

**Investigating the Effectiveness of Concept Mapping in Improving
Science Language Writing for English Second Language Grade 12
Learners at Lagunya Finishing School in Langa.**

A Research Report Presented by

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**UNIVERSITY of the
WESTERN CAPE**

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- (iii) Winterrose S. (WS)
- (iv) Eunice M (EM)
- (v) Vuyokazi Z (VZ)
- (vi) Ntombizodwa J (NJ)

A0
A1
A2
A3
A4 - A6
A7
A8 - A9
A10

Transpiration

- (i) Ayanda N (AN)
- (ii) Zoleka M (ZM)
- (iii) Winterrose S. (WS)
- (iv) Eunice M (EM)
- (v) Vuyokazi Z (VZ)
- (vi) Ntombizodwa J (NJ)

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- (iii) Winterrose S. (WS)
- (iv) Eunice M (EM)
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- (ii) Zoleka M (ZM)
- (iii) Winterrose S. (WS)
- (iv) Eunice M (EM)
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- (vi) Ntombizodwa J (NJ)

B0
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 - Organic Compounds
 - Transpiration
 - Photosynthesis & Respiration

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C1
C2
C3

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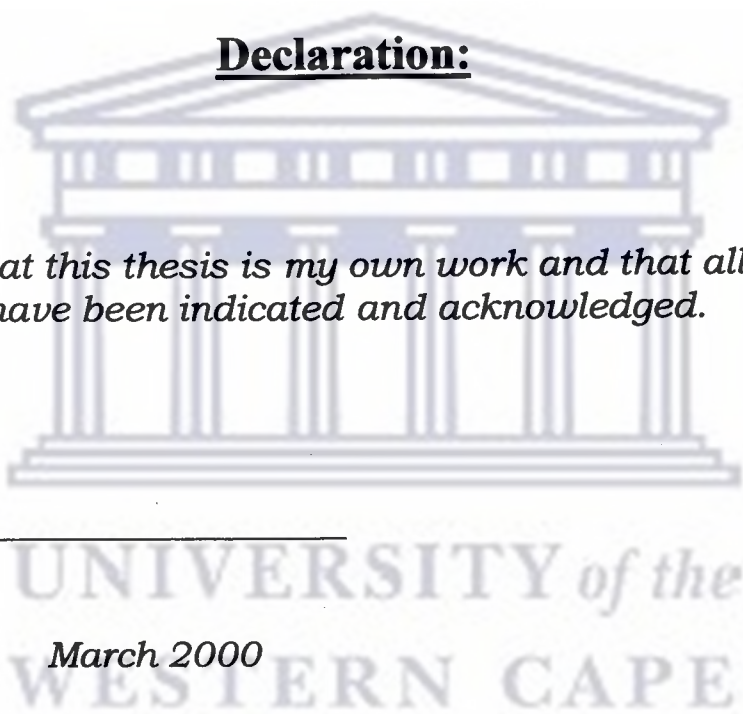
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Declaration:

I declare that this thesis is my own work and that all sources have been indicated and acknowledged.

Signed: _____

Date : *March 2000*



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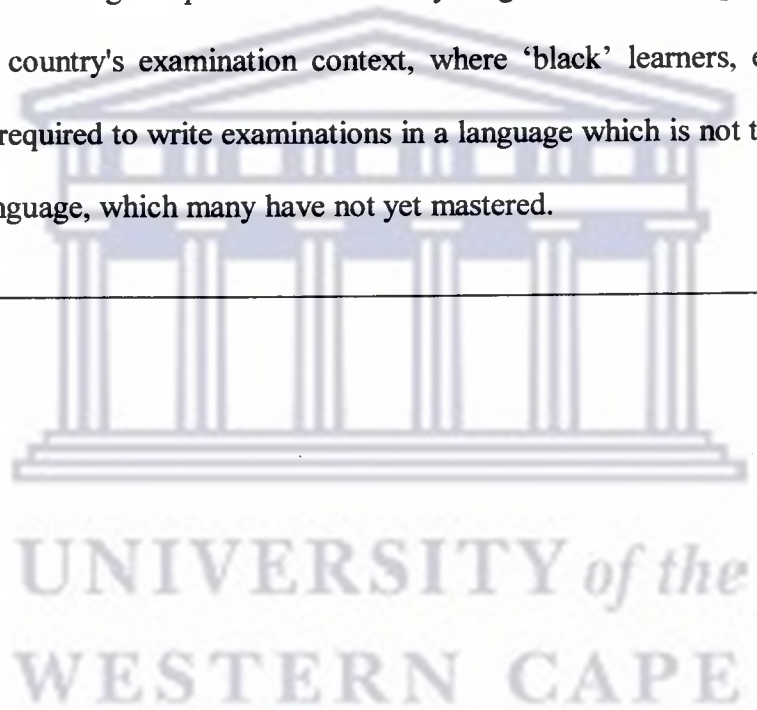
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An outcome of the study was that concept mapping had a positive effect on their writings, in that students wrote clearer descriptions, included more relevant information in essays, showed an ability to see inter-relations, and, to a fair degree, showed improved language usage. Their post concept mapping writings exhibit structure, form, and clarity in presentation of their ideas.

Concept Mapping shows great potential for use by English second language learners, especially, in our country's examination context, where 'black' learners, especially in senior grades, are required to write examinations in a language which is not their mother-tongue and in a language, which many have not yet mastered.



Chapter 1

Introductory Discussion

1.1 Introduction

This research deals with a particular type of learner – a learner having English as a second language as medium of instruction at a finishing school, repeating a subject which he/she has failed in the final matriculation exams; a learner who has been through the educational system and has failed at the exit point (for various reasons) and who is now finally attempting to exit the system through passing the outstanding subject/subjects needed for his/her Senior Matriculation Certificate.

As an introduction I will briefly sketch the origin, purpose and constitution of Lagunya Finishing School and show how it fits in with the broader educational objectives in preparing learners for further study and or for the workplace.

1.2 Background to the Institution and Learners

1.2.1 Concept of a finishing school

Lagunya Finishing School

Finishing schools were established in the mid 1980's, about 16 years ago, by the Department of Education and Training (DET) in order to address the large scale failure rates of 'black' learners at matriculation level. Due to the existing high enrolment numbers within 'black schools' and

the accompanying progression of learners onto the next level i.e. Standard (9) nine learners proceeding onto matriculation, the schools cannot logistically accommodate the failed learners by allowing them to repeat the year.

There are currently two finishing schools which give these matric failures an opportunity to complete by repeating the subjects which they have failed. Both are situated in Langa, a 'black' township situated 10km outside Cape Town in the Western Cape Province.

At a finishing school it is not required of a learner to repeat all six subjects in one sitting to gain their matriculation, but only the subjects they had failed, after which the subjects are combined in order to qualify for the Senior Matriculation Certificate. The age of a learner at a finishing school typically ranges between 18 and 25 years.

In addition to providing our learners with the necessary educational skills in trying to achieve their matriculation certificates, our mission is to prepare our learners for the real job market. If one takes into consideration that this is their final year of schooling and that the large majority of learners do not proceed onto higher education, but attempt to enter the labour market, the school also offers learners courses in Entrepreneurship, Travel and Tourism, and Computer Literacy, enhancing their job-related skills and improving their chances of finding a job.

1.22 Biology learners at Lagunya Finishing School

One of the requirements for repeating a subject is that the learner had to have failed the subject i.e. the learner should have obtained an F, G or H symbol. Very few learners who have passed the subject and are wanting to improve the subject are allowed to register for a subject.

Almost all (99%) of learners who are allowed to register for Biology enter for the subject having obtained G or H symbol and these are in general, the type of learners that we attempt to prepare for the Biology matriculation examinations; the rest have passed Biology and want to improve their symbols. The task of covering the required material for the Biology matric syllabus is to be completed within a period of about 6 months of teaching time. This includes a month used for 'catching up' on previous years' (Standard 8 and 9) work, which is used to lay a foundation for matric Biology.

We enrol on average between 600 and 700 Biology learners per year, roughly half entering for Higher Grade (HG) and the other half for Standard Grade (SG). The decision to register for Higher Grade (HG) or Standard Grade (SG) usually rests on the learner's requirements for subject combinations needed to qualify for a Senior Certificate.

Our learners have educational disadvantages including weak study skills, poor proficiency in English as the language of instruction, and in some cases, learning problems. The nature of the Apartheid education system prevented learners with the above types of problems from being detected, and hence opportunities for remediation were never realised.

1.3 The Learners in the Study

This case study investigates 6 learners' performance in essay writing exercises, all of whom failed Biology the previous year and came to our institution to redo the subjects that they failed. All of them failed Biology with an H symbol.

The biology department at our institution is well resourced and has 3 well qualified and competent biology teachers. Our mission at our institution is to provide every learner, as far as possible, with support and guidance as far as the subject is concerned. More than 90% of the Biology learners have Xhosa as their mother-tongue, the rest Sotho and other languages. The matric examination is written in English, so all learners receive instruction in English, which is their second language.

The level of English proficiency of most learners is average to weak and most indicated that they have problems expressing themselves verbally and in writing. To a great extent teachers are sensitive to this and explain concepts as simply as possible and with great care so as to enhance learner understanding.

About 50% of our biology learners indicate their future career choice to be nursing or other medical related fields such as radiography and medical technology. Nursing colleges and other medical campuses require at least a Higher Grade (HG) pass in Biology for learners to become eligible for consideration, with an average aggregate of an E symbol on the final certificate. This is a goal to which most biology learners aspire.

1.4 Introduction to the Problem

This thesis will look at particular problems which Biology learners at Lagunya Finishing School experience when it is required of them to write essays in English, particularly in Biology.

Mature learners are unable to move through the bulk of the information to draw on relevant information and concepts in order to show meaningful interrelations. This problem is not only a local one. For example Lazarowitz and Penso (1992) report that learners are unable to show inter-dependency between concepts, although learners were able to explain concepts in isolation to each other. And Waheed and Lucas (1992) similarly conclude from their studies that their learners were unable to interrelate between photosynthesis and respiration concepts.

The following is a profile of each learner in this study. This information was acquired at the first meeting with them. Some responses attempt to give the reader an indication about how learners perceive their own problems when writing paragraphs and essays.

Learner Number 1:

Name : Zoleka M

Age : 19 years

Sex : Female

Home Language : Xhosa

Previous matriculation mark for Biology: H symbol on the Higher Grade (HG)

In response to: "What are the problems which you experience when it is required of you to write essays/paragraphs?":

“I think I don't understand questions” and “When I write a essay I get poor marks.”

Learner Number 2:

Name : Vuyokazi Z.

Age : 19 years

Sex : Female

Home Language : Xhosa

Previous matriculation mark for Biology: GG symbol on the Higher Grade (HG)

In response to: “What are the problems which you experience when it is required of you to write essays/paragraphs?”:

“It is difficult when I am writing paragraph. If I don't understand, but if I understand I try and get little marks but in my opinion I think it enough what I am writing but get little marks.”

In response to reasons why she thinks she failed:

“It is because the time for me was too little and I didn't have time to think, I write only.”

Learner Number 3:

Name : Winterose S.

Age : 18 years

Sex : Female

Home Language : Sotho

Previous matriculation mark for Biology: GG symbol on the Higher Grade (HG)

In response to: "What are the problems, which you experience when it is required of you to write essays/paragraphs?":

"When reading questions I think my problem is that I don't understand what is needed in the question. In some questions I do understand, then in others I don't especially in essay-type questions."

"One other thing I can say I expect question to be asked the way I've been studying not tricky."

"I find a problem of not knowing what is needed, and I don't know what to start with, cause I think that maybe should I start with introduction or just write what is needed."

Learner Number 4:

Name : Ntombizodwa J

Age : 19 years

Sex : Female

Previous matriculation mark for Biology: H symbol on the Higher Grade (HG)

In response to: "What are the problems which you experience when it is required of you to write essays/paragraphs?":

"My problem is that I read correct but when the question comes out I don't understand it."

"My problem is that I write it but my essay became small and the mark comes down."

Learner Number 5:

Name : Eunice M.

Age : 19 years

Sex : Female

Matriculation mark for Biology : GG symbol on the Higher Grade (HG)

Response not available

Learner Number 6:

Name : Ayanda N.

Age : 21

Sex : Male

Matriculation mark for Biology: H symbol on the Standard Grade (SG)

Response not available

All 6 of the above learners have enrolled to repeat Biology on the Higher Grade (HG).

If one looks at most of the learners who responded with an explanation of their own reasons as to what the problems are when it is required of them to write an essay/ paragraph , their responses bear out my own experiences over the past 8 years with learners' writing. Their overall writing performance can be summarised as follows:

- many are seldom able to write concise and coherent descriptions of their understanding as is required by the biology syllabus.
- their writing exhibits poor language usage and poor structure of ideas.

- they appear to recall information verbatim about aspects of the question without integrating concepts, especially when they have to show inter-dependency between concepts.

The problems described above are particularly severe for English Second Language Biology learners such as those at my institution, when it is required by the Biology syllabus that HG learners are to be able to write an essay out of 45 marks in Section C of the paper out of a total of 300 marks, requiring them *"to arrange their thoughts logically and scientifically"*.¹

1.5 Significance of the Study

If one assumes that an aim of school science is to develop in learners an understanding of, and an ability to write about complex concepts, then the ability to write concisely and coherently about complex concepts requires more than generic writing skills. It also requires insight into the constituent concepts and their respective relationships. Teachers then need to have a way of getting learners to meaningfully represent the relationships they have constructed between the constituent concepts.

One way of doing this is to use *"Concept Mapping"* as described by Novak and Gowin (1984:15). They define concept mapping to be *"a technique for externalising concepts and propositions.....an explicit overt representation of the concepts and propositions a person holds."* (Novak and Gowin, 1984:17)

¹ (Biology Senior Certificate Examination : Guidelines with regard to examining during the interim period implementation date : January 1996)

Essentially concept mapping is a method which allows teachers and learners to visually and semantically share conceptual meaning.

This study is about how useful the concept mapping heuristic is as a teaching tool to help English Second Language Grade 12 Biology learners improve their ability to learn new meanings and relationships in order to enhance their ability to organise and represent their knowledge about complex concepts in written English in Biology.

1.6 Specific Research Questions

- ◆ Is Concept Mapping a teaching tool which can be fruitfully utilised as a means of improving ‘pupil learning’, (i.e. constructing new and meaningful relationships between concepts)?, and if so,
- ◆ Does this ‘improved learning’ help the learners to generate conceptually meaningful written descriptions?

Specifically:

In what ways do English Second Language learners, studying Biology at Lagunya Finishing School, skilled in the use of concept mapping, improve the form and meaning of their writing to show their understanding of organic compounds, transpiration, photosynthesis and respiration?

Chapter 2

Theoretical Framework & Literature Survey

In this section I will review the literature and some different perspectives of learning and learning theory, and attempt to show some linkages to the context of this study.

2.1 Definitions of Learning and Learning Theory

Learning:

According to Kolb (1984:38)

“Learning is the process whereby knowledge is created through the transformation of experience.”

Learning Theory:

According to Biggs and Shermis (1992:3)

“A learning theory is a systematic, integrated outlook in regard to the nature of the process whereby people relate to the environments in such a way as to enhance their ability to use both themselves and their environments more efficiently.”

On the other hand cognitive theorists are concerned with the changes in a student's understanding that result from learning. They believe that learning must be meaningful. Cognitive learning is based on schemata, or mental structures, by which learners organise their perceived environment. Schematic structures of cognitive development change by the processes of assimilation and accommodation. (Assimilation is the process by which a learner integrates

new information and experiences into existing schemata, and accommodation is the process of modifying existing schemata or of creating new schemata.)

David Ausubel's 'assimilation theory of learning' involves several components of learning, and promotes the idea that people learn better if they can find meaning in the learning. Rote learning or memorisation is used for information that a learner is required to know, but does not find meaningful. However, if a learner is presented with new information that possesses some external or internal characteristics, which enable the learner to associate it with previous learning, the learner may learn the new information because it is meaningful to him/her.

2.2 Ausubel: Learning Theory

David Ausubel (Ausubel, 1968) formulated a learning theory that has shown great promise for practical use in the educational context. The primary idea of Ausubel's theory is that learning of new knowledge is influenced by what is already known. According to Ausubel (1968), the construction of knowledge begins with our observation and recognition of events and objects through concepts we already possess. We learn by constructing a network of concepts and adding to them. A concept map is an instructional device that uses this aspect of the theory to allow instruction of material to learners of varying prior knowledge.

Another major concept of Ausubel's theory focuses on meaningful learning. To learn meaningfully, individuals must relate new knowledge to relevant concepts they already know. New knowledge must interact with the learner's knowledge structure. Meaningful learning can

be contrasted with rote learning, which can also incorporate new information into the knowledge-structure, but without interaction. Rote memory is fine for remembering sequences of objects (i.e. lists of structures), but does not aid the learner in understanding the relationships between the objects. Meaningful learning, therefore, is personal, idiosyncratic and involves a recognition of the links between concepts.

If one looks at the current situation in schools, especially in the context of my teaching experiences regarding the high incidence of rote learning, whereby learners simply ‘regurgitate the facts’, one needs to assess the reasons for this occurrence as well as its validity.

The first contributing factor is that preparing for matriculation examinations – the final exit exam at school level – is content driven – i.e. if one learns the facts and ‘give’ them back, the learner will get marks accordingly. This is a concept supported by Ausubel (in Hartley, 1980:19) when he asserts that pupils may resort to rote learning

“if they are under excessive pressure to exhibit glibness, or to conceal, rather than admit and gradually remedy, original lack of genuine understanding.”

“if they learn from sad experience that substantively correct answers lacking in verbatim correspondence to what they have been taught receive no credit whatsoever from certain teachers”, and

"because of a generally high level of anxiety or because of chronic failure experience in a given subject, they lack the confidence in their ability to learn meaningfully and hence they perceive no alternative to panic, apart from rote learning."

That many of my learners employ the rote learning strategy is testified to by certain comments made earlier. The sad reality is that because none of them have English as their first language, they have to 'memorise the facts' in a second language in which they have low proficiency. This could account for a high incidence of what I would term 'unsuccessful rote learning' by many; in effect, being only able to 'give back' bits and pieces of the answers from the whole.

Most of my learners' essays lack structure due to lack of planning, as well as a meaningful body. Instead they collect relevant information they remember about the question and place it down in whatever order it has been recalled.

A third key idea of Ausubel's theory is that concepts vary in depth. That is, concepts can range from the very general to the very specific. Furthermore, general concepts include (or subsume) less general concepts, which include most specific concepts. As such, concepts can be progressively differentiated by their level of specificity. In order to learn meaningfully, concludes Ausubel, the learner must discern the level of new concepts and then place them within progressively inclusive levels of specificity in his or her knowledge structure.

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Both rote and meaningful learning may be achieved no matter what instructional strategy is used (Novak and Gowin 1984). Either reception learning (passive listener, with teacher-directed agenda) or discovery learning (active learning, where the learner chooses information to be learned) may result in meaningful learning. Therefore, it is not necessarily how information is presented, but how the new information is integrated into the old knowledge structure that is crucial for meaningful learning to occur.

2.3 Vygotsky: Learning Theory

Vygotsky (1978) emphasises the influences of cultural and social contexts in learning and supports a discovery model of learning. This type of model places the teacher in an active role while the learners' mental abilities develop naturally through the paths of discovery.

According to Vygotsky (1978:56)

“learning first occurs on the interpersonal plane, then on the intra-personal planes, which means that higher mental functions such as thinking, reflecting, reasoning and problem-solving occur in co-operation and interaction with other people within a social and cultural framework.”

He believes that children learn scientific concepts out of a ‘tension’ between their everyday notions and adult concepts. Presented with a pre-formed concept from the adult world, the child will only memorise what the adult says about the idea. To make the concept his or her

'property', that child must use the concept and link that use to the idea as first presented to him or her. The relation between everyday notions and scientific concepts was not 'straight development' to Vygotsky. Instead, the prior conceptions and the introduced scientific concepts are interwoven, and influence each other as the child works out his or her own ideas drawn from the generalisations that he or she had previously, as well as those currently being introduced to him or her.

Vygotsky's theory rests on three principal assumptions, viz.:

1. **Making Meaning:**

- The community plays a central role.
- The people around the learner greatly affect the way he or she sees the world.

2. **Tools for Cognitive Development:**

- The type and quality of these tools determine the pattern and rate of development.
- The tools may include important adults to the learner, culture and language.

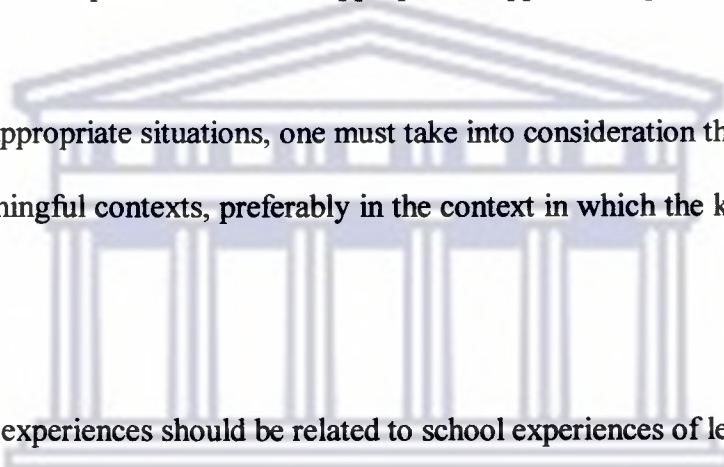
3. **The Zone of Proximal Development (ZPD):**

According to Vygotsky's theory, tasks involving problem-solving skills can be placed into three categories. These are as follows:

- (a) those performed independently by the learner;
- (b) those that cannot be performed even with help; and,
- (c) those that can be performed with help from others.

Applications of Vygotsky's Principles

- Learning and development are social and collaborative activities that cannot be ‘taught’ to anyone. It is up to the learner to construct his or her own understanding in his or her own mind. It is during this process that the teacher acts as a facilitator.
- The Zone of Proximal Development can be used to design appropriate situations during which the learner can be provided with the appropriate support for optimal learning.
- When providing appropriate situations, one must take into consideration that learning should take place in meaningful contexts, preferably in the context in which the knowledge is to be applied.
- The out of school experiences should be related to school experiences of learners.



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2.4 Vygotsky on Writing

Vygotsky (in Newman and Holzman, 1993) claims that becoming proficient in written language, however complex, disjointed or confusing as it may appear on the surface, is not discontinuous, but a unified process of development.

