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Abstract
Higher Education is currently undergoing relentless change worldwide in order to respond effectively to the aspirations of the 21st century. Consequently, prevalent literature in Higher Education calls for more emphasis on the students' learning process through increased metacognition and critical reflection. This paper starts off with the assumption that learning takes place through the integration of thinking, feeling and acting. As a result, 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 along with an awareness of how students prefer to learn, the students will go through a metacognitive learning process which would eventually lead to critical reflection and meaningful learning. Using University students' work products, 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.

Resumen
La educación superior está sometida actualmente de forma implacable a un cambio a nivel mundial, para responder de forma efectiva a los retos del siglo XXI. De esta forma, la literatura fundamental sobre educación superior pide poner énfasis en los procesos de aprendizaje de los estudiantes a través del aumento de los procesos metacognitivos y de reflexión crítica. Este artículo parte de la base de que el aprendizaje tiene lugar a través de la integración del pensamiento, los sentimientos y la acción. De esta forma, se presentará aquí un modelo de enseñanza y aprendizaje en educación superior a través del uso de integrado de "v" heurísticas y mapas conceptuales. Esta investigación sugerirá que, cuando se utilizan mapas conceptuales junto a "v" heurísticas, siendo sensibles a cómo los estudiantes prefieren aprender, éstos pasarán por un proceso de aprendizaje metacognitivo, que les pueden llevar eventualmente a la reflexión crítica y al aprendizaje significativo. Utilizando las producciones de estudiantes universitarios, este estudio describe el efecto de las operaciones mentales de un alumno en el uso de la "v" heurística y de los mapas conceptuales, cómo el aprendiz incrusta y recupera nuevos conocimientos y andamiajes y cómo el aprendiz incorpora y recupera el nuevo conocimiento organizado. Los datos obtenidos revelan el poderoso efecto que esta combinación de herramientas de aprendizaje tiene sobre la transformación del conocimiento y el rendimiento del estudiante.

Keywords
Learning process, metacognition, meta-learning, higher education, concept maps, vee heuristics, transformative learning.

Palabras clave
Procesos de aprendizaje, metacognición, metaprendizaje, educación superior, mapas conceptuales, "v" heurística.

1. Introduction

The Higher Education sector is undergoing relentless change worldwide in order to respond effectively to the aspirations of the 21st century (Biggs & Tang, 2011; Altbach & McGill Peterson, 2007). Altbach et al (2009) in a UNESCO report reveal that globalisation and massification which consequently lead to an increasingly student diversity are creating pressure on universities around the world to put in place innovative approaches to pedagogy. Across Europe this challenge in Higher Education is being addressed through the Bologna Process. The official website about the Bologna Process states that there are 47 European countries that are committed to the Process which aims to create a European Higher Education Area (EHEA).

The EHEA (Bologna, 1999; Prague, 2001; Berlin, 2003; Bergen, 2005; London, 2007; Leuven, Belgium, 2009; Budapest & Vienna, 2010; Bucharest, 2012) identified three key priority areas:

- **Mobility**: facilitates mobility of students, graduates and higher education staff;
- **Employability**: prepare students for their future careers and for life as active citizens in democratic societies and to support their personal development;
- **Quality**: offer broad access to high-quality higher education.

In order to address the reform in Higher Education for the 21st century that would react efficiently to high-quality higher education, prevalent literature in Higher Education calls for more emphasis on the student learning process through increased critical reflection (Cowan, 2006; Biggs & Tang, 2011; Prosser & Trigwell, 1999; Brockbank & McGill, 2000). Many students probably enter the University relying on learning strategies that have worked well for them in their previous learning experiences including rote learning through memorisation and recall of facts. This may have been a successful strategy to pass exams, but would not contribute to assist University students to become critical reflective learners and practitioners in their future careers. In the premise that the learning process should be highlighted in order to meet the new challenges, one should get interested in the nature of learning and then consequently ask: What kind of learning should take place in Higher Education?

2. Theories of learning

The history of Higher Education has emphasized cognition (knowledge) and content where learning is often thought of as an intellectual achievement (Brockbank & McGill, 2000; Land, 2004). However, Brockbank & McGill (2000:54) suggest that *"teaching that is primarily about the transmission of knowledge will not engender the concept of a critically reflective learner because the one-way process of transmission is antithetical to the means by which a person can become a critically reflective learner"*. Similarly, Barnett proposes that learning as seen in this way is too simplistic and that *"being a historian is no longer a sufficient rites de passage, higher education hears from society that an academic framing of knowledge is an inadequate preparation for the life ahead"* (Barnett, 1994:20).

