.), *Concept Maps: Making Learning Meaningful, Proc. of the Fourth Int. Conference on Concept Mapping*, Viña del Mar, Chile: Universidad de Chile.
- Zull, J.E. (2002). *The Art of Changing the Brain: Enriching the practice of teaching by exploring the biology of learning*. USA: Stylus Publishing LLC.