According to Vygotsky (in Haufman and Vakar, 1962:148):

“Written language demands conscious work because its relationship to inner speech is different from that of oral speech. The latter precedes inner speech in the course of development, while

written speech follows inner speech and pre-supposes its existence - the act of writing, implying a translation from inner speech.”

He adds that the grammar of thought is not the same in the two cases. The syntax of the inner speech is the exact opposite of the syntax of the written speech, with the oral speech standing in the middle. Inner speech is condensed, abbreviated speech, whereas written speech is used to its fullest extent, being more complete than oral speech. Inner speech is almost entirely predicative, because the subject of thought is always known to the thinker.

Written speech on the other hand must explain the situation fully in order to be intelligible. The change from maximally compact inner speech to maximally detailed written speech requires what might be called deliberate symantics - deliberate structuring of the web of meaning.

2.5 A Model for Second Language Acquisition

Much of what Vygotsky has said can be reconciled with others who have done research in the field of second language acquisition. It explains to a large extent the problems that we are faced with in Africa, and specifically in South Africa, regarding learners' poor/under-performance in schools where English is used as a medium of instruction to non-English learners.

According to Schumann (in Ellis, 1985), the Acculturation Model of Second Language Acquisition (Acculturation = the process whereby an individual becomes adapted to a new culture), Second Language Acquisition (SLA) is only one aspect of acculturation. The degree

to which a learner acculturates to the target group, in this case the English group, controls the degree to which a learner acquires a second language. Acculturation and therefore SLA is determined by the degree of social and psychological distance between the learner and the target language culture. How do we reconcile this with the situation in this country?

Firstly, Apartheid policy was based on the separation of ethnic cultures in terms of culture, language, education and race etc. In the process of applying Apartheid in practice, each ethnic culture ('whites', 'blacks', 'coloureds') was systematically isolated, both physically and culturally from the other along language, colour, education and even social lines.

If we look at this acculturation model, it appears to account (to some degree) for 'black' learners' poor command of the English language. The main factor here is that, under Apartheid, no opportunity existed for non-English speaking 'blacks' to be acculturated into the target language culture of English-speakers spoken by other race groups. For learners in township schools, their only exposure to the English language would probably have been and still is television and other media, representing only passive exposure and not active interaction.

In a situation in which these 'barriers' do not exist and where there can be integration at most levels, and where learners to a large degree are able to interact socially and psychologically, the enhancement of the acquisition of the second language is promoted. This is especially true of studies into foreign language acquisition.

Schumann (in Ellis, 1985) lists the social variables that are conducive to a 'good learning situation' for the acquisition of a second language:

1. The target language (e.g. English) and the L₂ (second language) learners view each other as socially equal.
2. The target language and the L₂ learners are both desirous that the L₂ group will assimilate.
3. Both the target language and the L₂ learners expect the L₂ learners to share social facilities with the target language group.
4. The L₂ group is small.
5. The L₂ group's culture is congruent with that of the target language group.
6. Both groups have positive attitudes to each other.
7. The L₂ group envisages staying in the target language area for an extended period of time.

When it is required of a learner to switch between L₁ (mother-tongue) and L₂ (second language) it becomes problematic to translate, especially if the learner has not mastered the L₂.

This is a common problem on the African continent. In Lesotho, Botswana, Swaziland and to a lesser degree in Zimbabwe, Zambia, Namibia and South Africa, the rule is that the child's mother tongue is used as medium of instruction during the first three to four years of instruction, and then English becomes the medium of instruction while the mother tongue is retained only as a subject.

However, from my discussions over the years with learners it is apparent that teachers in many 'black schools' continue teaching most subjects in the learners' mother tongue up to matric (the final school year), when they should be using English instead. This exacerbates the problems for the learners in that they have to write their final school exit exams (matriculation) in a language they have hardly heard.

This state of affairs is consistent with the findings of Mwamwenda (1995:169) in which he states the reasons why teachers do not switch to English as medium of instruction when they ought to:

“one (reason)... may be due to lack of confidence in the efficient use of English on the part of teachers. Another reason a considerable number of students have not mastered English and therefore have problems following and grasping what is being taught.”

According to Danesi (in Mwamwenda, 1995), in order to address this aspect one needs to take cognizance of the fact that the two languages (L_1 and L_2) do not stand in isolation to one another, but that the two are interdependent. Cummins (in Mwamwenda, 1995:170) explains this relationship as follows:

“To the extent that instruction in the L_1 is effective in promoting proficiency in L_1 , transfer of this proficiency to L_2 will occur provided that there is adequate exposure to L_2 (either in school or in environment) and adequate motivation to learn L_2 .”

Most research on the efficacy of concept maps covers their use as teacher-directed guides (Cliburn, 1990; Lambiotte and Dansereau, 1991; Moreira, 1979; Stewart, Van Kirk and Rowell, 1979). The idea here is that the expert-constructed map as constructed by the facilitator or teacher, which is offered to the student as an advance organizer, would provide an anchor on which to attach new knowledge. All the papers cited above showed that the use of teacher-made concept maps increased learning and/or retention of science information.

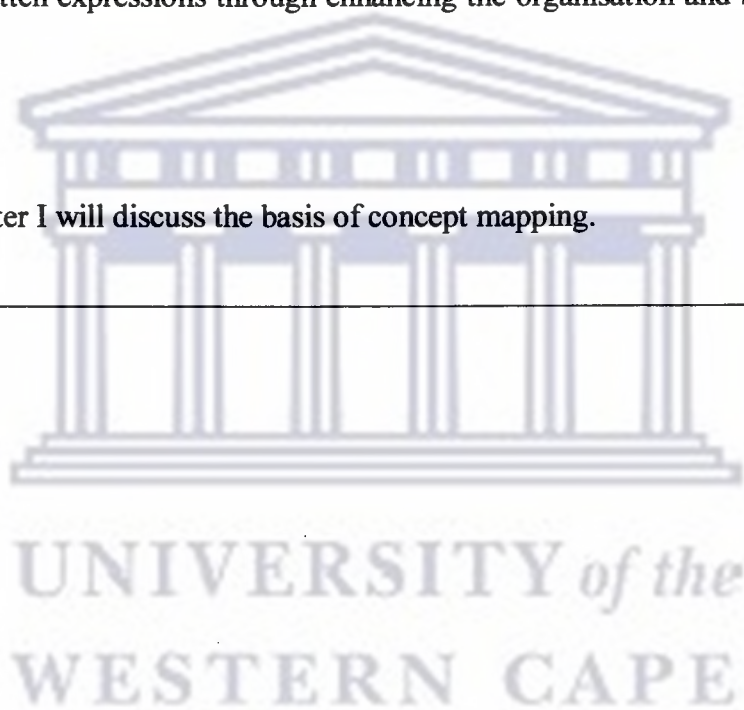
In addition, the richness of knowledge (how inter-linked the concepts were) was found to be increased through the use of concept maps (Lambiotte and Dansereau, 1991). These authors suggested that learners who made or viewed concept maps would have a broader knowledge base and therefore be better able to solve problems compared to those learners who learned by rote memorization. Lastly, the above authors' experiments tested the efficacy of different presentation types (concept mapping, text outlines or lists) on learning, between learners with differing amounts of prior knowledge. They found that learners with low prior knowledge learned better with concept mapping than the other two linear presentations. Concept mapping thus appears to be a good method to promote meaningful learning among senior learners with different academic preparedness - a situation typically found in introductory science classes.

Studies by Prater and Terry (1988) using concept mapping also showed positive results in that this method helped to enhance the written presentations in the social sciences, but in particular with learners in lower grades.

It appears from the literature that most of the studies in concept mapping, particularly with regard to written exercises, were done with learners in the lower grades; this study therefore aims to investigate the value of concept mapping to senior English second language learners, as an aid to organise, learn and inter-relate concepts when writing Biology essays in English.

In seeking a remedial intervention, I investigated the use of concept mapping as a strategy to improve learners' written expressions through enhancing the organisation and structure of their ideas and concepts.

In the following chapter I will discuss the basis of concept mapping.



Chapter 3

Methodology

3.1 Methods

3.1.1 Intervention Technique:

There are many types of techniques used to represent concepts, such as organisational charts, flow charts, cycle diagrams and predictability trees. However, one of the main arguments against them is that they are not based on contemporary theories of learning or knowledge e.g. Ausubelian learning theory. They might represent concepts, but not concept meanings (Novak and Gowin, 1984).

Concept Mapping

What is Concept Mapping?

In the 1960's, Joseph D. Novak at Cornell University began to study the Concept Mapping technique. His work was based on the theories of David Ausubel (1968), who stressed the importance of prior knowledge in being able to learn about new concepts. Novak and Gowin (1984:40) concluded that:

“Meaningful learning involves the assimilation of new concepts and propositions into existing structures.”

Concept Mapping is a technique that allows the mapper to understand the relationships between ideas by creating a visual map of the connections, thereby allowing the mapper and assessor to:

- (a) see the connections between ideas which the student already has ;
- (b) connect new ideas to knowledge that they already have, by building on what on the learner already knows; and,
- (c) organise ideas in a logical yet not necessarily rigid structure that allows future information to be included.

According to Novak and Gowin (1984:40), concept mapping has been specifically developed to tap into and externalise a learner's cognitive structure, enabling both the learner and teacher to see what the learner already knows.

A concept map therefore is a geographical representation, where nodes (points) represent concepts, and links (lines) represent the relationship between concepts. They serve to clarify links between new and old knowledge and encourage the learner to externalize those links.

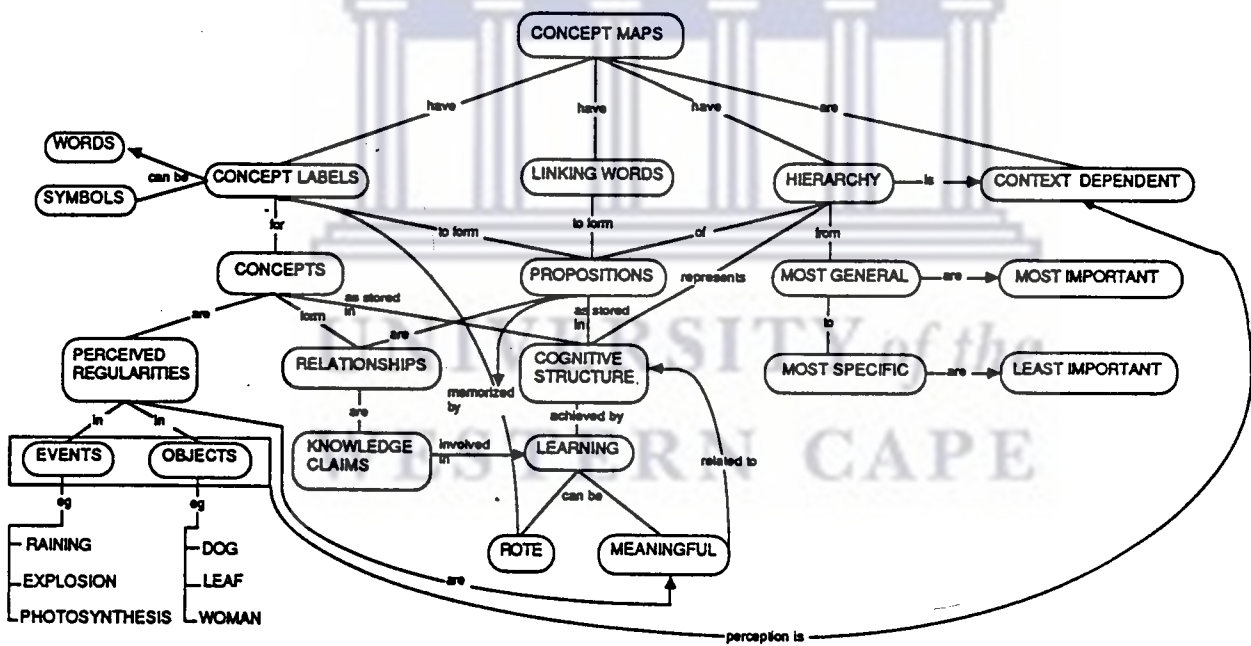
Concept maps are useful tools to help learners learn about their own knowledge structure and the process of knowledge construction (metaknowledge). In this way, concept maps also help the student learn how to learn (metalearning).

Since concept maps externalise a person's knowledge structure, they can also serve to point out any conceptual misconceptions the person may have concerning the knowledge structure.

This explicit evaluation of knowledge and subsequent recognition of misconceptions allows for finely targeted remediation. Furthermore, since concept maps are visual images they tend to be more easily remembered than text (Novak and Gowin, 1984).

Hierarchical Concept Mapping

Novak and Gowin (1984:15) contend that, “because meaningful learning proceeds most easily when new concepts or concept meanings are subsumed under broader, more inclusive concepts, Concept Maps should be hierarchical” as is illustrated below:



A Concept Map from Novak & Gowin (1984), showing the key features and ideas that underlie Concept Maps

Note that *“the more general, more inclusive concepts should be at the top of the map, with progressively more specific, less inclusive concepts arranged below them.”* Novak and Gowin (1984:15).

McCabe (1997:1) states the advantages of Hierarchical Mapping as follows:

“it encourages a more rigorous analysis of the topic than is possible using the unstructured method”. It also enables the teacher to *“have an even clearer picture of the student’s mental structure of the area under consideration.”*

This enables a teacher to see whether a student not only understands all the concepts, but also whether the student has mentally organised them in the correct relationships. This type of mapping therefore requires that the student and/or teacher develop the concepts or sets of statements to be used before the actual map is drawn. When the teacher develops the concepts, he or she has to develop the full set of concepts or sets of statements to be used describing the possible relationships that can exist between concepts.

I have chosen to use the Hierarchical Concept Mapping technique as proposed by Novak and Gowin (1984).

3.1.2 The Questions posed during the Sessions:

I have selected the following questions based on their relevance to the matriculation Biology syllabus.

Topic 1. (Organic Compounds)

(a) What do you understand by the term ‘Organic Compounds’?

(b) Explain the divisions of the Organic Compounds.

- This question required the student to explain what Organic Compounds are and show the different types of Organic Compounds and provide any other information about each type of compound as required in the syllabus.

Topic 2. (Transpiration)

(a) What do you understand by the term ‘Transpiration’?

(b) Explain how a plant’s internal structural features and its external environmental factors have an effect on the rate of transpiration.

- This question required the student to define the term transpiration and to give the external factors of a plant viz., temperature, humidity, light, etc., and the internal factors of a plant viz., stomata, cuticle, hairs, etc. It was then required of them to show how each of these factors inhibited or promoted the rate of transpiration.

Topic 3. (Photosynthesis & Respiration)

Explain why photosynthesis and respiration can be regarded as two processes vital to life on earth and show how they are inter-related.

- The nature of this question requires the student to bring together his or her understanding of the two processes in such a way that their inter-relatedness should be shown.

3.1.3 Quantitative vs Qualitative Research Methods:

In quantitative research, validity is concerned with whether or not the study indeed measures that which it is intended to measure and reliability with whether the study can be replicated by another researcher in the same context, as Allan (1991) argues that the reliability of research does not lie in the purity of the questions asked or the actions followed, but rather in the degree to which others can follow exactly the same procedures.

Within the quantitative, positivist realm of research, researchers are viewed as distanced, neutral observers; however within a qualitative framework, researchers cannot be seen as totally objective, because they “*use their own cultures implicitly to make comparisons with the one under investigation, clarifying both by comparing what is observed with what they have experienced in the past.*” (Le Compte and Preissle, 1993:93).

According to Miller and Crabtree (1994), qualitative researchers are not unbiased, but by using their perceptions in the investigation, it becomes 'essential data' and a crucial part of the knowledge generated by qualitative research.

Based on the nature of qualitative research, Denzin and Lincoln (1994:13-14) propose that quantitative terms such as 'validity', 'reliability' and 'objectivity', be replaced by terms such as 'credibility', 'transferability', 'dependability' and 'confirmability'.

In order to increase the credibility of the research findings, one can use various strategies such as triangulation, cross-checks and peer consultation. In this study, I made use of a number of cross-checks, which I will explain below in terms of methodological 'credibility' and 'confirmability'.

3.1.3.1 Methodological Credibility

I made extensive use of triangulation and peer consultation during the development of my categories of descriptions to be used for analysing writing. The draft categories of descriptions were tested and critiqued by co-teachers, an applied linguist and a botany professor, after which they were modified, before using them to categorise the constructs in the writings.

3.1.3.2 Methodological Confirmability

Techniques of inquiry cannot eliminate bias, but can try to minimize it. I have thus used a number of techniques to minimize subjectivity, which included keeping a record of cassette tapes used during interviews, interview transcripts and all student writings and maps, which were valuable for double checking findings, cross referencing and confirming findings.

3.1.4 Case Study:

Motivation for Case Study

The case study approach was chosen in order to investigate the changes that would take place (if any) in the nature of the learners' writings. The sample size of 6 learners enabled me to do the analysis of the constructs within their writings on a manageable scale. During the second part of the data collection I make use of interviews, hence once again the analyses of the transcripts were made more manageable.

Rose (1991:192) citing Mitchell (1983), explains that Mitchell characterizes the case study approach in terms of a "*detailed examination of an event which the analysts believe exhibits the operation of some identified theoretical principle*". A case study is therefore an empirical enquiry that investigates a contemporary phenomenon within its real life context. It is not a representative sample, but a deliberate choice of a critical case to see if certain theoretical assumptions can be validated. A case study can therefore be described as a 'snap-shot' approach to research.

All the procedures which I have followed in this study will thus be made as explicit as possible in order to facilitate the reliability (transferability) of my findings. This applies also to the development of categories and the selection of extracts from transcript texts in my data analysis. In this way I have attempted to address the issue of validity (credibility).

The shortcomings of the case study approach lies in the fact that findings cannot be easily generalised. However case-study research allows for the possibility of the development of

theory, based on findings produced within a single context. As such, a case study cannot be generalised to a larger universe, as Yin (1984:39) comments:

“This analogy to samples and universes is incorrect when dealing with case-studies. This is because survey research relies on statistical generalisations, whereas case-studies rely on analytical generalisations”.

An analytical generalisation is an attempt to generalise a specific set of results obtained from a single case to a broader theoretical position. Case studies allow the development of theory. The case study approach, as it represents the development of a hypothesis within a single situation, enables the development of a theoretical position.

It is hence not the goal of this case study to develop a position which, as in the case of survey research, can be generalised statistically to the broader universe. The main goal of this case study therefore is, to attempt to develop a theoretical approach within a single event, which might contribute to a broader theoretical understanding.

Pilot Study:

About six months before the start of this study I was considering the idea of doing a study on Concept mapping, but did not have a clear idea on which aspect of Concept mapping to focus. I brought together a group of 15 of my own Biology learners to whom I taught Concept mapping. The idea at the time was that I wanted to teach this group Concept mapping to see if Concept mapping would have an effect on their writing – the main idea

being that they construct their maps based on sample Biology questions and from their maps construct their answers in writing; however, in the end I had no data against which to gauge their final products, as I had not conducted any pre-testing on their writing ability before training them in concept mapping.

During this exercise I learnt a lot about how not to present the course, for example length of sessions, times when classes would be most suitable, keeping proper data records of individual writings and different ways in which to present the course – all of which played a valuable role in the main study which followed. The main study involved a totally fresh group of learners.

This Case Study:

This study is essentially a case study comparing the nature of the written essays of 6 learners, before they were skilled in concept mapping, and the effects on their written essays, after they were skilled in the use of concept mapping.

The learners who were selected to undergo training in the program, were chosen from a group who were experiencing problems in writing essays in Biology exams. Fifteen or more learners responded to an invitation to attend a writing course, but the decision to select the six learners that I did accept, was based on their level of need, interest and motivation, as one of the requirements was that we would have to meet from time to time after school hours.

3.1.5 Data Collection:

Data collection took place in 4 (four) stages:

- (a) before the Concept mapping intervention;
- (b) during the Concept mapping training;
- (c) after the Concept mapping intervention; and,
- (d) during an interview.

Learners were given topics on which to write before and after the Concept mapping intervention took place, to see if the intervention had any effect on their writing/learning.

3.1.5.1 Before the Concept mapping Intervention

Learners wrote responses to the given questions over a period of a week on three designated days viz., Monday, Wednesday and Friday. The break of one day in between writing sessions was for learners to have an opportunity to review the relevant chapters of the topics. Each writing session lasted between 40 - 45 minutes after school.

After the learners were selected to participate in this program they were told that I needed them to write an essay on each of the following chapter topics: organic compounds, transpiration and photosynthesis and respiration. They were required to study each of the above topics and they were informed on which days they were going to write each essay.

Learners hence knew the chapter topic, but not the content of the questions which were to be asked. The question was presented to them on the afternoon of the writing for each particular topic.

The essays (the pre-concept mapping essays) for all the topics were then collected after each session and the analysis of their writing took place, i.e. the categorisation and identification of constructs (as opposed to sentences) within their essays. In this way a profile of each essay for each student was developed. (See **Appendix A** for learners' pre-concept mapping writings and **Appendix B** for learners' pre-concept mapping analysis sheets.) No discussion on the overall performance in these essays took place between the researcher and the group.

3.1.5.2 During Concept Mapping Training

To view examples of each learner's Concept mapping training exercises which were compiled, see **Appendix J**.

Concept map training took place over a period of two months, with the group attending a series of eight sessions of one hour each over that period. During this period learners were taught the fundamentals of concept mapping, and how to draw acceptable maps. Examples ranged from simple everyday examples and later moved to more complex and syllabus-related examples.

Exercises for homework on other topics in the biology syllabus were used as examples in these concept mapping exercises and for further practice. These were to be presented at the following session to the rest of the group.

Learners were initially allowed to work in groups until they became familiar with the procedure, thereafter they worked individually. It must be emphasised that at no point were the topics (i.e. organic compounds, transpiration and photosynthesis & respiration) referred to in these exercises, discussed or taught by myself with(to) the group. Reference to these topics may have occurred as learners became more familiar with concept mapping and the more they studied in groups on their own. It is also worth noting that none of the six learners in this study were my own Biology learners, but rather were drawn from the rest of the Biology classes.

3.1.5.3 After the Concept Mapping Intervention

At the end of the concept mapping training, which took place over a period of approximately two months (8 sessions), learners were once again informed that they would be required to do formal writing exercises, but the content of the essay questions was once again not made known to them.