Learning involves a more complex process and the diverse numerous learning theories up till this day confirm this notion. There is little agreement among learning theories about how learning truly occurs for example, one of the major dominant learning theories is behaviourism. According to the behaviourists, learning takes place when new behaviours or changes in behaviours are acquired as a consequence of an individual's response to stimuli. Behaviourist theories suggest that performance and behaviour are the primary factors affecting learning. Internal processes such as thought; ideas and consciousness could not be "*reliably measured*" (Hergenhahn & Olson 2005:46) and therefore are to be disregarded. In an era where quantification is important, it is not surprising that behaviourism still prevails (Jarvis, 2006). Behaviourism has received criticisms from different researchers (Bandura, 1977; Sternberg, 2009) for example Daniels, Lauder & Porter, 2009:3 claim that behaviourism is a weak theory because "*human beings were assumed to have no free will but rather learned through a system of environmental stimuli and responses*".

In contrast and as a reaction to behaviourism, the cognitive theorists assume that the learner's mental processes are the major factor in learning. These processes include how individuals perceive, interpret, and mentally store the information they perceive from the environment. These theories focus on the ways that the learner's processing and application of information change one's thoughts and internal mental structures (Jarvis, 2006; Hergenhahn & Olson 2005). Areas of cognitive psychology one finds information processing, intelligence, reasoning, language development and memory. Historically, the cognitive development in humans has been studied in a variety of ways.

The oldest is through intelligence tests, such as the widely used Stanford-Binet Intelligence Quotient (IQ) Test. Since then, IQ testing has been extensively used but it has come under increasing criticism for defining intelligence too narrow. Nonetheless, cognitive psychology is probably the most dominant approach today and it served as a springboard to revolutionise the dominant behaviouristic perspective and cross boundaries from viewing learning as occurring mainly through performance and external behaviour to viewing learning as occurring through internal mental processes (Gredler, 2005).

One of the forerunners in challenging this definition of intelligence as measured by traditional intelligence tests is Howard Gardner's multiple intelligences theory (Gardner, 1983). Gardner's most influential research demonstrates that there are multiple ways of taking in the world around us and that all people exhibit one or a combination of at least eight or nine different intelligences, which operate in varying degrees depending upon each person's individual profile of intelligence. Although Gardner's theory of Multiple Intelligence has its utility and is very influential in education it does not go without criticism (Kincheloe & Berry, 2004). Nonetheless, this perspective helped educators around the world to view their students in a very different light, and "*educational researchers have tried to redress the balance by exploring the impact on learning of individual differences, giving taxonomies of learning styles*" (Brockbank & McGill, 2000:33).

The early years of the twentieth century produced a vast number of psychological and educational researches and related instruments that reveal a learner's preferred learning style (Kolb, 1984; Honey & Mumford, 1992). This is substantiated in the review by Coffield et al (2004) where this project's team identified seventy-one models of learning styles. The term 'learning styles' is used "*as a description at the attitudes and behaviours which determine an individual's preferred way of learning*" (Honey & Mumford, 1992:1). They argue that two people of similar intelligence and background who undergo a learning opportunity may be affected in very different ways, for example, one is enthusiastic while the second person is disaffected. Debello (1990) suggests that a learning style refers to "*the way people absorb, process and retain information.*"

Griggs (1991) suggests that learning style is one of the keys to an understanding of student learning and likewise Reay (1994) argues that without knowledge of how learning occurs it will be impossible to design a training programme which would make maximum use of everyone's learning ability. However, the term 'learning style' is often confused with cognitive style and its definition has varied over the years (Messick, 1976; Witkin et al, 1977; Tennant, 1988; Riding & Cheema, 1991).

There is vast literature about learning styles and numerous models (e.g. Coffield et al, 2004; Sharp et al, 2008) and "*nearly as many definitions of learning styles as there are theorists*" (DeBello, 1990:203). However, critics pose serious questions whether learning styles has had any effect on learning. Stahl (1999:1) states that "*the reason researchers roll their eyes at learning styles is the utter failure to find that assessing children's learning styles and matching to instructional methods has any effect on their learning.*" Furthermore, he stretches this argument by claiming that those teachers who attended learning styles workshop had one thing in common "*after one year, they had all stopped trying to match children by learning styles.*" Lafferty & Burley (2009) claim that "*learning styles are a myth…..they are at most an approximation of reality and offer little to learning process.*" Critics of learning styles seem to concur that learning styles reveal one's preferred way of learning but do not actually explain how learning occurs (Coffield et al, 2004; Debello, 1990; Sharp et al, 2008).