They were then given exactly the same questions, which they completed in three 50 minute sessions, by first drawing a concept map and then, from the concept map, writing their essay. No discussion on their overall performance in this task took place between the researcher and the group. Once again each of the essays were analysed through a categorisation process of their constructs and a profile was drawn up for each essay by each learner.

3.1.5.4 Interviews

Learners were interviewed in order to get their impressions about the two sets of writing that they did (i.e. before and after concept mapping). This was a supplementary method of data collection.

The interview was conducted about one month after the post-concept mapping writings were written. This was due to logistical problems in that learners had left school and were preparing for their final November examinations. Five of the participants were invited by telephone to participate in individual interviews. The sixth student was not available as she had left the Cape Town area.

(i) Motivation for Interviewing

The interview took the form of a semi-structured interview, which Kvale (1996:124) describes as:

“it has a sequence of themes to be covered, as well as suggested questions. Yet at the same time there is an openness to changes of sequence and forms of questions in order to follow up the answers given and the stories told by the subjects.”

The purpose of conducting the interview was to allow the learners themselves to offer their own impressions on their two sets of writing (i.e. before and after concept mapping).

In the interviews, the learners were asked to identify common characteristics of their two sets of writing and to account for ‘changes’, if there were any, that they observed, when given the chance to look at their essays again.

(ii) The Interview Setting

Learners from the group who participated in the interview, were each invited to attend an interview session with me at my home. It took place in a non-formal atmosphere in my study. I interviewed each one of them over coffee, at which time I presented each one of them with their pre- and post-concept mapping writings.

(iii) Instructions given to participants

Each learner was asked to examine their first piece of writing (pre-concept mapping) and their second piece of writing (post-concept mapping). No explicit reference to concept mapping was made by the researcher to learners when referring to their writings.

For example, this instruction took the following form

“you had a chance to look at the before (pre) and after (post) writing. Are there any differences between the way you wrote the first piece and the way you wrote the second piece?”

In this way care was taken not to lead them to conclude, that it was concept mapping that led to changes in their writing, if any. Thus, if concept mapping was seen to have played a part, learners would have to make that claim themselves.

(iv) Questions posed during the Interview

The interview took the form of a semi-structured interview, having a number of focus statements and questions, which I asked each one of them.

Focus instructions/questions in sequence:

1. Read the pre-writing.

This was done to allow them to reflect on their pieces of writing **before** concept mapping training.

2. Read the post-writing.

This was done to allow them to reflect on their pieces of writing **after** concept mapping training

3. Do you notice any differences between the above two pieces of writing?

If 'Yes' – What are they?

4. What do you think caused these differences?

If 'Concept Mapping' – Explain how it caused the difference.

If 'other reason' – Explain how it caused this difference.

If Concept Mapping:

5. How did concept mapping help you to write? – Describe.

6. Did concept mapping change the way you learnt the topics?

If 'Yes' – Describe

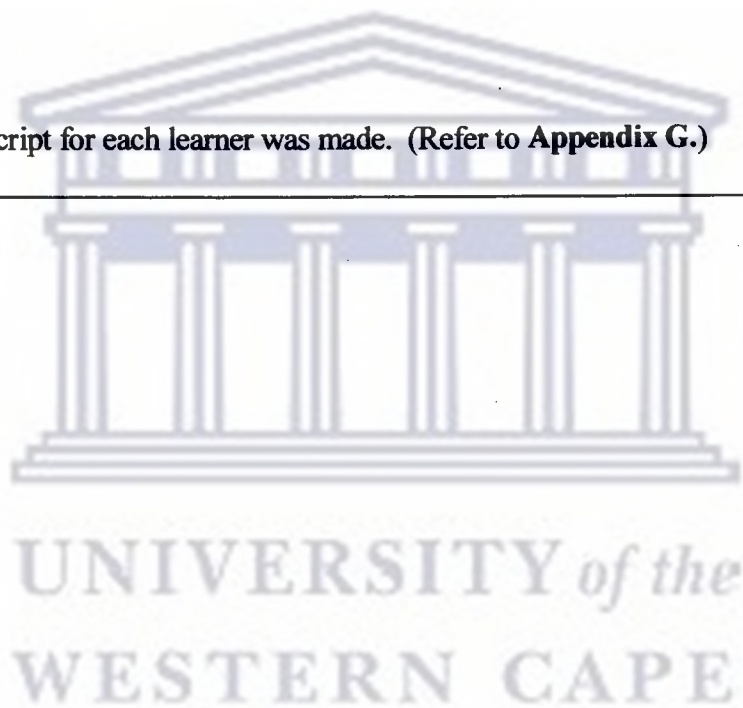
NB: If any other information arises during or between focus questions, follow up and probe further.

(v) **Interview Recordings**

The initial 3 interviews were recorded on a hand-held mini-recorder, which was later found to have poor sound quality and therefore abandoned. Subsequently a flat-plate audio mike was used for the remaining 2 learners, which produced very good sound quality, an aspect which was very important when transcribing the interviews. Learners did not seem inhibited by the researcher, but appeared relaxed during interview sessions.

(vi) **Transcripts**

A full verbatim transcript for each learner was made. (Refer to **Appendix G.**)



3.2 Data Analysis

(a) The Development of the Construct Item Analysis Profile (CICF).

The CICF is a representation of profile categories against which essays of a scientific nature can be reasonably assessed.

Construct Item Code Frame (CICF)

Criteria/Delimitation of Features:

Category	Delimitation
1. Alternate Conception/ Alternate Explanation	Explanation is not true in terms of the acceptable scientific explanation.
2. Recall Definition (Verbatim)	Definition is recalled in the exact form eg. from notes or texts.
3. Definition (Own Explanation)	Definition is explained in writer's own words.
4. Interrelate Concepts	Shows interrelation between concepts under discussion.
5. Relevant Information to Topic & Correct Factual Recall.	Uses relevant information to the topic under discussion & Recalls valid facts to substantiate information.
6. Relevant Information to Topic BUT Incorrect Factual Recall.	Uses relevant information to the topic under discussion BUT Recalls invalid facts to substantiate information.
7. Irrelevant Information.	Uses information, which does not have relevance to the topic under discussion.
8. Unclear Expression of Idea.	Connections between ideas are Confusing or Missing

Table 3.1

The Construct Item Code Frame

The 8 categories on which the analysis will focus are as follows:

Category Definitions

Category 1 (Alternate Conceptions) presents the total number of constructs produced by each learner and out of these, those which show whether or not they had alternate conceptions on the topics set.

Category 2 (Recall of Definitions Verbatim) presents the total number of constructs produced by each learner and out of these, the number that showed the learner simply recalled information/definitions in a verbatim way.

Category 3 (Recall Definitions - Own Explanations) presents the total number of constructs produced by each learner and out of these, the number of constructs in which each learner recalled definitions but presented them in his or her own words.

Category 4 (Interrelations) presents the total number of constructs produced by each learner and out of these, the number that indicate the learner's ability to interrelate concepts within the questions set.

Category 5 (Relevant Information & Correct Factual recall) presents the total number of constructs produced by each learner and out of these, the number that represent relevant information and the recall of correct facts.

Category 6 (Relevant Information BUT Incorrect Factual recall) presents the total number of constructs produced by each learner and out of these, the number that represented relevant information which was incorrectly recalled.

Category 7 (Irrelevant Information) represents the total number of constructs produced by each learner and out of these, the number that consisted of irrelevant information to the questions set.

Category 8 (Unclear Expression of Idea) represents the total number of constructs produced by each learner and out of these the number that (mostly because of poor language usage and or proficiency) represented unclear expressions of their ideas.

The above categories contained in the Construct Item Code Frame (CICF) were developed in response to the type of constructs (sentences) which I encountered in interaction and analysis of the writings during the coding and 'developing categories phase', using the constructs (sentences) contained in the learners' pre- and post-concept mapping writings. The above categories essentially aim to describe the types of constructs that can arise in the writing of an essay, which is of a scientific nature. The sentences/phrases taken from the learners' essays were assigned to categories 1 – 8 and were termed constructs, which would then form the units of analysis.

The categories of information, which emerged during this tentative period of coding were assessed and cross-checked for validity, through discussions with an applied linguist, a botanist

and two biology teachers. There was consensus among the group about the suitability of the coding frame, which was duly modified according to the inputs made. This was done in order to establish construct validity of the instrument.

The units of analysis from each student's writing are called constructs (as opposed to sentences). Each identifiable sentence construct of the student's writing was systematically categorised, using the coding frame instrument (CICF).

A table of features and examples of those particular features was then compiled to provide a profile of each student's responses. (See **Appendix B** for pre-concept mapping analysis sheets and **Appendix E** for post-concept mapping analysis sheets.)

(b) Analysis of pre- and post-concept mapping writings

From the learners' written essays (pre-and post-concept mapping), a profile for each student was compiled by categorising the nature of each of their constructs and tabulating those constructs offered in response to each topic, using categories within the Construct Item Coding Frame (CICF).

These categories were then used to compare and contrast the constructs, using appropriate quantitative and qualitative methods, **before** and **after** the concept mapping intervention.

(Examples of their actual pre- and post-concept mapping writings are found in the **Appendices A and D** respectively.)

(c) Analysis of Interview data

Full verbatim transcripts for each student were made. (See **Appendix G.**)

Extracts from these transcripts were used to substantiate claims and explanations that learners made regarding their descriptions and experiences of using concept mapping when making their written presentations. In analysing the transcript of each student, I was particularly looking for their 'voices' as answers to the questions listed below. The following categories (in bold) were used as anchors to extract learners' responses from the transcripts:

1. What did the student perceive to be the differences in the features between his/her pre- and post-concept mapping writings? (i.e. category **Features of Differences.**)
2. How did he/she account for the differences between his/her pre- and post-concept mapping writings? (i.e. category **Account for Differences.**)
3. What did he/she see as being the cause of the above difference between his/her pre- and post-concept mapping writings, if any? (i.e. category **Causes of writing differences.**)
4. If the reason for the above stated differences was concept mapping, then explain how? (i.e., the category **How CM helped** to cause the difference?)

(A full summary of table of categories with responses can be seen in **Appendix H**)

Chapter 4

Results

4.1 Presentation and Analysis of Individual Results

The following discussions are based on the sentence construct-responses, which were provided by learners in their pre- and post-concept mapping writings in answering the set questions.

I looked at each student's individual performance, highlighting certain aspects of his/her writing and linking them to responses that were made during the interview sessions when they had the opportunity to explain or account for certain aspects of their writings. (Please refer to learners' pre- and post-concept mapping writings in Appendices A and D.)

NB: [The writings found in the rectangular blocks are verbatim descriptions as given by the learners in their respective essays]

Student 1: Ayanda N. (AN)

Organic Compounds - Pre-concept mapping writing:

The piece of writing on organic compounds consists of 6 sentence constructs, consisting of one paragraph, all of which were categorised as Irrelevant to the Topic, as the following shows:

7. Irrelevant Information to Topic.	Organic Compounds: <ul style="list-style-type: none">• Organic Compounds are divided into macro and micro compound.• Micro-compounds: They are needed in small quantities. They are large compound Therefore they need to be catalzed[sic] eg Calcium, Sodium, Zinc.• Macro-organic Compound: They are needed in large quantities eg carbohydrates, proteins, fats.• Carbohydrates they are monomers.
-------------------------------------	---

The answers reflect a confusion of the meaning of the terms macro- and micro compounds with those of organic compounds.

During the interview he explains his above confusion between the two concepts:

SD: What do mean here when you say that the Organic compounds are divided into two, Macro and micro compounds?
Is there something called a macro compound?

A.N: No

S.D : But why do you think you wrote it wrong in the first one?

A.N: Because organic compounds are not divided in macro and micro compounds.

S.D: But where did you get that information from when you wrote it the first time?

A.N: I think I have had heard this information wrong in agriculture.

It therefore appears that AN misunderstood these concepts in the Agricultural Science class and transferred them to this topic under discussion. The actual piece of pre-concept mapping writing is short and it appears as if AN had an idea about organic compounds and jotted what came to mind and then could not continue any further.

Organic Compounds - Post-concept mapping writing:

In contrast the piece of writing after concept mapping shows a marked increase in the number of constructs (15) and the information is presented in a clear and structured manner. Out of the 15 constructs he wrote down 14 constructs categorised as Relevant to the Topic. Also the occurrence of 3 Interrelations between the fats, carbohydrates and proteins in terms of all of them containing C, H, O (Carbon, Hydrogen, Oxygen) is noted. The piece of writing appears structured with headings and clear paragraphs.

Transpiration - Pre-concept mapping writing:

This piece of writing consists of 6 sentence constructs categorised, of which only 2 constructs were notably Relevant and Correct. The rest of the constructs were relevant, but the explanation about what he wrote was incorrect. The ideas presented appear to be recalled from memory in bits and pieces and written down - the result is that there are no clear explanations, nor contrasts, which this particular question requires in the answer.

Transpiration - Post-concept mapping writing:

In contrast to the pre-concept mapping writing, which contains 6 constructs, the post-concept mapping writing contains 20 constructs. The writing itself is characterised by clear paragraphs with headings highlighting what is discussed within each paragraph; there is a distinct contrast being made between the two types of situations that can occur for a particular factor. For example:

<p>5. Relevant Information to Topic & Correct Factual Recall</p>	<p>Transpiration: Re: External factors:</p> <ul style="list-style-type: none">• Cuticle : The transpiration is determine by the Size of the cuticle. If the cuticle is thick the rate of transpiration is low. While is thin the rate of transpiration is high.• Stomata: few stomata or Sunken stomata reduce the rate of transpiration. While there is many Stomata the rate of transpiration is high.• Leaf area: When the leaf area is large there is an excess loss of water. While the leaf area is small there is low transpiration rate.• Leaf arrangement: There the transpiration is determined by the arrangement or the shape of the leaf. <p>Re: Internal factors:</p> <ul style="list-style-type: none">• Temperature: When the temperature is high the rate of transpiration is high. But when is cold the rate of transpiration is low.• Light: When there is no light the rate of transpiration is low. And if there is light there is high transpiration rate.• Wind: When there is high wind blowing there is high loss of water and if there is low wind there is low transpiration.
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Photosynthesis & Respiration - Pre-concept mapping writing:

This piece also consists of 6 sentence constructs of which 2 accounted for a Definition of photosynthesis. For the rest, 1 accounted for Relevant and Correct Information and the other was Unclear as to what he was trying to say:

8. Unclear Expression of Idea.	Photosynthesis & Respiration: <ul style="list-style-type: none">• This two process as they are taking place they provided Some important as Source of life.
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The writing is characterised by one large paragraph and exhibits a clear Verbatim recall of the Definitions of photosynthesis and respiration. No explanations are offered, nor are there any Inter-relations shown between the concepts, as is required by the question.

Photosynthesis & Respiration -Post-concept mapping writing:

This piece of writing consists of 11 sentence constructs, of which 9 are notably categorised as follows:

3. Definition (Own Explanation)	Photosynthesis & Respiration: <ul style="list-style-type: none">• This process needs Sun, Light, H₂O and CO₂. The sun come in Radiant energy. All the substances are needed to convert radiant energy to chemical energy. The chemical energy is used to combine ADP + P to form the substance ATP found in the molecule of Glucose in the leaf. Photosynthesis also Give off the O₂ from the leaf.
4. Interrelations of Concepts	Photosynthesis & Respiration: <ul style="list-style-type: none">• Respiration also needs the ATP in the Glucose. Respiration also needs the O₂ in the mitochondrion. It need to make this substance to make the energy in the cell as stored ATP.• Respiration also give off H₂O and the CO₂ which Photosynthesis can use.

It is interesting to note that he defines photosynthesis & respiration in his own words (Definition - Own Explanation) and shows 4 Interrelations between photosynthesis & respiration. His writing is paragraphed and ideas are presented clearly.

Summary Student 1: Ayanda N. (AN)

His written presentation in the pre- and post-concept mapping writing, clearly exhibits a trend from ‘ just writing what comes to mind’ towards more organised writing i.e. relevant headings and paragraphing.

It would appear that he relied much on the Direct recall of Information, especially regarding the recall of definitions, but no further elaboration on the topics. His writing overall shows a marked improvement from writing down Irrelevant Information in the pre-concept mapping writing, to writing down more Relevant Information in the post-concept mapping writings, for example:

Irrelevant Information - Organic Compounds	
Pre-concept mapping writing :	Post-concept mapping writing
83%	0 %

Comparing the incidence of Irrelevant Information before and after concept mapping.

Relevant Information - Organic Compounds	
Pre-concept mapping writing :	Post-concept mapping writing
0%	93%

Comparing the Incidence of Irrelevant Information before and after concept mapping.

In trying to ascertain how he characterised his own writing during the interview, he characterised his pre-concept mapping writing on transpiration as :

S.D: mmhm

Are there any other differences that you noticed the way you wrote before and the way you wrote after ?

A.N: In the first one I have write only the points and I didn't, I did not discuss them.

When Ayanda (AN) refers to ‘points’ he means headings. In other words he says that he only put down relevant headings, but did not discuss the underlying information.

Accounting for the way he wrote his pre- and post-concept mapping writings on photosynthesis & respiration with regard to Interrelations, he explains:

SD: And in the last topic, which was photosynthesis and Respiration?

Do you notice any differences there?

AN: In the last topic (Pre) , I only write the facts. I divide the photosynthesis and respiration (discuss them individually). But in the second (Post) one I write both together as they are interrelated.

Student 2 : Zoleka M. (ZM)

Organic Compounds - Pre-concept mapping writing:

This piece of writing consists of 3 sentence constructs, of which only 2 could be categorised:

8. Unclear Expression of Idea.

Organic Compound:

- Organic compounds are the living organisms eg plants, animals, grass.
- Compounds always twice such as hydrogen and oxygen.

In the interview when asked if she noticed any differences between her pre- and post-concept mapping writing on this topic, she responds:

ZM: Yes. I noticed a difference.

SD: What difference do you notice ?

ZM: Before it is short and it is not clear .

SD: What do you mean by clear ?

ZM: It is not sense.

SD: You say there is no sense. What do you mean by no sense ?

ZM:

SD: In the pre you are saying that the organic compounds are the living organisms eg. plants , animals grass. Compounds are always twice such as hydrogen and oxygen.

You say ...

What would you say that sentence says? Is it a clear idea or what?

When you are saying compounds always twice such as hydrogen and oxygen ?

ZM: It is not clear.

Organic Compounds - Post-concept mapping writing:

In contrast, the piece of writing after concept mapping training shows a marked increase in the number of constructs (23) and the information is presented in a clear and structured manner. Out of the 23 constructs, she notably wrote down 20 constructs categorised as Relevant Information to the topic. The piece appears structured with headings and clear paragraphs.

Transpiration - Pre-concept mapping writing:

In her writing on transpiration she only produced 3 sentence constructs notably a Definition of the concept and 1 correct sentence containing Relevant Information.

Transpiration - Post-concept mapping writing:

This discussion consists of 23 sentence constructs, of which 14 constructs are Relevant and Correct to the topic; this is compared to the 2 Relevant and Correct constructs out of 3 in the pre-concept mapping writing.

The writing itself is characterised by clear paragraphs with headings, highlighting what is discussed, and within each paragraph there is a distinct contrast being made between the two types of situations that can occur for a particular factor.

Photosynthesis & Respiration - Pre-concept mapping writing:

This piece of writing consists of 22 sentence constructs, out of which 14 constructs were characterised as being Recall of Definition Verbatim. She uses sentences which are characterised as coming directly out of the textbook/notes. She defines the two processes and

then gives the importance of each process separately under their respective headings and does not inter-relate the two processes:

<p>2.Recall of Definitions (Verbatim)</p>	<p>Photosynthesis:</p> <ul style="list-style-type: none"> • Photosynthesis is the process by which chlorophyll in green plants traps radiant energy from the sun and transforms it into chemical energy stored in molecules of carbohydrates. • Radiant energy is very important . Changed into chemical potential energy . Stored in organic fuel molecules eg carbohydrates , glucose. Used during cellular respiration or stored becomes fossil fuel. Also used in synthesis of other organic compounds eg Ethanol. Oxygen is released as a by product . Oxygen is used by living organisms for cellular respiration. <p>Respiration:</p> <ul style="list-style-type: none"> • Is the gradual release of energy in the form of heat and ATP from energy. • Organic compounds which contain potential energy. • Oxidised with release of energy in the form of ATP. • Energy used in metabolic activities, • Growth, cellular respiration development. • CO₂ is released. Oxygen is used. • Balance between oxygen and carbon dioxide in the atmosphere.
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Interestingly the 4 Interrelations she gives could also be classified as a definition of how they are interrelated. Example:

<p>4. Interrelations of Concepts</p>	<p>Photosynthesis:</p> <ul style="list-style-type: none"> • Photosynthesis and respiration they are interrelated : both process the nature of reactions are cyclic. Calvin cycle in photosynthesis. Krebs cycle in cellular respiration. • ATP formed in both processes. • In both processes electrons are activated.
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Her writing is heading-bound, although the question requires her to show the important components of each one related to each other, making them two vital processes to life on earth.

Photosynthesis & Respiration - Post-concept mapping writing:

This piece consists of 11 sentence constructs of which notably 2 constructs are Definitions explained in her own words. This is in marked contrast to the 14 Verbatim Definitions which she provides in her pre-concept mapping writing. Example:

<p>3. Definition (Own Explanation)</p>	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • Photosynthesis is a process which needs light from the sun, H₂O from the roots and CO₂ from outside. Photosynthesis all combine this substances to form O₂ and to form starch.
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In contrast to the 4 Interrelations which she provides in her pre – concept mapping writing, which are possibly contentious, she provides 5 clear Interrelations between photosynthesis & respiration in her post–concept mapping writing. Example:

<p>4. Interrelations of Concepts</p>	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • Respiration occurs in the mitochondria. The O₂ from photosynthesis is used by the process. Also the monosaccharides from photosynthesis is used by the process. • They are so interrelated when the respiration gives off the CO₂ and the H₂O so photosynthesis in the thylakoids can used them again. Respiration also give us and plants energy.
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Summary Student 2: Zoleka M. (ZM)

In characterising her overall pre-concept mapping writing, it would appear that she relied much on Direct Recall of Information, especially regarding the recall of definitions but no further elaboration on the topics in contrast to her post-concept mapping writing, in which she writes more clearly and in a more structured fashion. Accounting for her short discussions on transpiration, and referring to her observations about her own pre- and post-concept mapping writings on photosynthesis & respiration she says:

<p>SD: Okay. If we look at some of the other writings that you've done as well , you look on the one of transpiration , that's the pre , and the post, okay?</p> <p>What do you notice about your pre-writing about transpiration ?</p> <p>ZM: It is short.</p> <p>SD: It is short. What else ?</p>

(Long Pause by ZM)

It is short.

SD: I see here you give the headings for the internal factors and the external factors but you didn't explain it, why not? in the pre writing? Why didn't you explain it in the pre writing?

ZM: I don't understand the way

SD: You don't understand

ZM: I don't understand the way you discuss (write a discussion)

SD: You don't understand the way you discuss, okay.

Cause I see here in the post writing that you've actually - you've got your internal factors and you've got your external factors separately.

And then under each one you've got the factor and the explanation

ZM: Yes ...

SD: for that specific factor, okay?

And if we look at the last one for photosynthesis and respiration .

SD: All right , what do you notice about your pre writing and your post writing ?

Right so if we look at the writing pre and post on photosynthesis and respiration , what do you notice ?

ZM: In the first one I do not write about photosynthesis and respiration together, I write separately.

SD: Mmm. So what did you put under respiration here ? Just the

Are these the importances of respiration and the importance of photosynthesis ?.

ZM: Yes.

SD: But what do you notice in the post ?

ZM: The post I notice that I write photosynthesis and respiration together (Interrelate).

Student 3: Winterrose S. (WS)

Organic Compounds - Pre-concept mapping writing:

Out of a total of 28 sentence constructs, 12 constructs were notably categorised as Relevant and correct. In her discussion she has clear paragraphs, but she does not have all the information under that heading; later she places what she has left out before in another part of the essay.

She also included Irrelevant information in her discussion on Organic Compounds, namely she discusses the importance of water, which is not an Organic Compound. She could not be asked to explain the inclusion of water under this topic since she was not available for the interview session. Example:

7. Irrelevant Information to Topic.	Organic Compounds: Re: Water Functions <ul style="list-style-type: none">• It acts as a solvent.• It is hydrolysis• It helps the food to pass through oesophagus easily.• It is a useful substance in all living things.
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Organic Compounds - Post-concept mapping writing:

In contrast, out of a total of 25 sentence constructs, 18 constructs were categorised as Relevant and Correct. The information is presented in a clear and structured manner, having clear headings and paragraphs.

Transpiration - Pre-concept mapping writing:

Out of a total of 22 sentence constructs, she wrote 5 constructs, which could be categorised as Relevant and Correct. She does not show any contrasts between the features and how they change in relation to the environmental conditions; this leads to her losing half the marks, for example:

5. Relevant Information to Topic & Correct Factual Recall.	<p>Transpiration:</p> <p>Re: External Factors:</p> <ul style="list-style-type: none">• Temperature: If there is high temperature the transpiration rate increases• Light: If there is light transpiration rate increases When photosynthesis takes place.• Humidity: If there is humid air transpiration rate decreases. <p>Re: Internal Factors:</p> <ul style="list-style-type: none">• Size of the leaves/ plants: Transpiration rate must happen in a large surface Where it can photosynthesize + That will increase the rate of transpiration.• Cuticle / hairs : Hairs prevents the leave during the wind from loosing to much water.
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Transpiration - Post-concept mapping writing:

Out of a total of 23 sentence constructs, she wrote 14 constructs, which could be categorised as Relevant and Correct. In contrast to the previous example, she does include both scenarios to the feature, for example:

5. Relevant Information to Topic & Correct Factual Recall	<p>Transpiration:</p> <p>Re: Internal factors:</p> <ul style="list-style-type: none">• Stomata: The stomata is divided into few stomata which decrease the rate of transpiration. Sunken stomata also decreases the rate of transpiration.• Cuticle have two different layers. The thick and the thin cuticle. Thick cuticle have low transpiration rate and Thin cuticle have high transpiration rate.• Leaf area: The small leaf have a low transpiration rate. The large leaf have a high transpiration rate. <p>Re: External factors:</p> <ul style="list-style-type: none">• Temperature: High temperature have high transpiration rate. Low temperature have a low transpiration rate.• Humidity: Wet air have a low transpiration rate. Dry air have a high transpiration rate.• Water availability: Little water the transpiration rate is high. Lots of water the transpiration rate is low.
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Photosynthesis & Respiration - Pre-concept mapping writing:

Out of a total of 15 sentence constructs, she wrote 2 constructs which could be categorised as Relevant and Correct.

In addition, an Alternate Conception was present which, unfortunately could not be followed up on since the student was not available for the interview session, viz., :

1. Alternate Conception/ Alternate Explanation	Photosynthesis: <ul style="list-style-type: none">• So in respiration O_2 is used to give strength. The strength that we have is coming from the air that is, it gives energy.
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This piece also exhibits 4 Interrelations, viz.,

4. Interrelations of Concepts	Photosynthesis & Respiration: <ul style="list-style-type: none">• As we breath in fresh air i.e oxygen This air is the one which is given off by plants in the process of photosynthesis.• So these processes are vital to life on earth because there can be no plant on earth we cannot survive.• They are interelated because each process help one another to survive.• This oxygen which is produced by the plant it can be used by human.
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Photosynthesis & Respiration - Post-concept mapping writing:

Out of a total of 16 sentence constructs, she wrote 12 constructs, which could be categorised as Relevant and Correct. The Alternate Conception is not present. She discusses photosynthesis & respiration without showing the inter-relatedness of the two processes. She discusses photosynthesis separate from respiration and appears to be giving a factual definitive type of account of the two processes, viz.,

2. Recall of Definitions (Verbatim)	Photosynthesis & Respiration: <ul style="list-style-type: none">• Photosynthesis is the making of Carbohydrate from the raw materials CO_2 and H_2O using chlorophyl molecule .• The formula :- $CO_2 + 6H_2O \rightarrow$ sunlight, chlorophyll, Enzymes $\rightarrow C_6H_{12}O_6 + 6O_2$.
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Summary Student 3 : Winterrose S. (WS)

In her discussion on photosynthesis & respiration she fails to discuss respiration specifically.

Most of the discussion is around the concept of photosynthesis.

No Interview data is available for this student.

Student 4: Eunice M. (EM)

Organic Compounds - Pre-concept mapping writing:

This piece of writing consists of 6 sentence constructs, with only 3 constructs categorised as follows:

2. Recall of Definitions (Verbatim)	Organic Compounds: <ul style="list-style-type: none">• Organic compounds are all contain carbon atom and they are usually made in living organism.
7. Irrelevant Information to Topic.	Organic Compounds <ul style="list-style-type: none">• They occur naturally in our environment.• They are broken down by process called hydrolysis.

The piece contains correct information that has relevance to the topic, but it also shows rather clearly a misunderstanding of organic compounds, confusing it with the concept of nutrients eg.:

Organic compounds are Nitrogen, Carbon, hydrogen, Oxygen, Phosphorus, and Sodium (No CHOPS – Nitrogen, Hydrogen, Oxygen, Phosphorous, Sulpher)

She then continues recalling pieces of information relevant to organic compounds, but which are not exactly pertinent to the question. Example:

- They usually contain Carbon atoms.
- They occur naturally in our Environment.
- They are broken down by process called hydrolysis.
- This means that water is added to the bonds to break them forming their building units.

The piece is short and has no information answering the question. In clarifying as to why the piece was so short, see Transcript of Interview under post-concept mapping writing (organic compound) below.

Organic Compounds - Post-concept mapping writing:

In contrast to the pre-concept mapping writing which had a total of 6 constructs, 2 of which were categorised as Irrelevant Information, the post-concept mapping writing consists of 22 constructs containing notably 17 constructs, which were categorised as Relevant Information to the topic and Correct Factual Recall. The information is presented in a clear and structured manner, having clear headings and paragraphs.

The characteristic features are identified by the student personally in the interview about the short descriptions in the pre-concept mapping writing and the longer descriptions in the post-concept mapping writing when she says:

SD: E.N let's go for it. Okay. You've read through the pre-test questions, right, and you looked through the post-test questions, okay. Do you notice any difference the way you wrote before and the one after ?

EM: It is short.

SD: You noticed. What did you notice ?

EM: In the pre writing it is not clear and is short.

SD: What do you mean by clear ?

EM: I didn't writing in point form. (Meaning headings)

SD: You didn't write in point form. What else ?

You said it was short. What do you mean by short ?

EM: I not finish write.

SD: You didn't finish write, so did you cover everything that you wanted to cover ?

EM: No I don't cover everything.....

SD: Okay...

EM: In the post it is clear, and I write in point form and I finish write everything in the post.

SD: And you finish write everything you wanted in the post.?

EM: In the post yes.

Transpiration - Pre-concept mapping writing:

This piece is again characterised by a low number of sentence constructs, viz., 6, out of which only 2 constructs would have afforded scoring. Both of them were of the definitive type. The rest (4 constructs) were information which, although correct about transpiration, were however short of addressing the specific question.

7. Irrelevant Information to Topic.	Transpiration: <ul style="list-style-type: none">• There are 3 types of Transpiration Stomatal Transpiration from stomata and Cuticular transpiration from cuticle Lenticular transpiration from lenticule in the bark.• Transpiration cause H₂O to move up the stem.• Cause suction pull of transpiration.• Help to cool the plant by evaporation of the water.
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Transpiration - Post-concept mapping writing:

This piece of writing consists of 20 sentence constructs, out of which 16 were categorised as Relevant and Correct. This contrasts markedly with the pre-concept mapping writing:

Relevant Information - Organic Compounds	
Pre-concept mapping writing :	Post-concept mapping writing
0%	77 %

Comparing the Incidence of Irrelevant Information before and after concept mapping

Relevant Information - Transpiration	
Pre-concept mapping writing :	Post-concept mapping writing
0%	80%

Comparing the Incidence of Relevant Information before and after concept mapping

Here the student's writing is characterised by clear paragraphs with headings highlighting what is discussed, and within each paragraph there is a distinct contrast being made between the two types of situations that can occur for a particular factor.

Photosynthesis & Respiration - Pre-concept mapping writing:

This piece of writing consists of 12 sentence constructs, 10 of which were characterised as Direct Verbatim Recall of the Definitions; 5 were of photosynthesis and 5 were of respiration.

<p>2. Recall of Definitions (Verbatim)</p>	<p>Photosynthesis:</p> <ul style="list-style-type: none"> • Photosynthesis is important for Radiant energy. • It changed into chemical potential energy and stored in organic fuel molecules like carbohydrates and glucose. • It serves as a natural source of food for man and animal. • Carbon dioxide absorbed enormous amount of poisonous accordingly the concentration of carbon dioxide is kept constant. • Oxygen is released as by-product and used by living organism for cellular respiration. <p>Respiration:</p> <ul style="list-style-type: none"> • Organic compound which contains potential energy is oxidised with the release of energy in the form of ATP . • Energy used for metabolic activities growth/ cell work/ development. • Release carbon dioxide and use oxygen. • Retain balance between carbon dioxide and oxygen in the atmosphere.
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No concrete explanations for either of the two processes are provided, but somewhat of an overview of some of the important components of each process is given. Both topics are described separately, showing no clear interrelationships.

Photosynthesis & Respiration - Post-concept mapping writing:

In contrast to the pre-concept mapping writing, she shows 5 Interrelations and 6 Definitions of photosynthesis & respiration out of a total of 12 sentence constructs in her post-concept mapping writing.

<p>3. Definition (Own Explanation)</p>	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • Photosynthesis need the sun and takes place in the thylakodes of the leaf. The sun has the radiant energy which is changed into chemical potential energy which used to combine ADP and P to form ATP. Photosynthesis also need CO₂ and H₂O to take place. Photosynthesis make the O₂ and the Glucose. • Respiration occur in the day and night. Respiration it takes place in the mitochondrion in the cell.
<p>4. Interrelations of Concepts</p>	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • Respiration it uses the O₂ from the Photosynthesis. Respiration it uses the glucose from the Photosynthesis. It then stores it as energy in the form of ATP. • Respiration then give off Carbon dioxide and the H₂O . The CO₂ then can be used by the Photosynthesis.

. Her explanations appear clear and to the point.

Summary Student 4: Eunice M (EM)

In characterising her overall pre-concept mapping writing, it would appear that she relied much on Direct Recall of Information, especially the recall of definitions. This is in contrast to her post-concept mapping writing in which she writes more clearly and in a more structured fashion. This piece clearly shows total 'regurgitation' of the definitions of photosynthesis & respiration and no attempt is made to show how they are interrelated.

She also clearly makes the observation about the characteristic features of her pre- and post-concept mapping writings for photosynthesis & respiration when she says:

EM: In the pre I write the facts but I do not write things together. In the post I write things together .

Student 5: Vuyokazi Z. (VZ)

Organic Compounds - Pre-concept mapping writing:

This piece of writing consists of 25 sentence constructs, out of which 9 were categorised as Relevant and Correct, while 7 constructs were categorised as Irrelevant.

5. Relevant Information to Topic & Correct Factual Recall	Organic Compounds: <ul style="list-style-type: none">• Organic compound has C:H:O .• Food contain Carbohydrate: Potatoes, Bread, Rice.•test for Starch we put iodine in Starch.• the colour of Iodine is brown if it contains (starch) it will turn blue black.• test for fats is ether reagent .• if they contain fats it will turn / stain in paper.• Millions reagent are to test for protein.• If the substance turn into brick red it has protein.• PolysaccharideCellulose Starch
7. Irrelevant Information to Topic.	Organic Compounds: <ul style="list-style-type: none">• Water in our body play an important role.• Water softens food.• Water act as cleaning when it turn to faeces.• Enzymes are denatured .• They (enzymes) work at low pH.• Enzymes are proteins.

It does not appear as if she did any planning before she wrote. In the discussion she does not provide a clear division of the organic compounds as the question asks; rather it appears as if the information is written as it occurs to her. She also makes 4 Relevant constructs to the topic, but follows them up with Incorrect Factual Recall:

6. Relevant Information to Topic BUT InCorrect Factual Recall.	Organic Compounds: <ul style="list-style-type: none">• Monosaccharides is (1) Glucose (2) Lactose (3) Sucrose• Glucose + Fructose → Galactose• Glucose + Latose → Sucrose
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Organic Compounds - Post-concept mapping writing:

In this piece 16 (70%) of her sentence constructs are Relevant and Correct to the topic out of a total of 23 constructs. In contrast to the pre-concept mapping writing there are no Irrelevant information present. The piece of writing is written clearly with defined headings, discussions are focussed and each heading is discussed exhaustively.

Transpiration - Pre-concept mapping writing:

This piece of writing consists of 18 sentence constructs, of which only 1 construct could be categorised as Relevant and Correct to the topic. Three (3) constructs were Irrelevant to the topic altogether. She had 4 constructs, which were Relevant to the discussion, but in her explanation, she did not recall the correct explanations/facts to explain the relevance.

6. Relevant Information to Topic BUT InCorrect Factual Recall.	Transpiration: <ul style="list-style-type: none">• In transpiration there are three types of transpiration. Root pressure. Capillary. Suction force. Re: Internal factors: <ul style="list-style-type: none">• When Wind is blow rate of transpiration will decrease.• Light. when there is light bright transpiration will decrease.• Humidity : when there is too much air transpiration will increase
--	--

She wrote 5 constructs, which dealt with explaining the stomatal mechanism of opening and closing, which was entirely Irrelevant to the discussion.

Transpiration - Post-concept mapping writing:

This piece clearly shows an increase in the number of Relevant and Correct constructs, which contrasts markedly with her pre-concept mapping writing :

Relevant Information - Organic Compounds	
Pre-concept mapping writing :	Post-concept mapping writing
36%	70 %

Comparing the Incidence of Relevant Information before and after concept mapping

Relevant Information - Transpiration	
Pre-concept mapping writing :	Post-concept mapping writing
6%	61%

Comparing the Incidence of Relevant Information before and after concept mapping

Here the student's writing is characterised by clear paragraphs with clear headings; there is a distinct contrast being made between the two types of scenarios that can occur for a particular factor.

Photosynthesis & Respiration - Pre-concept mapping writing:

This piece consists of 14 sentence constructs of which 6 are notably characterised as:

4. Interrelations of Concepts	Photosynthesis: <ul style="list-style-type: none"> • Photosynthesis is the process of life if it was not yet we would not survive. I think it is very important to keep thing of natural resource in right way like plants and soil because we depend on them to breath at same time palnt depend on us. • If photosynthesis is produced $6\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{O}_2$ the Respiration is doing the opposite of that if each of them is not yet it cant survive only both of them are interconnected. • The CO_2 which we breath (out) is needed by the plant to survive this tells us that these kind of process between man and plant there is a huge relationship.
5. Relevant Information to Topic & Correct Factual Recall	Photosynthesis & Respiration: <ul style="list-style-type: none"> • Respiration does not need light and can made in dark and light. • Oxygen is produced during photosynthesis • Photosynthesis as made during light if there was no light it cannot made because it require light.

She offers a reasonable explanation of the interrelation between photosynthesis & respiration, but her writing (syntax) appears cumbersome with long sentences, repeating much of the information in another way, and the sentences need to be read more than once in order to ascertain the meaning of the idea. There are no paragraphs and discussion is over one full page. She discusses photosynthesis exhaustively, but only mentions respiration at the end in one sentence when she says:

If photosynthesis is produced $6\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{O}_2$ the Respiration is doing the opposite of that if each of them is not yet it cant survive only both of them are interconnected.

Photosynthesis & Respiration - Post-concept mapping writing:

Out of the 13 sentence constructs for this topic, the following are notable: 6 Interrelations and 2 Definitions of photosynthesis in her own words.

3. Definition (Own Explanation)	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • Photosynthesis needs light , CO_2, H_2O , Chlorophyll. Photosynthesis occurs in Thylakoids in chloroplast. Photosynthesis uses CO_2 + Water + Light + Enzymes to make glucose in leaves..
4. Interrelations of Concepts	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • (Respiration) It uses the glucose from the photosynthesis and give CO_2 and H_2O. It also gives off energy in the form of ATP. • Plants make the glucose and the cell uses it for energy. Plant need the CO_2 from the cell. The cell need the O_2 from the cell. • I think these processes has an important role in plants and animals to produce food and the other one to break down which was made.

Although she does not explicitly define respiration, she does so within the Interrelations.

Photosynthesis & respiration is described succinctly, containing only the main ideas.

Summary Student 5: Vuyokazi Z (VZ)

Her pre-concept mapping writing is characterised by the inclusion of Irrelevant Information, for example (Organic Compounds = 28%) and (Transpiration = 17%) , contrast markedly to her post-concept mapping writing in which there are no Irrelevant Information constructs.

Her writing is also clear and more structured in the post-concept mapping writing.

During the interview session about organic compounds:

SD: All right, if you compare the first piece right, with your second piece, I see there here in your second piece you've got Organic Compounds are divided into proteins , then you discuss everything about proteins, right, and then you say that Organic compounds are divided into Vitamins for example, then you discuss the vitamins, then you say in the your next paragraph, organic compounds are divided into carbohydrates and you went to go and explain everything that you know about the carbohydrates, . This is in the second piece of writing .

If we compare that to your first piece of writing , we see you start off by talking about...the test for starch , the test for fats, right ?, and then you've Millon's reagent coming in here. Okay. ?

What do you notice about the way you wrote this stuff here , the topics, and the topics over here in your second piece. ?

VZ: There are no headingsin the first.

SD: There are no. So you say there are no headings in the first piece and in the second piece?

VZ: There are headings.

On photosynthesis :

SD: If you look at the one on Photosynthesis and Respiration , what do you notice there ?

So what do you notice between the two writings on Photosynthesis . Photosynthesis is the first piece . What do you see there ?

VZ: In the first one I was writing things which are not needed, which are not necessary. There are no headings. In the second one there is things which are needed and are necessary as specified.

In her explaining why her discussion on photosynthesis & respiration was long and cumbersome:

VZ: In the first one I was writing things which are not needed, which are not necessary. There are no headings. In the second one there is things which are needed and are necessary as specified.

SD: So mmm. Once you look at these things now , what would you say , what would you say caused this difference in the way you wrote before, this first piece and the second piece ?

VZ: In the first piece I was writing what I was reading, I not understand but I just read and read and read again and write it. In the second one I was reading and understand and doing concept map and linking words. That's why they helped me in this essay to write.

From my experience with learners, 'reading' refers to 'studying'. So essentially when she says "*In the first piece I was writing what I was reading*", she makes it explicit that she was recalling what she was studying without real understanding, whereas in the post-concept mapping writing she was studying and with the aid of the concept map, it helped her to

understand what she was to write about. It therefore appears that much more planning and focusing took place before she wrote the post-concept mapping writing.

Student 6: Ntombizodwa J. (NJ)

Organic Compounds - Pre-concept mapping writing:

This piece of writing consists of 5 sentence constructs, of which 2 were categorised as :

6. Relevant Information to Topic BUT InCorrect Factual Recall.	Organic Compounds: <ul style="list-style-type: none"> • The element that are found in organic compound are Nitrogen, carbon dioxide, phosphorus and Sodium.
7. Irrelevant Information to Topic.	Organic Compounds: <ul style="list-style-type: none"> • In inorganic compounds do not usually contain carbon atoms and they occur naturally in our environment eg. Water Salt and Carbon dioxide.

and the last 2 ideas were unclear :

8. Unclear Expression of Idea.	Organic Compounds: <ul style="list-style-type: none"> • The living organism compose of human and animal life and the dead organism compose of plant and all things which did not live. • Organic Compound are compound that found in living organism and dead organism/ non-living organism.
--------------------------------	--

On the whole, the piece of writing contained no information, which could give her credit during evaluation of the piece, since it did not contain the necessary information that the question asks for in terms of the divisions of the organic compounds, nor does she mention any examples. It is a very short piece of writing.

Organic Compounds - Post-concept mapping writing:

A very clear and focused piece of writing having 17 constructs out of the 18 categorised as Relevant and Correct. The last construct is a Verbatim Definition of organic compounds.

Although she has no headings, the constituent topics are all put together in a single paragraphed and are discussed together.

Transpiration - Pre-concept mapping writing:

This piece of writing contains 7 sentence constructs, of which 4 constructs were categorised as Unclear Expression of Idea.