In a nutshell, the critical literature pertaining to learning styles are concerned with and address the following issues:

a) reliability and validity of the instruments are highly questionable.
b) no justified and comprehensive definition of learning is given as a starting point
c) consequently, the instruments used do not focus on the actual mental processes involved in learning but they mainly focus on psychological/cognitive aspects.
d) the learning styles' instruments may reveal parts of who the learner really is but stop there. They do not provide metacognitive strategies which are effective in helping both the teacher and the learner to respond adequately to different learning tasks so as to be successful.

Although the confusion in the array of terms, theoretical frameworks, instruments, applications and interpretations do not help in favour of the learning styles debate (Cassidy, 2004), learning styles have helped educators worldwide to understand that each person takes in the world around him/her in different ways. Consequently, this has made teachers to stop and reflect about their own practice

and to listen more to the learner's voice. This has brought about more "*respect for individual differences among children*" (Stahl, 1999:5). Similarly, Pritchard (2009:42,43) claims that teaching with an understanding of individual differences enhances learning "*when students are taught new and challenging material through instructional approaches that fit their learning style, the chances of their understanding and retaining the information greatly increases……the differentiation on instruction based on learning styles is imperative for meaningful education.*" Surely, in common among the arguments for and against learning styles are that the learners who are **actively engaged** in the learning process will be more likely to achieve success (Pritchard, 2009).

One of the major criticisms to both behaviourism and cognitive psychology is the disregard of the affective domain (Forgas, 2000). These two major dominant paradigms in educational psychology did not give much importance to the study of emotions. "Emotions play a major role in behavior and in human learning since they are at the heart of our personhood" (Jarvis, 2006:177). Novak (1998:24) proposes that "*feelings or what psychologists call affect, are always a concomitant of any learning experience and can enhance or impair learning.*"

Ample research shows that there is a direct link between emotion and motivation (Gorman, 2004; Slavkin, 2004) and much of the motivational theories such as Weiner's attribution theory or Maslow's hierarchy of needs continue to contribute and is still very influential in areas of learning. Upon reading about motivational theories, one can observe similarities with behaviourism (Skinner's operant condition and Hull's drive theory) and cognitive psychology (Bandura's perceived self-efficacy). However, neither tradition emphasized learning as a direct relationship with emotions and cognition or performance. Each of the different learning theories give us an aspect or another (cognition [thinking], affectation [feeling] or conation [performance/behaviour]) of the learning process and each theory has its truths and positive aspects in helping us to understand more about learning. However, it is very difficult to find a learning theory which explains in a comprehensive way how does learning occur.

Therefore, learning is a complex process involving different mental processes. We have all experienced learning, we usually know it when we see it and we tend to accept its crucial function in life. Learning is part of our being and if one want to be successful one must understand how one learns (Slavkin, 2004; Pritchard, 2009). Coffield et al (2004:1) pose a very simple question which triggers of critical reflection "*How can we teach students if we do not know how they learn?*"

This scenario leads us to an understanding that learning can no longer be viewed as a process which involves solely cognition. While students are going through a process of thinking during learning, they are also doing and feeling. Novak & Gowin (1984:xi) in their preface to this book claim: "*Human experience involves not only thinking and acting but also feeling, and it is only when all three are considered together that individuals can be empowered to enrich the meaning of their experience.*" As a result, understandings of learning have advanced significantly in the past few decades and increasing attention has been given to 'higher order' processes of understanding. Consequently, the term '**metacognition**' (thinking about thinking) has become a buzz word in educational settings. If one wants to be successful one must understand how one learns and then make sense of it so as to make one's mental mechanisms work most efficiently for him/her. This is the primary reason why educational research is nowadays focusing on **meta-learning** (learning about learning). "*Meta-learning covers a much wider range of issues than metacognition, including goals, feelings, social relations and context of learning*" (Watkins, 2001:1). Meta-learning is to make sense of one's own experience of learning and in this way the learners would be equipped with a life-long learning skill.

3. The Learning Experience within Higher Education

University students are more assumed to be more focused on passing their exams than to enhance themselves as critical and reflective learners. "*They tend to study without reflecting on the purpose or strategy and to see the course content as discrete items of information*" (Kinchin, Baysan & Cabot 2008:377). This approach promotes *surface learning* where "*students see tasks as external impositions and they have the intention to cope with these requirements*" (Prosser & Trigwell, 2002:3) as opposed to *deep learning* where "*students aim to understand ideas and seek meanings*" (Prosser & Trigwell, 2002:3).