<p>8. Unclear Expression of Idea.</p>	<p>Transpiration:</p> <ul style="list-style-type: none"> • The internal factors of transpiration causes the suction pull of transpiration. • The external factors: When the plant have lose water the leaves and flower were follen and the plant death. • Cuticular helps plant to loose not to much water. • Lenticular transpiration help the plant to breathe.
---------------------------------------	--

Sentences appear to be written without clear focus on what is to be said and they come out as unclear ideas. During the interview session she was asked to account for differences between her pre- and post-concept mapping writings:

SD: This one here is transpiration before and , transpiration after.

NJ: In transpiration before I just write about transpiration and internal factors and don't not discuss about internal factors and external factors.

And in this transpiration after, I write about transpiration and then I discuss about internal factors what they contains and the external factors.

SD: Hmm. But why do you think you wrote like this before ?

NJ: I just write the factors what is there in transpiration but not explain them.

SD: But why did'nt you explain them, for example.

NJ: I don't understand (laughter) I don't know how

SD: You did'nt know how to explain it ?

You say did'nt understand, what do you mean when you say that you didn't understand it before ?

NJ: I'm just write and then write

SD: So are you saying

NJ: without understanding

SD: before you wrote you just wrote what came to your mind ?

NJ: Yes.

SD: Is that what you did ?

NJ: Yes.

SD: And afterwards ?

NJ: After I just write and I organise my mind that what is going on in this transpiration

SD: So what do you think caused this difference in the way you wrote before and after ?

NJ: It causes the difference because if you write you must organise what is the thing all about , you don't just writing.

Transpiration - Post-concept mapping writing:

In contrast to the pre-concept mapping writing this piece consists of a clearly written paragraphed essay consisting of a total of 22 sentence constructs. Out of the 22 constructs, 13 constructs could be categorised as Relevant and Correct, with 2 Unclear Expressions, example:

8. Unclear Expression of Idea.	Transpiration: Re: Internal Factors <ul style="list-style-type: none">• Arrangement of leaf can be vertical when the transpiration rate increase.• Opposite leaf decrease during transpiration rate.
--------------------------------	--

Photosynthesis & Respiration - Pre-concept mapping writing:

This piece of writing consists of 7 sentence constructs, of which 3 are Definitive, 1 Relevant but Incorrect, 1 Relevant and Correct recall of information and 2 are Unclear Expressions, for example:

8. Unclear Expression of Idea.	Photosynthesis: <ul style="list-style-type: none">• Respiration formed quality of ethanol forms energy.• Photosynthesis manufacturing of carbohydrates food and forms CO₂ and H₂O in the presence of chlorophyll using energy from the sun and O₂ is liberated.
--------------------------------	---

Photosynthesis & Respiration - Post-concept mapping writing:

This piece consists of a total of 12 sentence constructs, in which 4 constructs describe the two processes in her own words (Own Explanation), while 8 of them show Interrelations. Example:

3. Definition (Own Explanation)	Photosynthesis & Respiration: <ul style="list-style-type: none">• Photosynthesis occurs in the leaf chlorophyll of a plant. The leaf Chlorophyll needs the sun as Radiant Energy. It needs the water and the Carbon dioxide to make glucose in leaf. It also make the O₂.
4. Interrelations of Concepts	Photosynthesis & Respiration: <ul style="list-style-type: none">• Respiration occur in the mitochondrin of cells . Mitochondrion uses glucose from photosynthesis. Mitochondrion uses the O₂ from the leafs. This they use to make and give off energy which is stored as ATP in cells.• Men need glucose from plants and O₂. This was made during photosynthesis process. It is interrelated because respiration needs O₂ and glucose. The plants need respiration for CO₂.

In contrast to her pre-concept mapping writings there were no Interrelations. The writing is clear, focused, short and to the point.

Summary Student 6: Ntombizodwa J. (NJ)

It becomes clear that if we look at Table 4.3 that Ntombizodwa possibly has a problem expressing herself clearly in the second language in which she is writing, since Unclear Expressions occur in all her topics in the pre-concept mapping writings.

4.2 Discussion of Results as per Individual Question

Learners constructs were analysed in relation to each essay question asked and by comparing performance in the pre- and post-concept mapping writing. Extracts from each learner's writing are used to illustrate trends and shifts, and therefore the effect that the concept mapping intervention had on the quality of the learners' writing.

I will focus on each of the questions that I posed to the group separately, highlighting overall trends and shifts in their writings before and after the concept mapping intervention.

4.2.1 Overall Performance on Question One

- | |
|---|
| <p>(a) What do you understand by the term 'Organic Compounds'?</p> <p>(b) Explain the divisions of the Organic Compounds.</p> |
|---|

In the pre-concept mapping writing the quality is generally poor and exhibits poor planning in that ideas are mixed up and appear to have been thrown together as information came to mind about the topic under discussion.

Four out of six learners had between them a total of only 3 to 6 sentence constructs for answering this question. The remaining two learners had a total of 25 and 28 sentences constructs each respectively. These constructs were inadequate to effectively answer the question.

However, a trend which stands out in their pre-concept mapping writing, is the incidence of Irrelevant Information. All six learners had incidences of Irrelevant Information and Unclear Expressions of Ideas.

For example, Ayanda (AN) : Out of a total number of 6 constructs, had written 5 of them which were categorised as Irrelevant Information.

Organic Compounds:

- Organic Compounds are divided into macro and micro compound.
- Micro-compounds: They are needed in small quantities. They are large compound Therefore they need to be catalyzed eg Calcium, Sodium, Zinc.
- Macro-organic Compound: They are needed in large quantities eg carbohydrates, proteins, fats.
- Carbohydrates they are monomers.

and Vuyokazi (VZ) : Out of a total of 25 constructs focusing on the importance of water in the body, had 7 constructs categorised as Irrelevant Information.

Organic Compounds:

- Water in our body play an important role.
- Water softens food.
- Water act as cleaning when it turn to faeces.
- Enzymes are denatured .
- They (enzymes) work at low pH.
- Enzymes are proteins .

In contrast to the post-concept mapping writing, the incidence of Irrelevant Information and Unclear expressions of Idea within the whole group was totally absent for this particular topic.

The post-concept mapping version of all the learners' writings contained notably more constructs which were categorised as Relevant and Correct Information to the topic, as compared to the Pre-concept mapping writing, where only two learners had constructs which contained Relevant and Correct Information.

A comparison of pre- and post-concept mapping writing by Ayanda (AN) illustrates this. The script seen below is given verbatim as he wrote the topic in his pre-concept mapping writing.

He wrote:

Organic Compounds:

- Organic Compounds are divided into macro and micro compound.
- Micro-compounds: They are needed in small quantities. They are large compound Therefore they need to be catalzed eg Calcium, Sodium, Zinc.
- Macro-organic Compound: They are needed in large quantities eg carbohydrates, proteins, fats.
- Carbohydrates they are monomers.

It is worth noting that the above piece of writing contains 6 constructs, of which 5 were categorised as Irrelevant Information. In his post-concept mapping writing, out of a total of 15 constructs, Ayanda (AN) now had 14 constructs categorised as Relevant Information & Correct Factual Recall as seen below:

Organic Compounds:

Re: Fats

- Fats contain the CHO.
- Fats consist of 3 fatty acid and 1 glycerol molecule.
- To test for starch we use ether .
- And the result are grease substance in the filter paper.

Re: Carbohydrates:

- Carbohydrates consist of monossacharide, dissacharide, Polyssacharide.
- Monossacharide eg Glucose, Galactose and fructose.
- Dissacharide has lactose and maltose and sucrose.
- Polypeptide has Starch cellulose and Glycogen.
- To test for starch we use Benedict Solution .
- And the result are Orange precipitate..

Re: Protein

- Protein consist of Dipeptide, tripeptide and polypeptide.
- To test for the presence of protein we use Millon's reagent.
- The result are brick red precipitate.

Re: Vitamins

eg. Vitamin A, B, C

In contrast to his pre-concept mapping writing, this piece of writing is presented in a clear, structured manner and the divisions of the organic compounds are shown clearly. In addition, the writing exhibits clarity in structure and form. The above type of shift is particularly common and applicable to the whole group.

4.2.2 Summary of Performance on Question One

In conclusion, a significant improvement was noted in learners' post-concept mapping writing on the topic of organic compounds. This improvement was first apparent in the increase in the total number of constructs learners produced, and secondly, it was apparent in the relevance of the information and the correctness of the factual recall of information as relating to the question set.

4.2.3 Overall Performance on Question Two

- | |
|--|
| <p>(a) What do you understand by the term 'Transpiration'?</p> <p>(b) Explain how a plant's internal structural features and its external environmental factors have an effect on the rate of transpiration.</p> |
|--|

This question required the student to define the term transpiration and to explain what the internal and external factors are that would have an effect on the rate of transpiration. Learners would then be required to explain how and under what condition(s) each factor would promote or inhibit the rate of transpiration.

This type of question from the Matriculation Biology Syllabus is typical. For example, in the November 1997 Biology HG exam the following question regarding Transpiration was asked:

“Explain the influence of external factors on the transpiration rate of plants.”
[Nov 1997 WCED Biology HG Exam]

The question which I have asked, required them to look at both factors (internal and external).

Out of the group of six learners, 4 learners produced less than 10 sentence constructs in answering this question in the pre-concept mapping phase, as shown in the following examples, which appear short and fragmented.

eg Ntombizodwa (NJ) Pre concept mapping writing

Transpiration 19 August 1997

1. Transpiration is the lose of water in the form of water vapour to the aerial part of the plant.

2. The internal factors of transpiration causes the suction pull of transpiration which help to cool the plant in the water.

The external factors

When the plant have lose water the leaves and flower were fallen and the plant death.

Temperature, humidity

Effect on the rate of Transpiration

Stomata transpiration

Cuticular helps plant to ~~lose~~ not to much water

Lenticular transpiration help the plant to breath

The aim is to demostate transpiration

and Zoleka (ZM): Pre concept mapping writing

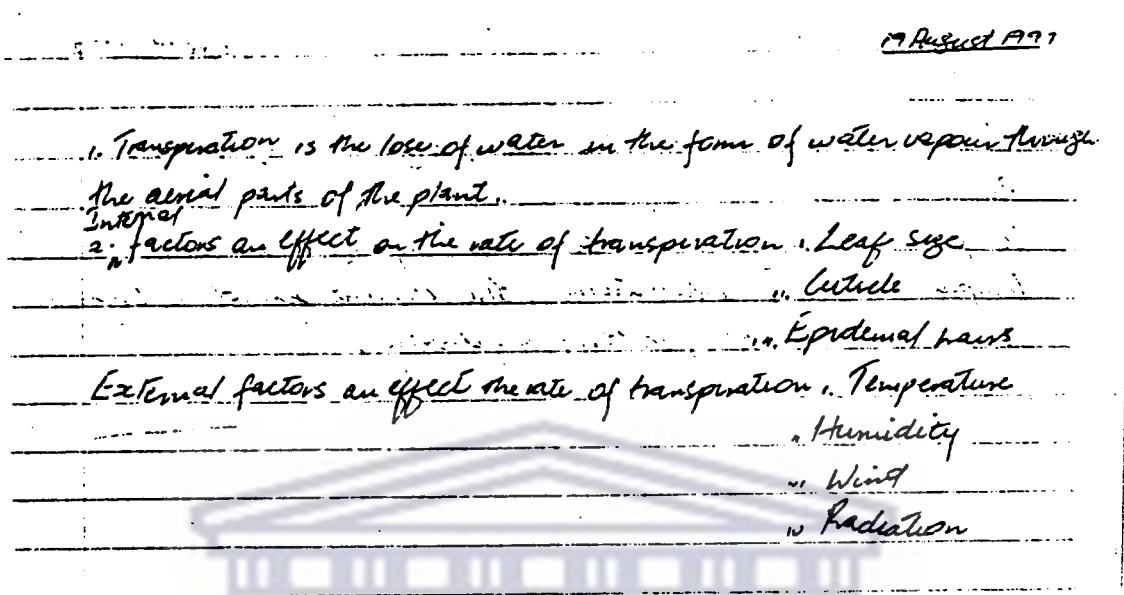


Table 4.1 below shows the relative improvement in the writing of 4 learners under the category Relevant Information & Correct Factual Recall. This improvement suggests that the concept mapping intervention had a positive effect on learners' writing (and therefore learning).

Effect of Concept Mapping on Learner Writing - Transpiration

Name of Student	Pre-CM writing 5.Relevant Information & Correct Factual Recall	Post-CM writing 5. Relevant Information & Correct Factual Recall
	6	20
Ayanda (AN)	2	13
	3	23
Zoleka (ZM)	1	14
	22	23
Winterrose (WS)	5	14
	18	23
Vuyokazi (VZ)	1	14

Table 4.1

Numbers in shaded areas represents total number of constructs in essay and numbers in unshaded areas the number of constructs identified per category.

As can be seen in Table 4.1, the number of constructs categorised as Relevant Information & Correct Factual Recall increased notably in their post-concept mapping writing, as does the total number of constructs.

The learners' post-concept mapping writing compared to their pre concept mapping writing is distinctly clearer, to the point, more structured and explanations are given for both scenarios that can arise for each given factor, for example Zoleka (ZM) had 1 construct out of a total of 3 categorised as Relevant Information & Correct Factual Recall in her pre-concept mapping writing, as opposed to 14 out of 23 constructs in her post-concept mapping writing below.

Zoleka (ZM) Relevant Information & Correct Factual Recall

Transpiration:
Re: External factors:

- Temperature when it is cold day the rate of transpiration is low. When it is hot day the rate of transpiration is high.
- Wind when wind blows the rate of transpiration is high. When the day is no wind the rate of transpiration is low.
- When it is light the rate of transpiration is high. When it is dark the rate of transpiration is low.
- When water in soil is little the rate of transpiration is low. When lot of water the rate of transpiration is high.

Re: Internal factors:

- When cuticle is thick the rate of transpiration is low. When it is thin the rate of transpiration is high.
- Stomata when stomata are many the rate of transpiration is high. When stomata are sunken the rate of transpiration is low.
- Leaf area: If the leaf is small the rate of transpiration is low. If it is large the rate of transpiration is high.

The above shift in structure and form is evident for the whole group in their post-concept mapping writings, exhibiting clarity of ideas and expressions about the given factors.

This improvement is found consistently in all the writings of the learners on the topic of transpiration. The form of the writing appears to be well-structured, clearly written with specific paragraph discussions dealing with particular division headings. They stick to the topic and no Irrelevant Information is contained within their discussions in their post-concept mapping writings.

4.2.4 Summary of Performance on Question Two

In summary, on the topic of transpiration, no Irrelevant Information was found in learners' post-concept mapping writing and there were more Relevant Information and Correct Factual Recall. The total number of constructs also notably increased in their post-concept mapping writing on this topic.



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4.2.5 Overall Performance on Question Three

Explain why Photosynthesis and Respiration can be regarded as 2 vital processes to life on earth and show how they are interrelated.

The nature of this question is such that it requires the student not merely to offer definitions of the two processes; rather the student is required to bring together their understanding of the two processes in such a way that the inter-relatedness should be explicitly shown.

The following categories will be discussed as trends, which presented themselves in the answering of this question:

1. Recall Definition (Verbatim) vs Recall Definition (Own Explanation)
2. Interrelations
3. Relevant Information & Correct Factual recall
4. Unclear Expression of Ideas

1. Recall Definition (Verbatim) vs Recall Definition (Own Explanation)

The pre-concept mapping responses are characterised by learners Recalling Definitions Verbatim for the 2 processes, as is illustrated by the following learners Zoleka(ZM) and Eunice(EM). Zoleka (ZM) : Out of a total of 22 constructs, 14 were categorised as Recall Definition Verbatim, for example:

Photosynthesis:

- Photosynthesis is the process by which chlorophyll in green plants traps radiant energy from the sun and transforms it into chemical energy stored in molecules of carbohydrates.
- Radiant energy is very important . Changed into chemical potential energy . Stored in organic fuel molecules e.g. carbohydrates , glucose. Used during cellular respiration or stored becomes fossil fuel. Also used in synthesis of other organic compounds eg Ethanol. Oxygen is released as a by product . Oxygen is used by living organisms for cellular respiration.

Respiration:

- Is the gradual release of energy in the form of heat and ATP from energy. Organic compounds which contain potential energy . Oxidised with release of energy in the form of ATP. Energy used in metabolic activities , Growth cellular respiration development. CO₂ is released. Oxygen is used. Balance between oxygen and carbon dioxide in the atmosphere.

and Eunice(EM): Out of a total of 11 constructs, 10 were categorised as Recall of Definition (Verbatim):

Photosynthesis:

- Photosynthesis is important for Radiant energy.
- It changed into chemical potential energy and stored in organic fuel molecules like carbohydrates and glucose.
- It serves as a natural source of food for man and animal.
- Carbon dioxide absorbed enormous amount of poisonous accordingly the concentration of carbon dioxide is kept constant.
- Oxygen is released as by-product and used by living organism for cellular respiration.

Respiration:

- Organic compound which contains potential energy is oxidised with the release of energy in the form of ATP .
- Energy used for metabolic activities growth/ cell work/ development.
- Release carbon dioxide and use oxygen.
- Retain balance between carbon dioxide and oxygen in the atmosphere.

Both these writings show evidence of memorisation and rote learning. The information appeared as if they have been reproduced from a text or classroom notes and is presented as if it is the learners' own texts. There are no attempt to paraphrase the information and use their own words.

In short, definitions are memorised and reproduced in their writings. There is also no attempt to relate the two processes, photosynthesis & respiration. There is no evidence that the information has been processed and internalised.

In the post-concept mapping writing, no definition type recall answers are given and there is an attempt to define photosynthesis & respiration in the learners' own words. Five(5) learners in the group explained photosynthesis & respiration in their own words, keeping the language simple, clear and to the point.

This shift from 'Verbatim Recall of Definitions' in the pre-concept mapping writing to the use of 'own words' in the post-concept mapping writing, can clearly be seen in the writing of Eunice (EM) who had 10 Recall (Verbatim) Definitions in her pre-concept mapping writing, compared to 6 Own Explanations (Definitions) in her post-concept mapping writing, as shown below.

Photosynthesis & Respiration:

- Photosynthesis need the sun and takes place in the thylakodes of the leaf. The sun has the radiant energy which is changed into chemical potential energy which used to combine ADP and P to form ATP. Photosynthesis also need CO₂ and H₂O to take place. Photosynthesis make the O₂ and the Glucose.
- Respiration occur in the day and night. Respiration it takes place in the mitochondrion in the cell.

2. Interrelations

It is also noted that both Eunice (EM) and Ntombizodwa (NJ) who gave no interrelations in their pre-concept mapping writing, offer 5 and 8 Interrelations in their post-concept mapping writing respectively, eg. Eunice (EM) writes the following in her post-concept mapping writing:

Photosynthesis & Respiration:

- Respiration it uses the O_2 from the Photosynthesis. Respiration it uses the glucose from the Photosynthesis. It then stores it as energy in the form of ATP.
- Respiration then give off Carbon dioxide and the H_2O . The CO_2 then can be used by the Photosynthesis.

and Ntombizodwa (NJ) wrote the following in her post concept mapping writing :

Photosynthesis & Respiration:

- Respiration occur in the mitochondrin of cells . Mitochondrion uses glucose from photosynthesis. Mitochondrion uses the O_2 from the leafs. This they use to make and give off energy which is stored as ATP in cells.
- Men need glucose from plants and O_2 . This was made during photosynthesis process. It is interrelated because respiration needs O_2 and glucose. The plants need respiration for CO_2 .

These examples (EM & NJ's) show an attempt is made to use their own words. The language is simple, but the clarity of the meaning is evidence of understanding. The learners have gone beyond definitions and related the two processes explicitly.

For the rest of the group who offered Interrelations in their post-concept mapping writings, I would say that the nature of the constructs given is clearer and simpler. Learners used their own words in the post-concept mapping writings and gave less of a definition type answer. For example Vuyokazi (VZ) in her pre-concept mapping writing wrote:

PHOTOSYNTHESIS

Explain in your own words why photosynthesis and Respiration can be regarded as 2 processes vital/important to life on earth.?

Photosynthesis is the process of life if it was not yet we would not survive. I think it is very important to keep things of natural resource in right way like plants and soil because we depend on them to breathe and at some time plants depend on us. Oxygen is produced during photosynthesis which is very important to us which must have that. Photosynthesis is made during light if there was no light it cannot be made because it requires light. Respiration does not need light and can be made in dark and light. The CO_2 which we breathe is needed by plants to survive this tells us that there is a kind of process between man and plant there is a close relationship. H_2O which is made during photosynthesis is very important to us and also in respiration. Photosynthesis in other ways is source of life and respiration. I think if there was no soil or other things that make us survive we would die. There next thing is some all things like enzymes chlorophyll very important. CO_2 is useless to us but plants need that to make them survive because this CO_2 is made by us which is not needed by our body and O_2 Oxygen which is produced by plants to make us survive. I think if there were no plants there will be a desert where only animals live but they will not survive right because almost things that survive has an interconnection with another one like plants must have H_2O and grow and animals go and eat that plant after that human being is responsible.

and in her post-concept mapping writing wrote:

Photosynthesis & Respiration:

- (Respiration) It uses the glucose from the photosynthesis and give CO₂ and H₂O. It also gives off energy in the form of ATP.
- Plants make the glucose and the cell uses it for energy. Plant need the CO₂ from the cell. The cell need the O₂ from the cell.
- I think these processes has an important role in plants and animals to produce food and the other one to break down which was made.

The same type of shift can also be seen for Zoleka(ZM) :

In her pre-concept mapping writing she wrote the following:

Photosynthesis:

- Photosynthesis and respiration they are interrelated : both process the nature of reactions are cyclic. Calvin cycle in photosynthesis. Krebs cycle in cellular respiration.
- ATP formed in both processes.
- In both processes electrons are activated.

compared with her post-concept mapping writing in which she wrote:

Photosynthesis & Respiration:

- Respiration occurs in the mitochondria. The O₂ from photosynthesis is used by the process. Also the monosaccharides from photosynthesis is used by the process.
- They are so interrelated when the respiration gives off the CO₂ and the H₂O so photosynthesis in the thylakoids can used them again. Respiration also give us and plants energy.

It appears that the Interrelations in the post-concept mapping writings clearly show the type of interrelations they wish to make, using clear constructs.

In these examples above of pre- and post-concept mapping writings, there is much more clarity in the post-concept mapping writing. In the latter, the points are identifiable and relationships are described. There is less difficulty with regard to control of language in the latter because the

points are known. The paragraph is concise in the latter, compared to that produced before the concept mapping intervention.