However, one cannot solely blame the students for this kind of experience. University teaching tends to ignore how students prefer to learn and many times it does not embrace the notion that students

are capable of transformation (not only accumulation) and so leads to non-learning outcomes (Kinchin, Lygo-Baker and Hay, 2008). As we have read in the previous paragraphs, historically, Higher Education has emphasized cognition (knowledge/content) at the expense of other mental processes which directly affect meaningful learning: "*the prevailing wisdom maintains the acquisition of facts and skills as the important outcome of learning, often to the exclusion of emotion and action*" (Brockbank & McGill, 2000:30). Very often this led to a 'banking' (Freire, 1972) or 'factory' (Dwyer, 1995) model of education and consequently to passive intellectuals without the capability for critical reflection or transformation. Barnett (1997) argues that it is ironic how Universities although aware of critical thinking yet they seldom practice what they preach "*Higher Education, which prides itself on its critical thought, has done no adequate thinking about critical thinking*" (Barnett, 1997:2). Consequently university students are rarely provided with opportunities for self-exploration. On the other hand, the university system would have become so ingrained in traditional methods of teaching and learning that it would be very difficult to introduce or implement different approaches to teaching and learning. This is 'the let sleeping dogs lie' philosophy (Barnett, 1997:2). Very often we tend to forget that the way in which learning occurs is as important as the content so that the goal of education revolves around the mastery of oneself rather than the mastery of subject matter (Orr, 2004). Various authors propose that in order for students to become agents of their own learning they need metacognitive strategies (Gamache, 2002; Bruer, 1993).

In order for tertiary students to become professional practitioners they need to go through a critical and reflective educational journey which would eventually lead to a process of transformation. Through a transmissive approach, education is associated with the transfer of information therefore it would be instructive and imposed. On the other hand, through a transformative approach, education is associated with engaging the learner in constructing and owing meaning therefore learning would be constructive and participative (Sterling, 2004). If one wants to challenge the *status quo* one has to first and foremost transform oneself before being able to transform others (Mezirow et al, 2000). Tertiary education is the ideal environment for this transformation to take place so that students would later on be able to contribute to society as agents of transformation.

Brockbank & McGill (2000) and Barnett (1997) propose that in order to generate the conditions for critical reflection and transformation, the practice of teaching in Higher Education must include not only cognition (thinking) but also conation (doing) and affectation (feeling). Barnett & Coate (2005:15) while criticizing that the notion of curriculum is "*pretty well missing*" in Universities and that despite all the expansions barely any debates about what students should be learning and experiencing take place, they suggest that "*no curriculum can be complete…..without these three building blocks being present*" (Barnett & Coate, 2005:65).

With all of the above in mind 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. These two tools will be presented without any pretensions to being a quick fix, sure tool, but can definitely serve as a stepping stone to challenge the ever prevailing transmission model of education in Higher Education. 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). Active self-reflection and self-direction are two kinds of metacognition (Gage & Berliner, 1998).

4. Research Question and Methodology

The path that this study pursues is not to seek absolute truths but rather to shed light upon a pedagogical process which captures personal structures of knowledge and their development so as to generate meaningful learning and critical reflection. 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?"***

The data collected in this pilot study is generated from University students pursuing the course in Bachelor of Education (B.Ed) at the University of Malta. The setting is not chosen for a particular reason but because it just happened to be the only Higher Education Institution in Malta which caters

for teacher training. The lectures took place at the University of Malta and were held once a week for even consecutive weeks during the first semester of the academic year. Each lecture had duration of two hours. This programme was offered to B.Ed students who are in their second, third or fourth year of the course as an optional credit. As a result, the group of participants in this pilot study is self-selected since they came out of their own free will. It is also worth mentioning that in this way the students participating have different subject specialisation.

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 6, 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.

5. Merging metacognitive tools for use in Higher Education

Learning is about change and changing oneself (Ramsden, 2003; Zull, 2002). Higher Education must nowadays highlight quality of education not just certification and 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 and critical reflection. It will also raise awareness of how students' mental processes work most effectively leading to conceptual transformation for both the teacher and the student.

More importantly, these two metacognitive tools lay open what's going on in the learner's mental processes so that they are empowered 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 don't 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.

6. 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. In this paper I shall only be presenting a sample of 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, were 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 do they think that this process has helped them to become more effective teachers if it did.
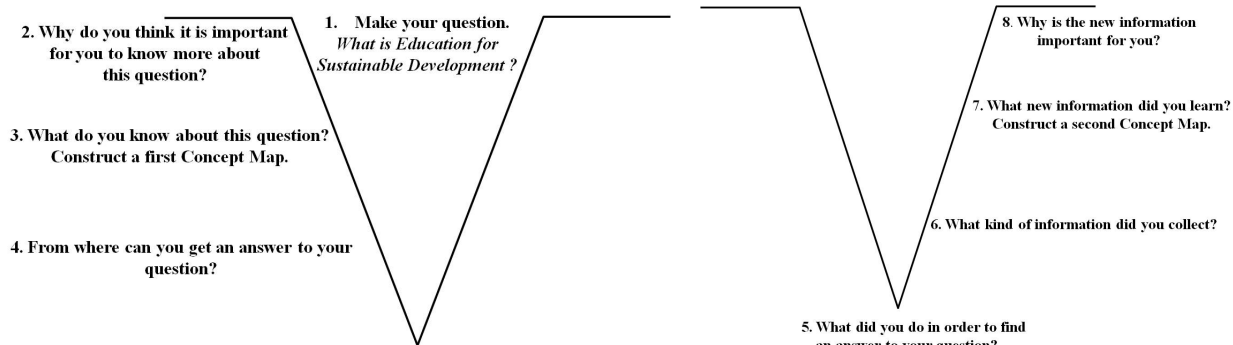
Figure 1: Vee Heuristic presented before the learning programme.

Figure 2: Vee Heuristic presented after the learning programme.
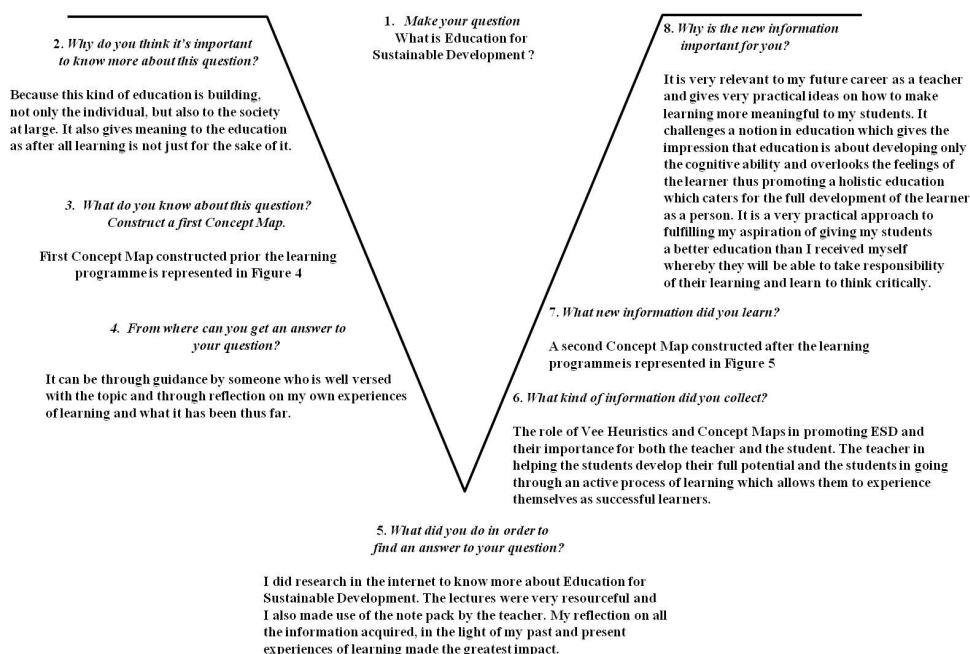
6.1. Learner 1 Maryanne