3. Relevant Information

Note that in Table 4.2 below, under the category Relevant Information and Correct Factual Recall, it would appear that no relevant information was offered by Eunice (EM) and Ntombizodwa(NJ). This is because in the context, the nature of the constructs which they offered were such that they were more suited to be categorised as Interrelations rather than Relevant Information & Correct Factual Recall.

4. Interrelations	Name of student	5. Relevant Information & Correct Factual Recall
12		12
8	NJ	0
12		12
5	EM	0

Table 4.2
Construct Identification

Numbers in shaded areas represents total number of constructs in essay and numbers in unshaded areas the number of constructs identified per category.

Concept mapping helped them to establish interrelations between the two processes. There are 8 and 5 constructs respectively to show this. Thus, concept mapping not only helped them to identify the correct factual information, but also aided them in seeing how concepts were related.

It may be that the increase in the number of 'Interrelationship constructs' is due to the way in which the question was phrased. It specifically requested learners to relate the two processes. However, the concept mapping intervention allowed them to relate specific things.

4. Unclear Expression of Idea

It is noted that 3 out of the 6 learners had 2 Unclear Expressions each in their pre-concept mapping writing. No Unclear Expressions are recorded in the post-concept mapping writing of the whole group.

For example Ayanda (AN) in his pre concept mapping writing wrote:

Photosynthesis & Respiration:

- This two process as they are taking place they provided Some important as Source of life.

and Ntombizodwa (NJ) wrote:

Photosynthesis:

- Respiration formed quality of ethanol forms energy.
- Photosynthesis manufacturing of carbohydrates food and forms CO₂ and H₂O in the presence of chlorophyll using energy from the sun and O₂ is liberated.

However in the post-concept mapping writings, no Unclear Expressions of Ideas were recorded for the whole group.

4.2.6 Summary of Overall Performance on Question Three

In summary, and with regard to the question on photosynthesis & respiration, there is a shift from Verbatim Definitions to using their Own Words to explain and interrelate the two processes. The number and quality of Interrelations increased in the post-concept mapping writings. The total number of constructs also increased in the post-concept mapping writing.

4.3 Presentation and Analysis of Overall Group Results

Table 4.3 and Table 4.4 below represent a quantification of the number of constructs produced by each student for each of the essay topics.

Table 4.3: Pre Concept Mapping Writing Summary

	1. Alternate Conception			2. Recall Definition (Verbatim)			3. Recall Definition (Own Explanation)			4. Interrelations			5. Relevant Info & Correct Factual Recall			6. Rel Info BUT Incorrect Factual Recall			7. Irrelevant information			8. Unclear Expression of Idea			
	O C	T R	P R	O C	T R	P R	O C	T R	P R	O C	T R	P R	O C	T R	P R	O C	T R	PR	OC	T R	PR	O C	T R	P R	
					6	6							6			6			6						6
AN					1	2								2		1			5						2
					3	22						22		3		3							3		
ZM					1	14					4		1		1								2		
	28		15		22							15	28	22	15	28	22		28	22		28	22		22
WS	2		2		1						4	12	5	2	4	2			4	2		2	1		
					6	6	11		6										6	6					
EM					1	1	10		1										2	4					
					25				18				14	25	18	14	25	18		25	18		25	18	14
VZ					1				1			3	9	1	3	3	4		7	3		1	1	2	
					7	7			7					7	5		7	5				5	7	7	
NJ					1	1			2					1	1		1	1				2	4	2	

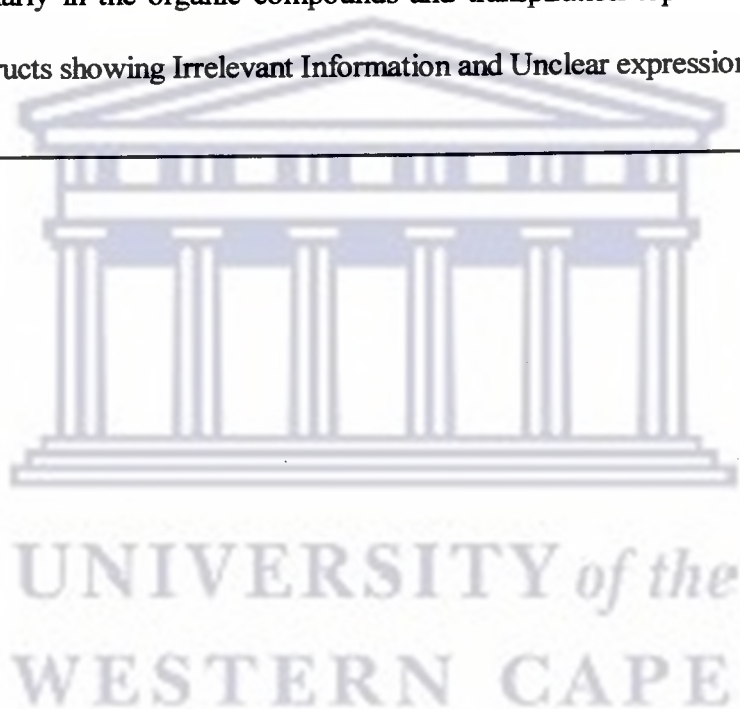
Grey shaded area - denotes Total number of Constructs produced by learner
 Unshaded area - denotes Number of Constructs identified within specific category.

Table 4.4 : Post Concept Mapping Writing Summary

	1. Alternate Conception			2. Recall Definition (Verbatim)			3. Recall Definition (Own Expln)			4. Interrelations			5. Relevant Info & Correct factual Recall			6. Rel Info BUT Incorrect Factual Recall			7. Irrelevant information			8. Unclear Expression of Idea			
	O C	T R	P R	O C	T R	P R	O C	T R	P R	O C	T R	P R	O C	T R	P R	O C	TR	P R	O C	T R	P R	O C	TR	P R	
				15					11			11	15	20	11										
AN				1					5			4	14	13	2										
				23					11			11	23	23	11		23							23	
ZM				2					2			5	20	14	2		3							1	
				25	23	16							25	23	16			16							
WS				1	1	2							18	14	12		1								
				22	20				12			12	22	20			20								
EM				2	1				6			5	17	16			2								
				23					23	13		14	23	23	13		23								
VZ				2					1	2		6	16	14	3		1								
				18	22				12			12	18	22			22							22	
NJ				1	1				4			8	17	13			2							2	

In general there were fewer constructs that showed straightforward Recall of Verbatim Definitions and slightly more constructs showing Reformulating of Definitions.

There were more constructs in learners' post-concept mapping writings that suggest the ability of learners to interrelate the concepts of photosynthesis & respiration. There was a notable increase in the number of constructs showing Correct Factual Recall of Relevant information by all learners, particularly in the organic compounds and transpiration topics. There were also notably fewer constructs showing Irrelevant Information and Unclear expressions.



4.4 Findings

The following discussion will now attempt to draw together the findings in terms of the problem statement and the specific research questions, which I set out to answer from the outset.

The data suggests that there was considerable improvement in learners' writing after the concept mapping intervention. This improvement was evident in the learners' ability to identify and recall relevant information, their ability to recall more information, and their reduction of reliance on memorised facts and attempts to process the information learned.

Their understanding of the information was also evident in the way they related different processes in the essay topics, especially on the topic of photosynthesis & respiration. Their ability to use language to describe these processes also improved. Table 4.5 below presents an overall view on the differences in features that were observed about the group's writing before and after concept mapping:

Summary of Improvements from Pre- to Post-Concept Mapping

Pre-CM Writing	Post-CM Writing
Majority of learners have few sentence constructs.	Relative increase in number of constructs.
Occurrence of Irrelevant Information for topics (except for P&R).	Absence of Irrelevant Information (except Transpiration).
Occurrence of Unclear Expression of Ideas for all topics.	No Unclear Expression of Ideas.
Lacks Structure , Form and Clarity in presentation of ideas.	Has Structure , Form and Clarity in presentation of ideas.
Fewer Relevant Information constructs.	Higher incidence of Relevant Information constructs.

Table 4.5

4.5 Discussion of Findings

The benefits derived by English second language learners through using concept mapping, and its effect on their writing, were identified as follow:

(i). The Organisational Value of Concept Mapping

Learners admitted that in their pre-concept mapping writing they did not write their answers according to any particular plan. They just put down whatever came to mind, whatever they could remember from memory. It would thus appear that the concept mapping intervention also proved to be useful in the planning and organisation of a piece of writing.

Table 4.6 below shows the value of concept mapping with regard to planning before writing. On the whole, learners appear to have grasped the value of this aspect, as shown by the following responses.

An Account for difference between Pre-& Post-CM writing in terms of Planning .	
<p>In the last topic (P&R) I write only the facts. I divide photosynthesis and respiration (discuss them individually) (Ayanda - AN)</p> <p>I not planning I just write I'm just write and then write without understanding (what comes to mind) (Ntombizodwa - NJ)</p> <p>In the first one I was things which was not needed, which are not necessary (Vuyokazi - VZ)</p>	<p>But in the second one I write them both together as they (P&R) are interrelated. (Ayanda – AN)</p> <p>I planned that (Ntombizodwa - NJ)</p>

Table 4.6

In commenting on the value of concept mapping, Ntombizodwa (NJ) said that concept mapping helped her

“To plan how to write about that concepts. It helped me to write because you write just what transpiration is all about. Because it has linking words and the facts and you must then organise how to (not) write them all together”

“Because first I without a concept map I did’nt plan my essay, I just write it. and by using concept mapping you must plan the essay.”

and Zoleka (ZM) said :

“Concept maps is better because firstly you organise your ideas. You firstly looking at the map and write essay by using these linking words.”

A natural consequence of concept mapping is that you have to plan the structure of your writing with the main concepts and the constituents. Thus, concept mapping has intrinsic value as an organisational tool.

(ii) Clarity , Structure and Form of Writing

Table 4.7 below shows the responses of learners when probed about the characteristics of their writing, in terms of its structure, clarity of ideas and form of writing, before and after Concept mapping training.

Pre-concept mapping writing	Post-concept mapping writing
Re: Clarity, Structure & Form	
In the first one I have only write the points and I didn't, I did not discuss them. In the first one (Pre-CM) I was not writing very clearly.(Ayanda -AN)	In the second one I was writing very clearly and I writing in points as it is... (Ayanda – AN)
In the Pre-(CM) writing it is not clear and short and there I just mix up (information) (Eunice – EM)	In the Post-(CM) it is clear and I write in point form (headings) and I finish write everything in the post. (Eunice - EM)
Before(Pre-CM) it is short and not clear. It is not sense (Zoleka-ZM)	It is longer. It is in point form (there are headings) (Zoleka-ZM)
The first piece is not clearly .and no way of writing what I have to say . (Vuyiseka -VZ)	There are headings,..... and they(sentences) have meaning (Vuyiseka - VZ)

Table 4.7

Comparison between pre- and post concept mapping writings - Re: Clarity, Structure and Form of writings

Table 4.7 confirms that learners, having drawn their concept maps, could see what needed to be discussed (main concepts and their constituent concepts). Hence, there were more relevant content, because learners could clearly see which information was relevant to the discussion.

(iii) Relevant Information

Having to draw the concept map before they could write the essay had a significant effect on the learners' post-concept mapping writing, since they had to unpack the constituent relevant concepts and discard those not applicable to the topic which they had to discuss. All the concepts that could then be seen on the map could be discussed in detail. Hence, the more constituents, the more content and more relevant information.

This is evidenced by the high incidence of relevant information which appeared in the post-concept mapping writings compared to the high incidences of irrelevant information in their pre-concept mapping writings.

Vuyokazi (VZ) sums up this aspect when she explains how concept mapping helped her to focus on aspects which were relevant to what she had to write:

“It helped me to understand clearly and to write an essay without things that are not necessary and writing that what the question is asking to do.”

(iv) Own Explanations

Often, when a person reproduces information from a text verbatim, it may be a sign that the person has not understood the information and has therefore not processed it to internalise and make it their own.

Compared to the pre-concept mapping writings, where 4 out of the 6 of the learners offered Verbatim Definitions of photosynthesis & respiration, 5 out of the 6 learners offered definitions in their own words (Recall Definitions - Own Explanations) in their post-concept mapping writings. Although the writing is not highly sophisticated, the attempt to paraphrase the definitions shows that understanding has taken place.

Some learners accounted for this by saying that concept mapping helped them to understand the concepts better and they were able to explain (define) the concepts in their own words. Concept mapping in itself requires the mapper to unpack the constituents of the main concept, and this in itself cannot occur if the mapper does not understand the constituent aspects, which make up the main concept. Thus, the process of constructing a concept map provides the learner with a framework of his/her own design, within which he/she can make sense of the concepts.

(v) Interrelations

The incidence of interrelations present in the post-concept mapping writing shows that the links had to have been made before writing. The fact that Interrelations were expressed in their own words also shows a measure of understanding.

(vi) Language Usage

The level of language proficiency of these learners is very low, as can be seen from the extracts, particularly extracts from the pre-concept mapping writing. Comparatively, the post-concept mapping writings shows some degree of improvement in the way they use language to express and relate concepts.

In summary, the nature of the benefits derived by the learners were such that concept mapping: enhanced their ability to organise, inter-relate and select relevant information; improved the form and structure of their writings leading to clarity of expression; since learners need to understand the concepts before they can map, it led to an increase in the occurrence of concepts explained in learners' own words. A feature in this study is that it appears that concept mapping also contributed to an improvement in language usage of the learner.



Chapter 5

Outcome Overview and Further Research

My experience with matriculation learners is that they are seldom able to write concise and coherent descriptions of their understanding, as is required by the biology syllabus. Typically, their writing exhibits poor language usage, poor structure of ideas, and they appear to recall information verbatim, about aspects of the question without integrating concepts, especially when they have to show inter-dependency between concepts.

This study set out to investigate if concept mapping as a teaching tool can be fruitfully utilised as a means of improving ‘pupil learning’, (i.e. constructing new and meaningful relationships between concepts). And does this ‘improved learning’ help learners to generate conceptually meaningful written descriptions, and if this is so, specifically,

“In what ways do English Second Language learners, studying Biology at Lagunya Finishing School, skilled in the use concept mapping, improve the form and meaning of their writing to show their understanding of organic compounds, transpiration, photosynthesis and respiration?”

In summary, the following benefits in using concept mapping by English Second Language learners in this study are therefore identified as follows:

1. Concept mapping has value in improving learners’ ability to organise information.
2. Concept mapping improves clarity, structure and form of writing.
3. Concept mapping leads to higher inclusion of relevant information in expression.

4. Concept mapping enables learners to offer definitions in their own words.
5. Concept mapping enhances learners' ability to see and present inter-relations.
6. Concept mapping leads to an improvement in language usage.

In light of the above, concept mapping can be seen as a heuristic tool which has excellent worth, especially in schools where learners have to express themselves in a second or third language, since it does not rely heavily on articulate grammatical expressions, which the teacher must then read and attempt to understand. It also stimulates the student to understand the relationships between ideas by creating a visual map of the connections, enabling the learner and teacher as Novak and Gowin (1984:40) state:

“to tap into the learner’s cognitive structure, externalising for both teacher and learner to see, what the learner already knows.”

and enabling the learner to

“connect new ideas to knowledge that they already have and to organise ideas in a logical, but not necessarily rigid structure that allows for future information to be included.”

Against the backdrop of modern learning theory and the deficiencies experienced by learners who are required to write essays or express themselves adequately in a second or third language under examination conditions, it could be valuable and significant to expand research in the field of science writing using the concept mapping heuristic as a

start, but not as a final solution to addressing the “writing problem”. As Novak and Gowin (1984:40) state so succinctly, they

“do not claim that a concept map is a complete representation of the relevant concepts and propositions the learner knows, but we do claim that it is a workable approximation, from which both learner and teacher can consciously and deliberately expand and move forward.”



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Appendix A



Pre Concept-Mapping Writings

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The logo of the University of the Western Cape, featuring a classical building with a pediment and six columns.

Organic Compounds

UNIVERSITY *of the*
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ORGANIC Compounds.

1. Organic compounds

2. Organic compounds are divided into two. Macro, and micro compound.

Micro compounds.

They are needed in small quantities. They are large compounds therefore they need to be catalyzed. e.g. Calcium, Sodium, Zinc.

Macro. Organic compound.

They are needed in large quantities. e.g. ~~cellulose~~, carbohydrates, protein, fats.

carbohydrates. they are monomers.

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1. Organic compounds are the living organisms eg plants, animals, grass.

Compounds always twice such as hydrogen and oxygen.

Compound contains carbon atom. The element found in organic compound are nitrogen, carbon, hydrogen.



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ORGANIC COMPOUNDS

(11/11)

Biological compound is to know what is needed by animal and by plant in their body/living?

eg

Water

Functions

It acts as a solvent

It is hydrolysis

It helps the food to pass through oesophagus &

It during swallowing

It is a useful substance in all living things

THE Proteins

Amino Acid is the building blocks of Proteins

In proteins we also have non proteins

The food that is use we find proteins are - Meat

egg

Functions of Proteins are Proteins are arranged in a form of a chain

FATS.

The building materials are Fatty Acids and Glycerol

Functions of Fats are:

They are insoluble in water

They are soluble in Ether

When we want to test for fats, we use

Cobalt chloride paper and Ether

if there are fats the stain we remain in the paper.

Test for protein we can take use Fodine solution
Millon's reagent solution and then
the Brick-red color show the presence of protein

The elements that we find in proteins

are. Carbon
Hydrogen
Oxygen
Phosphorus
Sulphur
Nitrogen

Carbohydrates:

It is divided into three saccharides

Monosaccharides
Disaccharides
Polysaccharides

Monosaccharides are simple sugar which are soluble in water namely: Sucrose
Fructose

galactose
Disaccharides are many sugar
Sucrose
~~Glycero~~ lactose
Galactose.

Polysaccharides - are

1. Starch
2. Cellulose

Starch mainly found or used in both animals and plants.

Cellulose we mostly found in animals in mitochondria

When we test for starch we use Iodine solution
then the blue black colour shows the presence

of starch.

Mostly starch is tested in the leaf of a plant
the same blue black colour appears.

Carbohydrates functions a lot in all living things.



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Organic Compounds

1. What do you understand by the term organic compounds?

2. Discuss Organic Compounds

1. Organic compounds are all contain carbon atom and they are usually made in living organisms.

2. Organic compounds are Nitrogen, Carbon, hydrogen, Oxygen, Phosphorus, and Sulfur (No cross) they

- usually contain carbon atoms

- they occur naturally in our environment

- they are broken down by process called hydrolysis

This means that water is added to the bonds

to to break them forming their building units.

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Organic Compounds they come from nature.

needed in large quantities. There are Inorganic compound needed in small quantities. Organic compound has C, H, O

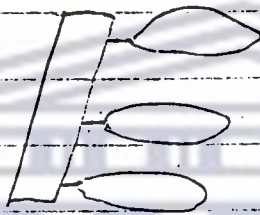
food contain Carbohydrate Potatoes

Bread

Rice

After this we have to look for test for Carb Starch. we use iodine in starch, the colour of iodine is brown if it contains it will turn blue black.

Test for fats
reagent if they




test for fats is either
contain fats it will turn brick

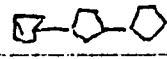
red / stain in paper

Million reagent are to test for protein if the substance turn into brick red it has protein but if remains will be blue.

There are Three types of Carbohydrates

Monosaccharides 

Disaccharides 

Poly saccharide 

Mono saccharides is

1) Glucose

2) Lactose

3) Sucrose

Disaccharides

Glucose + Glucose \rightarrow Maltose.

Glucose + fructose \rightarrow Galactose

Glucose + Lactose \rightarrow Sucrose A8

ZUNI

~~Potatoes~~

Polysaccharide

cellulose → muscle

Starch →

If we add water in them that process is hydrolysis

Temperature

Enzymes acts at 37°C in the body

Enzymes

They are denatured. They work at low pH.

Enzymes are proteins. There are co-enzymes

Water in our body play an important role

Water softens food. Water act as cleaning when it turns to faeces. It transport in our bodies

Vitamins are important we must

eat so to stay alive

Food contain fat are meat
fish

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Organic Compounds

Organic compounds are compounds that are found in living organisms and dead organisms / non-living organisms.

The living organisms consist of human and animal life and the dead organisms consist of plants and all things which did not ~~live~~ live.

Water is in organic compounds, do not usually contain carbon atoms and they occur naturally in our environment. e.g. water, salt and carbon dioxide.

The elements that are found in organic compounds are Nitrogen, Carbon dioxide, phosphorus and Sodium. The compounds all contain carbon atoms and they are usually made up of all living organisms.

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Transpiration

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A11

<http://etd.uwc.ac.za/>

TRANSPIRATION

Transpiration is the loss of water in a form of water vapour in the ~~core~~ ^{lower} part of the leaf.

- (i) ^{Control} Light Stomata during the process of photosynthesis the rate of water potential increases.
- (ii) Cuticle. In other regions the cuticle is more thicker to prevent the excess loss of water during transpiration.
- (iii) Size of the leaf. The loss of water in the leaf is determined by the size of the leaf.

Light. too much light causes a great loss of water by the plant.

wind wind has a great effect over the plants especially when there is too much wind

19 August 1997

1. Transpiration is the loss of water in the form of water vapour through the aerial parts of the plant.

Internal

2. factors an effect on the rate of transpiration: Leaf size

ii. Cuticle

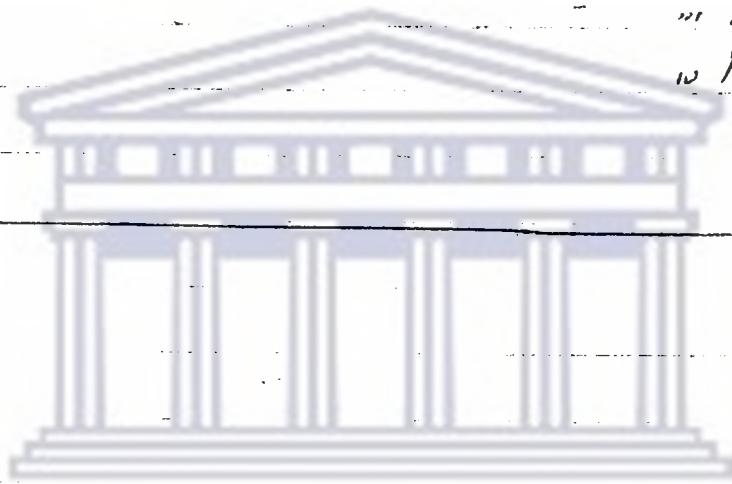
iii. Epidermal hairs

External factors an effect the rate of transpiration: Temperature

ii. Humidity

iii. Wind

iv. Radiation



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Questions

1. What do you understand by the term transpiration?
2. Explain how the internal and external factors to a plant have an effect on the rate of transpiration.