Figure 3: Maryanne's Vee Heuristic

This Vee Heuristic illustrated in Figure 3 reveals this learner's development in her thinking process. It is very clear to observe a difference between the left hand side of the Vee, which was done during the first lecture, that is prior the learning programme and the right hand side of the Vee, which was done during the last lecture that is after the learning programme. The information given for question No.3 reveals that this learner had few ideas of what ESD is all about and this is corroborated by her first Concept Map constructed before the learning programme as represented in Figure 4. It is worth noting that question No. 2 tries to capture the learner's feelings about the issue in question and from the learner's response one can deduce that this learner was very much interested in wanting to know more about the focus question. The reply in question No. 2 reveals her 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 No. 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 consecutively, one can easily note that the number of concepts and propositions has increased therefore 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, she 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 about 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.*"
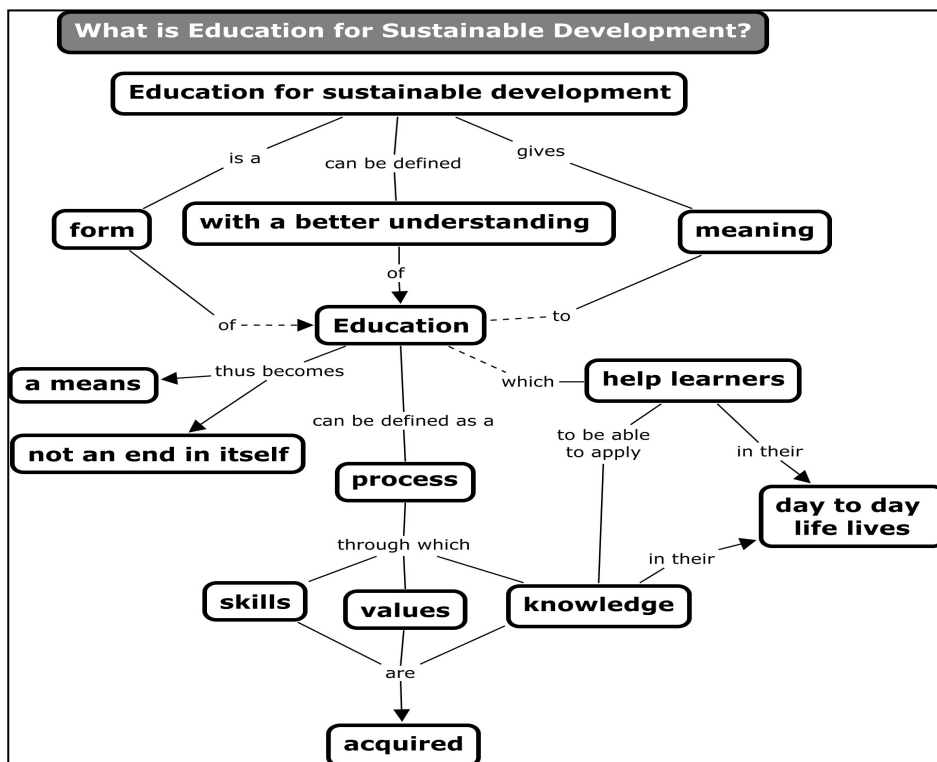

Figure 4 Maryanne's first CMap constructed before the learning programme.4:

She also wrote how she could implement all that she has learnt in the classroom and finally she wrote about the relevance of this credit towards 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.*"
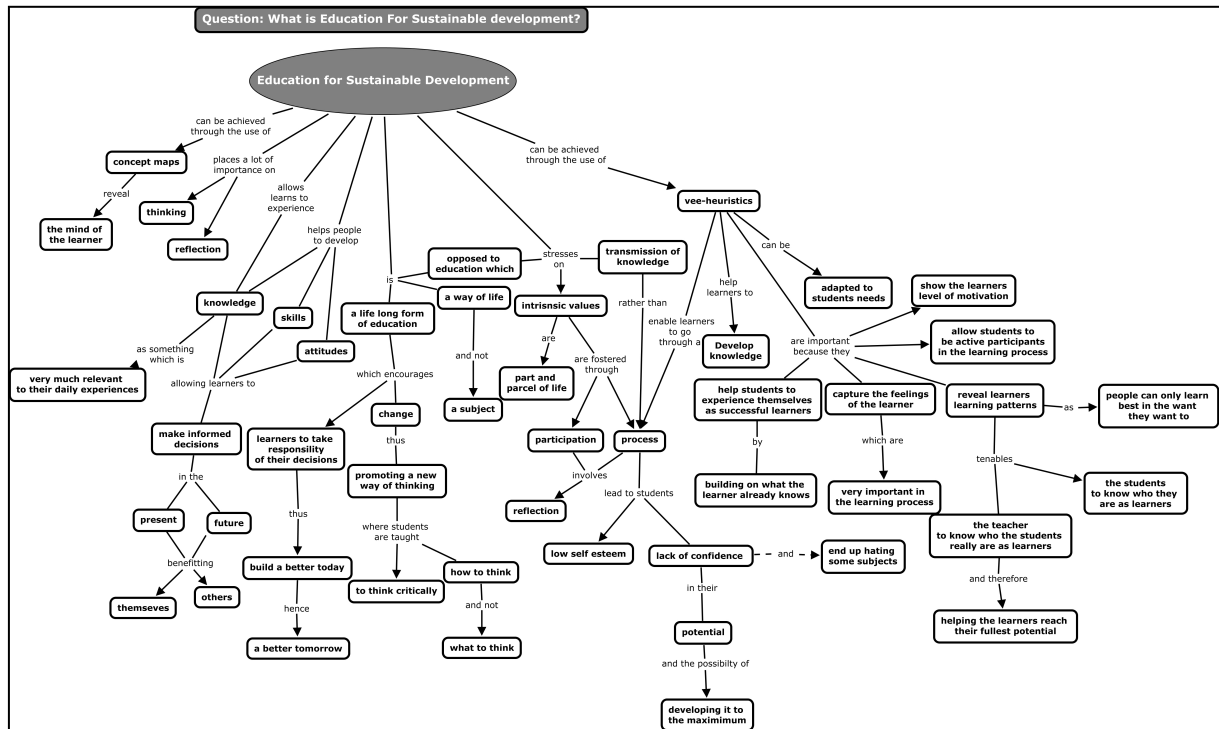
Figure 5: Maryanne's second Concept Map constructed after the learning programme.

6.2. 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 this student had for this credit. Actually, when discussing with this learner, he confessed that he attended this credit just because it was the only one that 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, of importance is 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.

1. *Make your question*
What is Education for
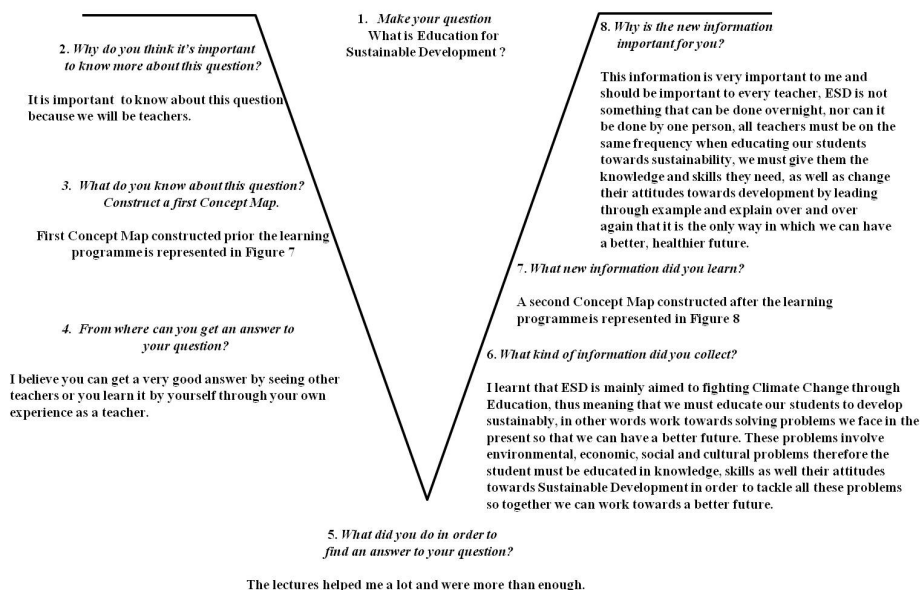*Sustainable Development ?*

2. *Why do you think it's important*
to know more about this question?

It is important to know about this question
because we will be teachers.

3. *What do you know about this question?*
Construct a first Concept Map.

First Concept Map constructed prior the learning
programme is represented in Figure 7

4. *From where can you get an answer to*
your question?

I believe you can get a very good answer by seeing other
teachers or you learn it by yourself through your own
experience as a teacher.

8. *Why is the new information*
important for you?

This information is very important to me and
should be important to every teacher, ESD is not
something that can be done overnight, nor can it
be done by one person, all teachers must be on the
same frequency when educating our students
towards sustainability, we must give them the
knowledge and skills they need, as well as change
their attitudes towards development by leading
through example and explain over and over
again that it is the only way in which we can have
a better, healthier future.

7. *What new information did you learn?*

A second Concept Map constructed after the learning
programme is represented in Figure 8

6. *What kind of information did you collect?*

I learnt that ESD is mainly aimed to fighting Climate Change through
Education, thus meaning that we must educate our students to develop
sustainably, in other words work towards solving problems we face in the
present so that we can have a better future. These problems involve
environmental, economic, social and cultural problems therefore the
student must be educated in knowledge, skills as well their attitudes
towards Sustainable Development in order to tackle all these problems
so together we can work towards a better future.

5. *What did you do in order to*
find an answer to your question?

The lectures helped me a lot and were more than enough.