ANSWERS

Transpiration is the loss of water in the plant in the form of water vapour through all the aerial parts of the plants.

External factors that affect the rate of transpiration in plants.

1. Wind

If there is too much wind transpiration rate decreases.

2. Temperature

If there is too high temperature the transpiration rate increases because of the ~~sunlight~~ ^{chloroplast} during photosynthesis.

3. Light

If there is light transpiration rate increases when photosynthesis takes place.

4. Humidity

If there is humid air transpiration rate decreases.

5. Water Availability

If there is too much water in the leaves transpiration rate increases because of water vapour.

~~EXTERNAL~~ ~~FA~~
INTERNAL FACTORS

Transpiration rate is affected in ?

Stomata

Sunken Stomata

When Stomata opens at day light it photosynthesises and allows the CO_2 to accumulate at night. As it photosynthesises the transpiration rate increases because of the high ψ the ~~stom~~^{thick} epidermal cell / thick outer cell wall stretches.

Shape of the plant

It depends on what types of the plant of shape of a plant will transpiration occur. It doesn't occur if the shape of leaves of a plant is not necessary for photosynthesis.

Size of the leaves/plants

Transpiration rate must happen in a large surface where it can ~~be~~ photosynthesise ~~+~~ that will increase the rate of transpiration

Cuticle / HAIRS

HAIRS prevents the leaf during the wind from ^{loosing} lose too much water.

a) What do you understand by the term transpiration?

b) Explain how the Internal and External factors to a plant have an effect on the rate of transpiration.

1. It is the loss of water vapour from a plant. This causes a lower water potential.

2. There are 3 types of transpiration Stomatal transpiration from stomata and Cuticle transpiration from cuticle Lenticle transpiration from lenticle in the bark.

- Transpiration cause H_2O to move up the stem

- Cause suction pull of transpiration

Help to cool the plant by evaporation of the water.

WHAT DO YOU UNDERSTAND BY THE TERM TRANSPIRATION?

I understand this term that it is a movement of the water through the aerial parts of a plant through stomata.

The Transpiration occurs in many things Wind, Humidity.

In Transpiration there are ~~two~~ ^{three} types of Transpiration

Root pressure.

Capillary

Suction force.

These things occur just in their 1/1 time.

Explain how the internal & external factors to a plant have an effect on the rate of transpiration.

Internal factors of transpiration

When Wind is blow or humidity rate of Transpiration will decrease

Temperature when Temperature is high climate the transpiration will increase.

Humidity when there is too much air Transpiration will increase

Light when there is too much light Transpiration will ~~increase~~ ^{decrease}

External factors of transpiration

Shape of plant

Size of a plant

Availability of water in a plant

During light phase the CO_2 concentration is high, light flaccid. This occurs in chloroplast during day with CO_2 .

Glucose is then made which lowers the ψ of potential of guard cell. The epidermal cell have low. It causes that water will move from a region of high ψ to a region of low ψ . This gives us guard cell will be flaccid after H_2O has moved by transpiration.

Transpiration can pass thro three parts.

Stomata transpiration \rightarrow most of H_2O pass through the stomata.

Lenticular \rightarrow H_2O will pass through lenticell.

Cuticular \rightarrow H_2O will pass not most thro cuticle.

Advantages

The ~~soil~~ H_2O will pass thro the mineral salt and .

Disadvantages

If water is more in a plant the plant will die



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1. Transpiration is the loss of water in the form of water vapour to the aerial part of the plant.

2. The internal factors of transpiration causes the suction ~~water~~ ^{pull} of transpiration. Lenticle help to cool the ^{water} plant in the ^{plant} water.
The external factors

When the plant have lose water the leaves and flower were fallen and the plant death.

Temperature, humidity.

Effect on the rate of Transpiration

Stomata transpiration

Cuticular ~~cuticle~~ helps plant to ~~lose~~ ^{lose} not too much water.

Lenticular transpiration help the plant to breath.

The aim is to demonstrate transpiration.

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Photosynthesis &

Respiration

A20

Photosynthesis Respiration

Photosynthesis

Photosynthesis is the absorption of radiant energy from the sun converted into chemical energy and they are stored in the form of H_2O . During photosynthesis there are two phases light phase and dark phase. During the light phase the respiration is the conversion of ~~chemical~~ ^{light} energy to chemical where by oxygen is needed in the this process. This two process as they are taking place they provided some important as source of life. On the process of photosynthesis ~~oxygen~~ oxygen is given off.

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Photosynthesis is the process by which chlorophyll in green plants traps radiant energy from the sun and transforms it into chemical energy stored in molecules of carbohydrates.

Vital process to life on earth

Radiant energy is very important. Changed into chemical potential energy. Stored in organic fuels molecules. eg carbohydrates, glucose. Used during cellular respiration or stored becomes fossil fuel. Also used in synthesis of other organic compounds. Also used in synthesis of other organic compounds eg Ethanol. Oxygen is released as a by product. Oxygen is used by living organisms for cellular respiration.

RESPIRATION

is the gradual release of energy in the form of heat & ATP from energy rich.

Vital process to life on earth

Organic compounds which contain potential energy. Oxidised with release of energy in the form of ATP. Energy is used in metabolic activities, growth cellular respiration development. CO_2 is released. Oxygen is used. Balance between oxygen and carbon dioxide in the atmosphere.

Photosynthesis and respiration they are interrelated both processes the nature of reactions are cyclic. Calvin cycle in photosynthesis, Krebs cycle in cellular respiration. ATP formed in both processes. In both processes electrons are actuated.

PHOTOSYNTHESIS & RESPIRATION

12/11/11

Questions

1. Explain in your own words why photosynthesis and respiration can be regarded as 2 processes vital to life on earth.

ANSWERS

I can say in photosynthesis as it happens in plants. It helps the plant to grow. We all know that it takes place in the leaves of a plant and it takes part in chloroplast. During the process of photosynthesis CO_2 is absorbed from the air so that it can be used by plants. At that time O_2 is produced. This O_2 which is produced by the plant it can be used by human.

For an example: ~~plant~~ human respiration. Like respiration it takes place in mitochondria of the human body. So in respiration O_2 is used to give strength. The strength that we have is coming from the air that is, it gives energy.

In respiration all carbohydrates are broken down so that the body can function easily.

As we breathe in fresh air i.e. oxygen

this air is the one which is given off by plants in the process of photosynthesis.

So these processes are vital to life on earth because if there can be no plants on earth we ~~can't~~ cannot survive. As I said we breathe air/gas which is produced by plants and that air/gas is us.

WRO

by ~~man~~ the body which normally take place
in mitochondria by means of Respiration.

I have said the plant are the things that
photosynthesis mostly like all that the oxygen
which is produced by the leaves during this
process is use by the human which it takes place
in mitochondria which makes a circle in the body.
so plants uses CO_2 mostly then in respiration
ATP gives energy to the body and CO_2 the body gives off CO_2
they are interrelated because each process help
one another to survive.



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Photosynthesis is important for radiant energy
It changed into chemical potential energy
and stored in organic fuel molecules like carbohydrates
and glucose

It used during cellular respiration or stored in starch.

It also used in synthesis of other organic compounds e.g. ethanol

It serves as a natural source of food for men and animals
Carbon dioxide absorbs enormous amount of poisonous
accordingly, the concentration of carbon dioxide is kept
constant

Oxygen is released as by-product and used by living
organisms for cellular respiration

Importance of Respiration

Organic compound which contains potential energy
is oxidised

With the release of energy in the form of ATP

Energy used for metabolic activities

growth / cell work / development

releases carbon dioxide and uses oxygen

maintains balance between carbon dioxide and oxygen
in atmosphere.

PHOTOSYNTHESIS

Explain in your own words why photosynthesis and Respiration can be regarded as 2 processes vital/important to life on earth.?

Photosynthesis is the process of life if it was not yet we would not survive. I think is very important to keep things of natural resource in right way like plants and soil because we depend on them to breathe and at same time plants depend on us. Oxygen is produced during photosynthesis which is very important to us which must have that.

Photosynthesis is made during light if there was no light it cannot be made because it requires light. Respiration does not need light and can be made in dark and light. The CO_2 which we breathe is needed by plants to survive. This tells us that these are kind of processes between man and plants there is a huge relationship. H_2O which is made during photosynthesis is very important to us and also in respiration. Photosynthesis in other way is source of life and respiration. I think if there was no soil or other things that make us survive we would die. There next thing is some all things like enzymes chlorophyll very important. CO_2 is useless to us but plants need that to make them survive because this CO_2 is made by us which is not needed by our body and O_2 Oxygen which is produced by plants to make us survive. I think if there were no plants it will be a desert planet where only animals live but they will not survive right because almost things that are survive has an interconnection with another ones like plants to must have H_2O and grow and animals go and eat that plant after that human being is responsible

to those things to survive. If photosynthesis is produced to H_2O ~~from~~ ^{enzyme} Chlorophyll ⁰ the Respiration is doing the opposite of that if each of them is not yet it can't survive with both of them are interconnected.



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Photosynthesis and Respiration

Photosynthesis and Respiration can be regarded as two vital processes to life. Because photosynthesis is for food formation and Respiration is for cell division and growth.

Photosynthesis liberate Oxygen to atmosphere

Respiration liberate CO_2 and O_2 is formed

Photosynthesis prevent the suffocation it uses CO_2 and ~~so~~ source of energy.

Respiration formed quality of ethanol form energy

Photosynthesis manufacturing of carbohydrates from CO_2 & H_2O in the presence of Chlorophyll using energy from the sun and Oxygen is liberate

Respiration is the gradual release of energy from glucose in the cells and the storage of energy in the form of ATP.

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Appendix B



Pre Concept-Mapping Writing Analysis Sheets

Ayanda (AN) “ Pre CM Writing

Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Transpiration:</p> <ul style="list-style-type: none"> • Transpiration is the loss of water in a form of water vapour in the aerial part of the leaf. <p>Photosynthesis:</p> <ul style="list-style-type: none"> • Photosynthesis is the absorption of radiant energy from the sun converted into chemical energy and they are stored in the form of starch. • Respiration is the conversion of starch to chemical where by oxygen is needed in this process.
3. Definition (Own Explanation)	
4. Interrelations of Concepts	
5. Relevant Information to Topic & Correct Factual Recall	<p>Transpiration:</p> <ul style="list-style-type: none"> • Size of the leaf. the loss of water in the leaf is determined by the size of the leaf. • Light . too much light causes a great loss of water by the plant. <p>Photosynthesis</p> <ul style="list-style-type: none"> • In the process of photosynthesis oxygen is given off.
6. Relevant Information to Topic BUT InCorrect Factual Recall.	<p>Transpiration:</p> <ul style="list-style-type: none"> • Stomata during the process of photosynthesis control the rate of water potential.
7. Irrelevant Information to Topic.	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • Organic Compounds are divided into macro and micro compound. • Micro-compounds: They are needed in small quantities. They are large compound Therefore they need to be catalyzed eg Calcium, Sodium, Zinc. • Macro-organic Compound: They are needed in large quantities eg carbohydrates, proteins, fats. • Carbohydrates they are monomers.
8. Unclear Expression of Idea.	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • This two process as they are taking place they provided Some important as Source of life.
9. Term/ Concept used incorrectly	<p>Transpiration:</p> <ul style="list-style-type: none"> • Stomata during the process of photosynthesis control the rate of water potential.

Zoleka (ZM) " Pre CM Writing

Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Transpiration:</p> <ul style="list-style-type: none"> • Transpiration is the lose of water in the form of water vapour through the aerial parts of the plant. <p>Photosynthesis:</p> <ul style="list-style-type: none"> • Photosynthesis is the process by which chlophyll in green plants traps radiant energy from the sun and transforms it into chemical energy stored in molecules of carbohydrates. • Radiant energy is very important . Changed into chemical potential energy . Stored in organic fuel molecules eg carbohydrates , glucose. Used during cellular respiration or stored becomes fossil fuel. Also used in synthesis of other organic compounds eg Ethanol. Oxygen is released as a by product . Oxygen is used by living organisms for cellular respiration. <p>Respiration:</p> <ul style="list-style-type: none"> • Is the gradual release of energy in the form of heat and ATP from energy. Organic compounds which contain potential energy . Oxidised with release of energy in the form of ATP. Energy used in metabolic activities , Growth cellular respiration development. CO₂ is released. Oxygen is used. Balance between oxygen and carbon dioxide in the atmosphere.
3. Definition (Own Explanation)	
4. Interrelations of Concepts	<p>Photosynthesis:</p> <ul style="list-style-type: none"> • Photosynthesis and respiration they are interrelated : both process the nature of reactions are cyclic. Calvin cycle in photosynthesis. Krebs cycle in cellular respiration. • ATP formed in both processes. • In both processes electrons are activated.
5. Relevant Information to Topic & Correct Factual Recall	<p>Transpiration:</p> <ul style="list-style-type: none"> • External factors an effect the rate of transpiration (1) Temperature (2) Humidity) (3) Wind (4) Radiation (No elaboration)
6. Relevant Information to Topic BUT InCorrect Factual Recall.	<p>Transpiration:</p> <ul style="list-style-type: none"> • Internal factors an effect on the rate of transpiration (1) Leaf size (3) Epidermal hairs (No elaboration)
7. Irrelevant Information to Topic.	
8. Unclear Expression of Idea.	<p>Organic Compound:</p> <ul style="list-style-type: none"> • Organic compounds are the living organisms eg plants, animals, grass.

	<ul style="list-style-type: none">• Compounds always twice such as hydrogen and oxygen.
9. Term/ Concept used inCorrectly.	



Winterrose (WS) " Pre CM Writing

Feature	Examples
1. Alternate Conception/ Alternate Explanation	<p>Photosynthesis:</p> <ul style="list-style-type: none"> • So in respiration O_2 is used to give strength. The strength that we have is coming from the air that is, it gives energy.
2. Recall of Definitions (Verbatim)	<p>Transpiration:</p> <ul style="list-style-type: none"> • Transpiration is the loss of water in the plant in the form of water vapour through all the aerial parts of the plants.
3. Definition (Own Explanation)	
4. Interrelations of Concepts	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • As we breath in fresh air i.e oxygen This air is the one which is given off by plants in the process of photosynthesis. • So these processes are vital to life on earth because there can be no plant on earth we cannot survive. • They are interrelated because each process help one another to survive. • This oxygen which is produced by the plant it can be used by human.
5. Relevant Information to Topic & Correct Factual Recall.	<p>Organic Compounds:</p> <p>Re: Proteins</p> <ul style="list-style-type: none"> • Amino acids are the building blocks of Proteins. • The food that we find proteins are : Meat Egg. • The elements that we find in proteins are : Carbon, hydrogen, oxygen, Phosphorus, Sulphur, Nitrogen. • Test for protein we use Millon's reagent solution and then a brick-red precipitate shows the presence . <p>Re: Fats</p> <ul style="list-style-type: none"> • The building materials of Fatty acids and Glycerol • They are insoluble in water. • They are soluble in ether <p>Re: Carbohydrates</p> <ul style="list-style-type: none"> • It is divided into three saccharides, Monosaccharides, Disaccharides, Polysaccharides. • Monosaccharides are simple sugar which are soluble in water mainly, Fructose , Galactose. • Disaccharides are many sugar : Sucrose, Lactose • Polysaccharides are Starch, Cellulose. • When we test for starch we use Iodine solution. Then the blue black colour shows the presence of starch. <p>Transpiration:</p> <p>Re: External Factors:</p> <ul style="list-style-type: none"> • Temperature: If there is high temperature the transpiration rate increases • Light: If there is light transpiration rate increases When photosynthesis takes place. • Humidity: If there is humid air transpiration rate decreases.

	<p>Re: Internal Factors:</p> <ul style="list-style-type: none"> • Size of the leaves/ plants: Transpiration rate must happen in a large surface Where it can photosynthesize + That will increase the rate of transpiration. • Cuticle / hairs : Hairs prevents the leave during the wind from loosing to much water. <p>Photosynthesis</p> <ul style="list-style-type: none"> • We all know that it takes place in the leaves of a plant and it take part in chloroplast. • During the process of photosynthesis CO₂ is absorbed from the air so that it can be used by the plant. <p>Re: Respiration</p> <ul style="list-style-type: none"> • In respiration all carbohydrates are broken down so that the body can function easily.
<p>6. Relevant Information to Topic BUT Incorrect Factual Recall.</p>	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • Cellulose we mostly found in animals in mitochondria • Cellulose we mostly found in animals in mitochondria • Monosaccharides are Sucrose. • Disaccharides are Galactose. <p>Transpiration:</p> <ul style="list-style-type: none"> • Wind: If there is too much wind transpiration rate decreases. • Water availability: If there is too much water in the leaves transpiration rate increases because of water Vapour.
<p>7. Irrelevant Information to Topic.</p>	<p>Organic Compounds:</p> <p>Re: Water Functions</p> <ul style="list-style-type: none"> • It acts as a solvent. • It is hydrolysis • It helps the food to pass through oesophagus easily. • It is a useful substance in all living things. <p>Transpiration:</p> <p>Re: External factors:</p> <ul style="list-style-type: none"> • Sunken Stomata: (A discussion on the stomatal Mechanism of Opening.) • Shape of the plant:
<p>8. Unclear Expression of Idea</p>	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • Biological compound is to know What is needed by Animals and by plant in their body./ living things. • Light can also make organic compound. <p>Transpiration:</p> <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • It depends on what types of the plant transpiration will occurs. It does'nt occur if the shape of the leaves of a plant is not necessary for photosynthesis.
<p>9. Term / Concept used</p>	

inCorrectly.	
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B6

Eunice (EM) “ Pre CM Writing

Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • Organic compounds are all contain carbon atom and they are usually made in living organism. <p>Photosynthesis:</p> <ul style="list-style-type: none"> • Photosynthesis is important for Radiant energy. • It changed into chemical potential energy and stored in organic fuel molecules like carbohydrates and glucose. • It serves as a natural source of food for man and animal. • Carbon dioxide absorbed enormous amount of poisonous accordingly the concentration of carbon dioxide is kept constant. • Oxygen is released as by-product and used by living organism for cellular respiration. <p>Respiration:</p> <ul style="list-style-type: none"> • Organic compound which contains potential energy is oxidised with the release of energy in the form of ATP . • Energy used for metabolic activities growth/ cell work/ development. • Release carbon dioxide and use oxygen. • Retain balance between carbon dioxide and oxygen in the atmosphere. <p>Transpiration: It is the loss of water vapour from a plant.</p>
3. Definition (Own Explanation)	
4. Interrelations of Concepts	
5. Relevant Information to Topic & Correct Factual Recall	
6. Relevant Information to Topic BUT InCorrect Factual Recall.	
7. Irrelevant Information to Topic.	<p>Organic Compounds</p> <ul style="list-style-type: none"> • They occur naturally in our environment. • They are broken down by process called hydrolysis. <p>Transpiration:</p> <ul style="list-style-type: none"> • There are 3 types of Transpiration Stomatal Transpiration from stomata and Cuticular transpiration from curticle Lenticular transpiration from lenticule in the bark. • Transpiration cause H₂O to move up the stem.

	<ul style="list-style-type: none"> • Cause suction pull of transpiration. • Help to cool the plant by evaporation of the water.
8. Unclear Expression of Idea.	
9. Terms / Concepts used incorrectly	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • Organic compounds are Nitrogen, Carbon, hydrogen, Oxygen, Phosphorus, and Sodium.



Vuyokazi (VZ) " Pre CM Writing	
Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	Organic Compounds: <ul style="list-style-type: none"> • There are Three types of Carbohydrates. Monosaccharides, Disaccharides, Polysaccharide.
3. Definition (Own Explanation)	Transpiration: <ul style="list-style-type: none"> • I understand that it is a movement of H₂O thru the aerial parts of a plant through Stomata.
4. Interrelations of Concepts	Photosynthesis: <ul style="list-style-type: none"> • Photosynthesis is the process of life if it was not yet we would not survive. I think it is very important to keep thing of natural resource in right way like plants and soil because we depend on them to breath at same time palnt depend on us. • If photosynthesis is produced 6CO₂ + 6H₂O → C₆H₁₂O₆ + 6O₂ the Respiration is doing the opposite of that if each of them is not yet it cant survive only both of them are interconnected. • The CO₂ which we breath (out) is needed by the plant to survive this tells us that these kind of process between man and plant there is a huge relationship.
5. Relevant Information to Topic & Correct Factual Recall	Organic Compounds: <ul style="list-style-type: none"> • Organic compound has C:H:O . • Food contain Carbohydrate: Potatoes, Bread, Rice. •test for Starch we put iodine in Starch. • the colour of Iodine is brown if it contains (starch) it will turn blue black. • test for fats is ether reagent . • if they contain fats it will turn / stain in paper. • Millions reagent are to test for protein. • if the substance turn into brick red it has protein. • Polysaccharide ... cellulose Starch Transpiration: Re: Internal Factors: <ul style="list-style-type: none"> • Temperature: when temperature is right climate the transpiration will increase. Photosynthesis & Respiration: <ul style="list-style-type: none"> • Respiration does not need light and can made in dark and light. • Oxygen is produced during photosynthesis • Photosynthesis as made during light if there was no light it cannot made because it require light.
6. Relevant Information to Topic BUT InCorrect Factual Recall.	Organic Compounds: <ul style="list-style-type: none"> • Monosaccharides is (1) Glucose (2) Lactose (3) Sucrose • Glucose + Fructose → Galactose • Glucose + Latose → Sucrose

	<p>Transpiration:</p> <ul style="list-style-type: none"> • In transpiration there are three types of transpiration. Root pressure. Capillary. Suction force. <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • When Wind is blow rate of transpiration will decrease. • Light. when there is light bright transpiration will decrease. • Humidity : when there is too much air transpiration will increase
<p>7. Irrelevant Information to Topic.</p>	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • Water in our body play an important role. • Water softens food. • Water act as cleaning when it turn to faeces. • Enzymes are denatured . • They (enzymes) work at low pH. • Enzymes are proteins . <p>Re: External Factors:</p> <ul style="list-style-type: none"> • Shape of plant • Size of a plant • (A discussion on the mechanism of stomatal function)
<p>8. Unclear Expression of Idea.</p>	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • Temperature acts at 37⁰ C in our body. <p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • The next thing is some all things a like enzymes chlorophyll very important. • Photosynthesis in other way is source of life and respiration.
<p>9. Term / concept used incorrectly.</p>	<p>Transpiration:</p> <p>Re: Internal Factors:</p> <ul style="list-style-type: none"> • Humidity : when there is too much air transpiration will increase

Ntombizodwa (NJ) " Pre CM Writing

Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Transpiration:</p> <ul style="list-style-type: none"> • Transpiration is the lose of water in the form of water vapour to the aerial part of the plant. <p>Photosynthesis:</p> <ul style="list-style-type: none"> • Respiration is the gradual release of energy from glucose in the cells and the storage of energy in the form of ATP.
3. Definition (Own Explanation)	<p>Photosynthesis:</p> <ul style="list-style-type: none"> • photosynthesis is for food formation and Respiration is for cell division and growth. • Photosynthesis liberate Oxygen to atmosphere.
4. Interrelations of Concepts	
5. Relevant Information to Topic & Correct Factual Recall	<p>Photosynthesis & Respiration</p> <ul style="list-style-type: none"> • Photosynthesis prevent the suffacation it uses CO₂.
6. Relevant Information to Topic BUT InCorrect Factual Recall.	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • The element that are found in organic compound are Nitrogen, carbon dioxide, phosphorus and Sodium. <p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • Respiration liberate CO₂ and Oxygen is formed.
7. Irrelevant Information to Topic.	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • In inorganic compounds do not usually contain carbon atoms and they occur naturally in our environment eg. Water Salt and Carbon dioxide.
8. Unclear Expression of Idea.	<p>Organic Compounds:</p> <ul style="list-style-type: none"> • The living organism compose of human and animal life and the dead organism compose of plant and all things which did not live. • Organic Compound are compound that found in living organism and dead organism/ non-living organism. <p>Transpiration:</p> <ul style="list-style-type: none"> • The internal factors of transpiration causes the suction pull of transpiration. • The external factors: When the plant have lose water the leaves and flower were follen and the plant death. • Cuticular helps plant to loose not to much water. • Lenticular transpiration help the plant to breathe. <p>Photosynthesis:</p> <ul style="list-style-type: none"> • Respiration formed quality of ethanol forms energy.