Figure 6: Stefan's Vee Heuristic

This was very important information for me as a teacher to know since I took it into consideration when doing my planning for this credit and I made certain that this learner is catered for during the planning of the programme since from the Vee I observed that he prefers to learn from real life experiences and avoids detailed information. This part of the Vee is in this way very important since it reveals the learners' preferred way of learning and as educators we have to take this into consideration if we would like 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 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 did 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 contrasts from the responses given on the left hand side. This reveals that through the learning programme this learner's motivation to learn increased, furthermore he found this unit quite meaningful and this is proved in the reply to question No.8 where he stated: "*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 managed to have an impact on this learner who 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 to change 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, however, what is more important is that it reveals how this learner's knowledge developed. An increase in concepts and propositions is present and therefore learning has taken place.
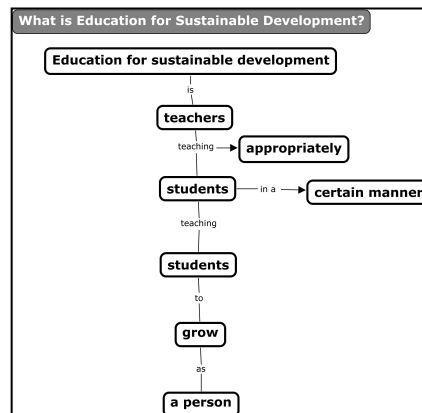

Figure 7: Stefan's First Concept Map created before the learning programme.

These 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 that 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 and therefore the difference in these two Concept Maps reveal that this learner has learned meaningfully although he started off this programme with a lack of interest and motivation. I have also to say that although this learner avoids details, this second Concept Map has more details than his paragraph written 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 more constructing the second CMap than the first one. The way in which this learning programme was presented and experienced may have helped in increasing this learner's interest and motivation.
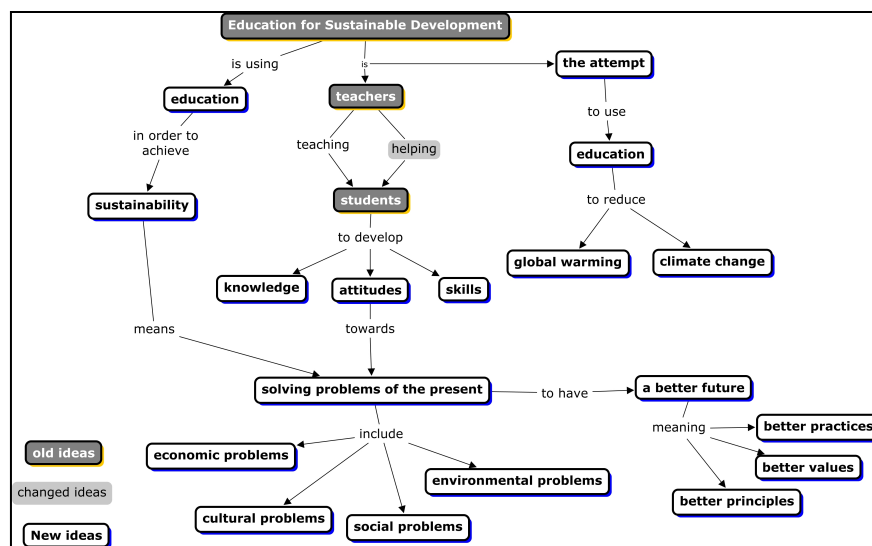

Figure 8: Stefan's second Concept Map constructed after the learning programme.

7. 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, however, the actual process of constructing a Cmap does involve these three mental processes. On the contrary to "traditional" teaching and learning where the students are asked to represent their knowledge through ways which mainly rely on memory in order to produce chunks of

information (surface learning), when students are asked to represent their knowledge by constructing Concept Maps, they would be going through a process of metacognition (deep learning). Metacognition is a process which 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 would not be simply reproducing chunks of information which would be totally irrelevant to one's own experience because it would have been studied by heart. When constructing a Cmap, since one would be presenting knowledge according to one's own cognitive structure, one would be creating knowledge according to one's own perspective and automatically this would be related to one's own personal experience and this is why learning becomes more meaningful.

8. 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 was developed; misconceptions were altered while new knowledge was constructed. So, 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). Therefore, this process facilitates more teacher/student interaction.

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. This will be the next stage in this research.

9. 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 Higher Education. This would hopefully lead to creative and reflective practitioners in our society and empower them to become agents of transformation.

This paper is part of a PhD in progress. This research will develop further so as to delve deeper from a teacher engagement point of view. This research will refocus from the influence on the student to the influence on the teacher but will consider that **both** the student **and** the teacher need to be actively engaged for transformative learning to take place. Various authors (Ramsden, 2003; Kinchin, 2004; Richards, 2007; Brockbank & McGill 2000) suggest that separating learning and teaching within Higher Education is a false myth and that engaging in reflective dialogue and interaction are contributing fundamental factors affecting the level of learning.

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