	<ul style="list-style-type: none">• Photosynthesis manufacturing of carbohydrates food and forms CO₂ and H₂O in the presence of chlorophyll using energy from the sun and O₂ is liberated.
9. Term/ Concept used incorrectly.	



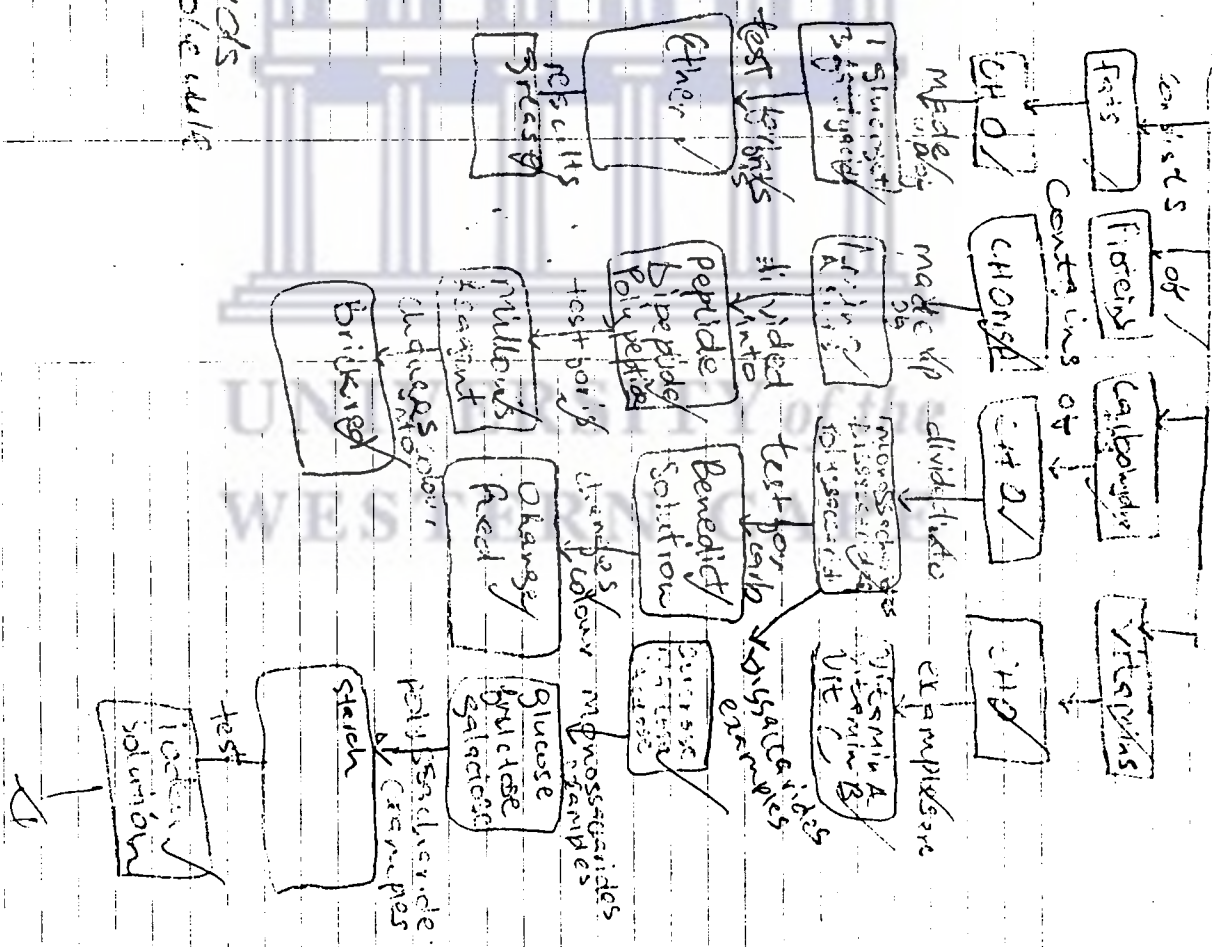
Appendix C



Concept Maps
drawn
by

Students

ORGANIC COMPOUNDS



1 Glycerol & 3 fatty acids
 = form fat molecule

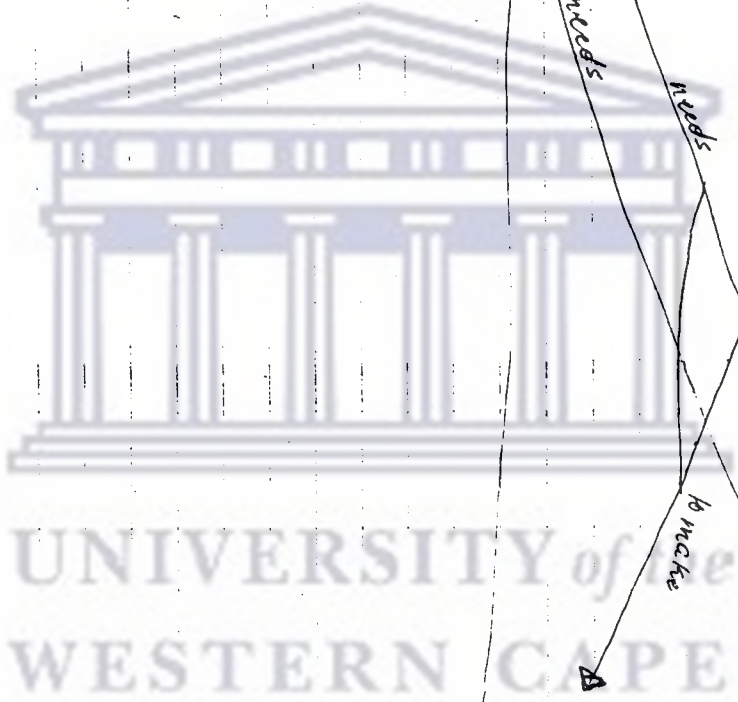
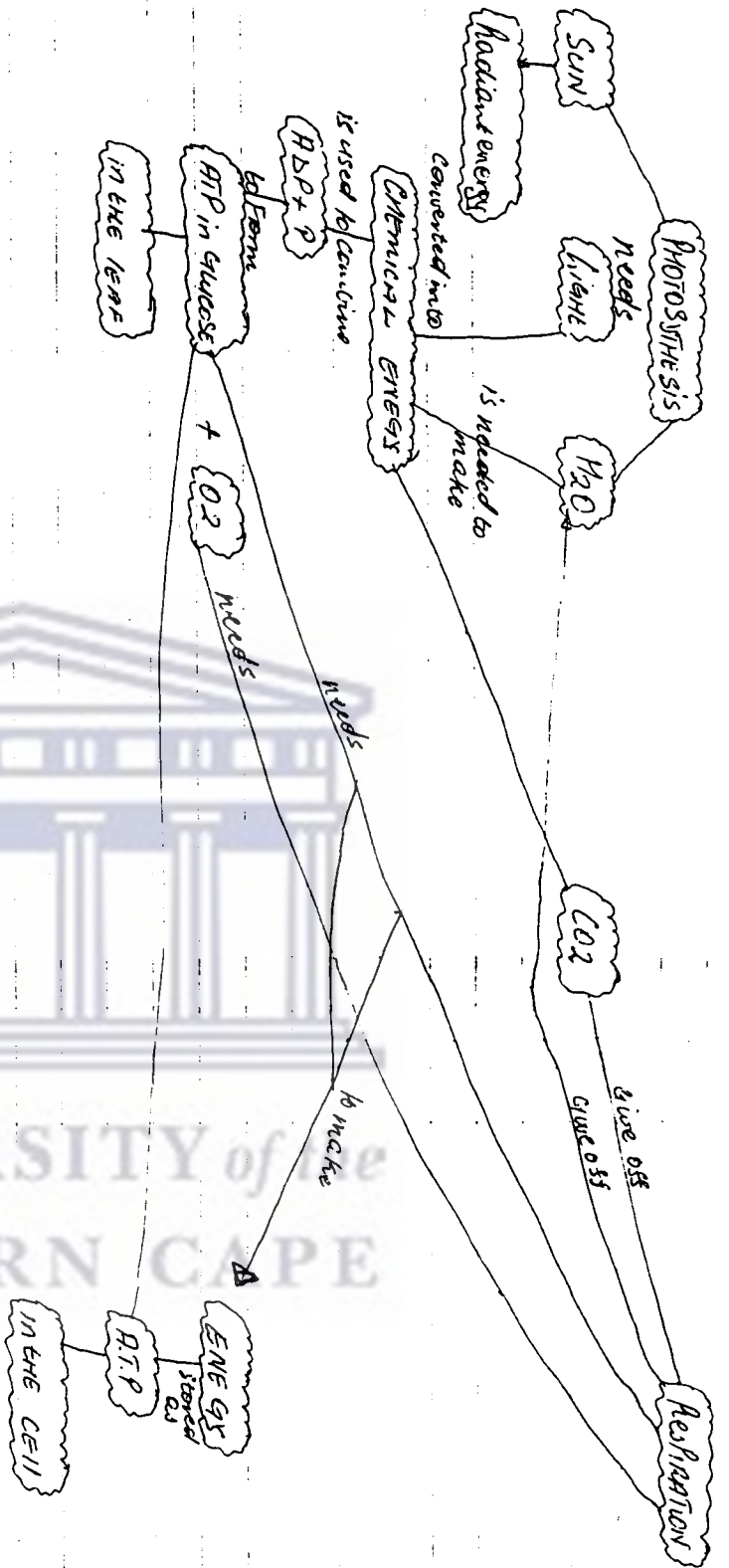
AM

C1



A3

C2



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R. N

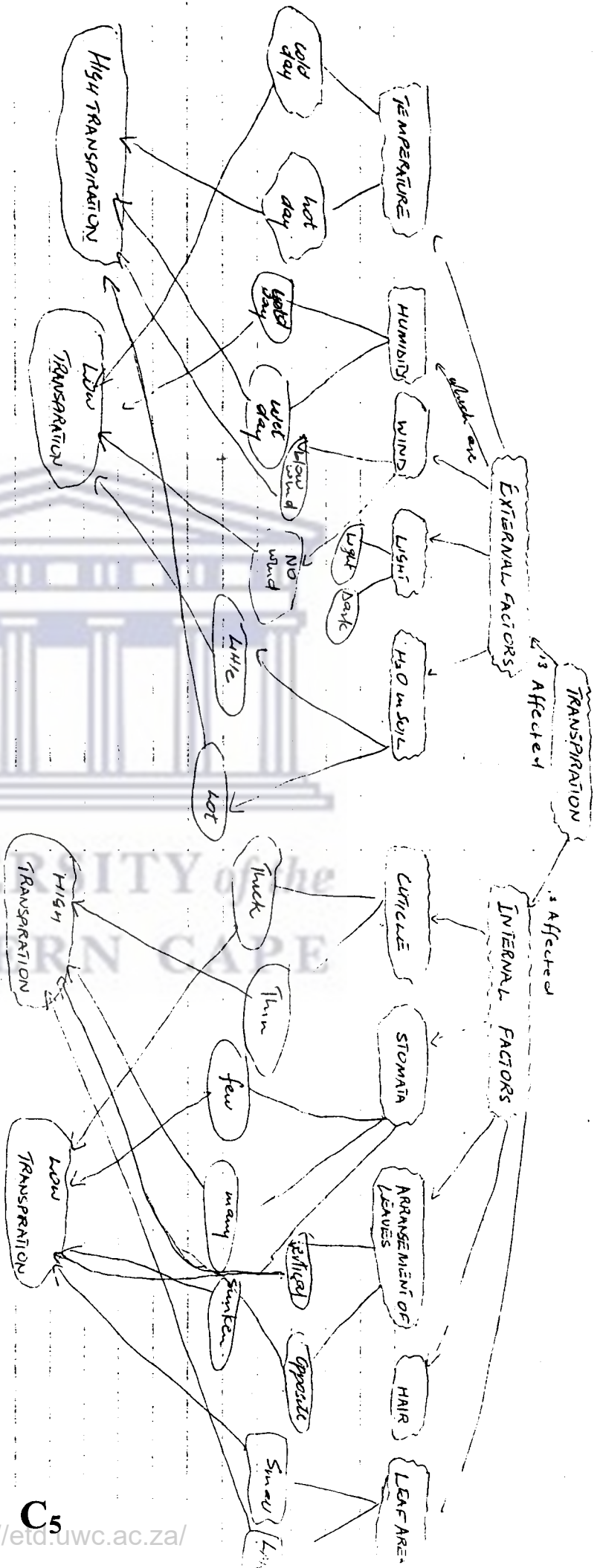
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C₃

Arjuna

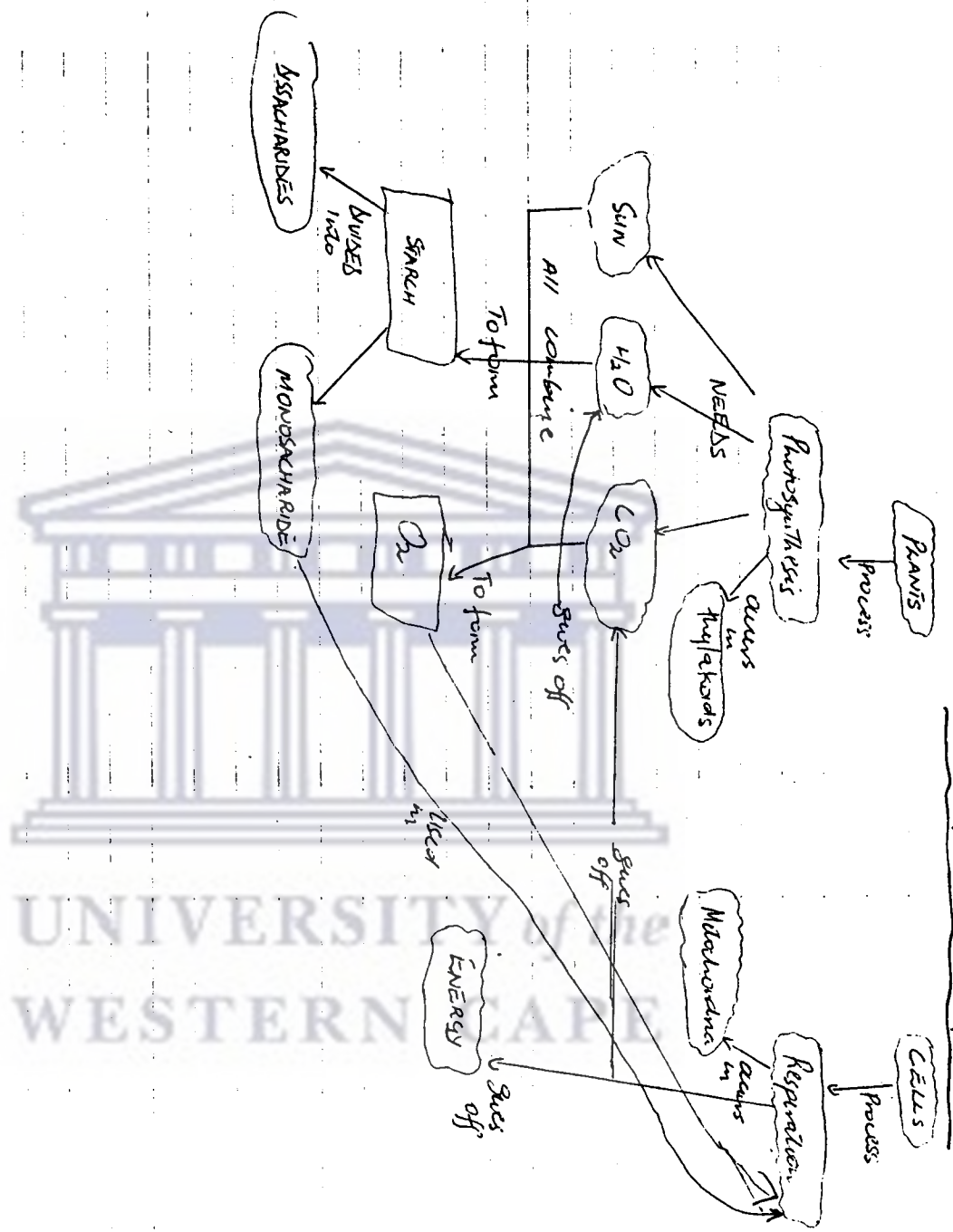


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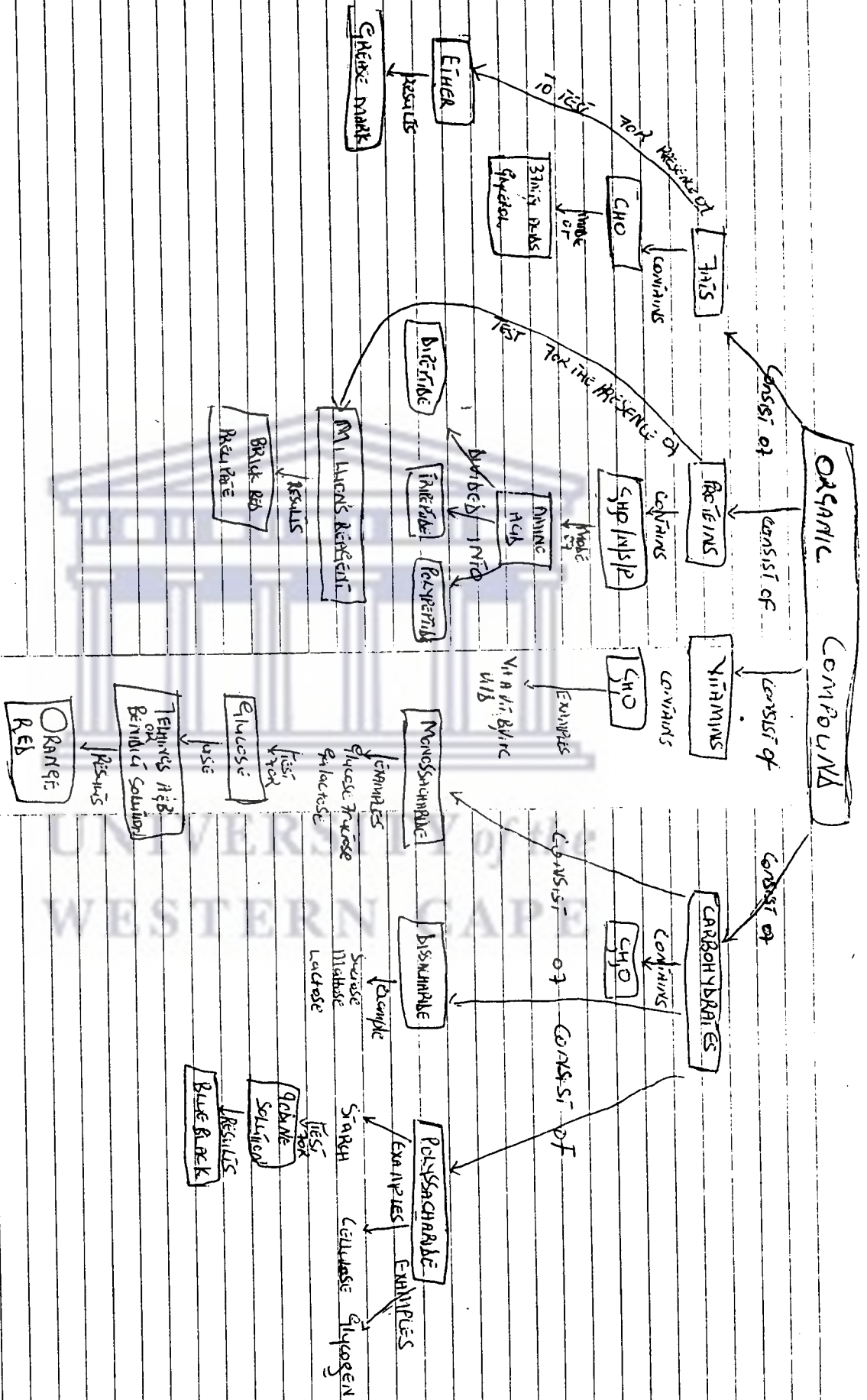
2M

PHOTOSYNTHESIS & RESPIRATION



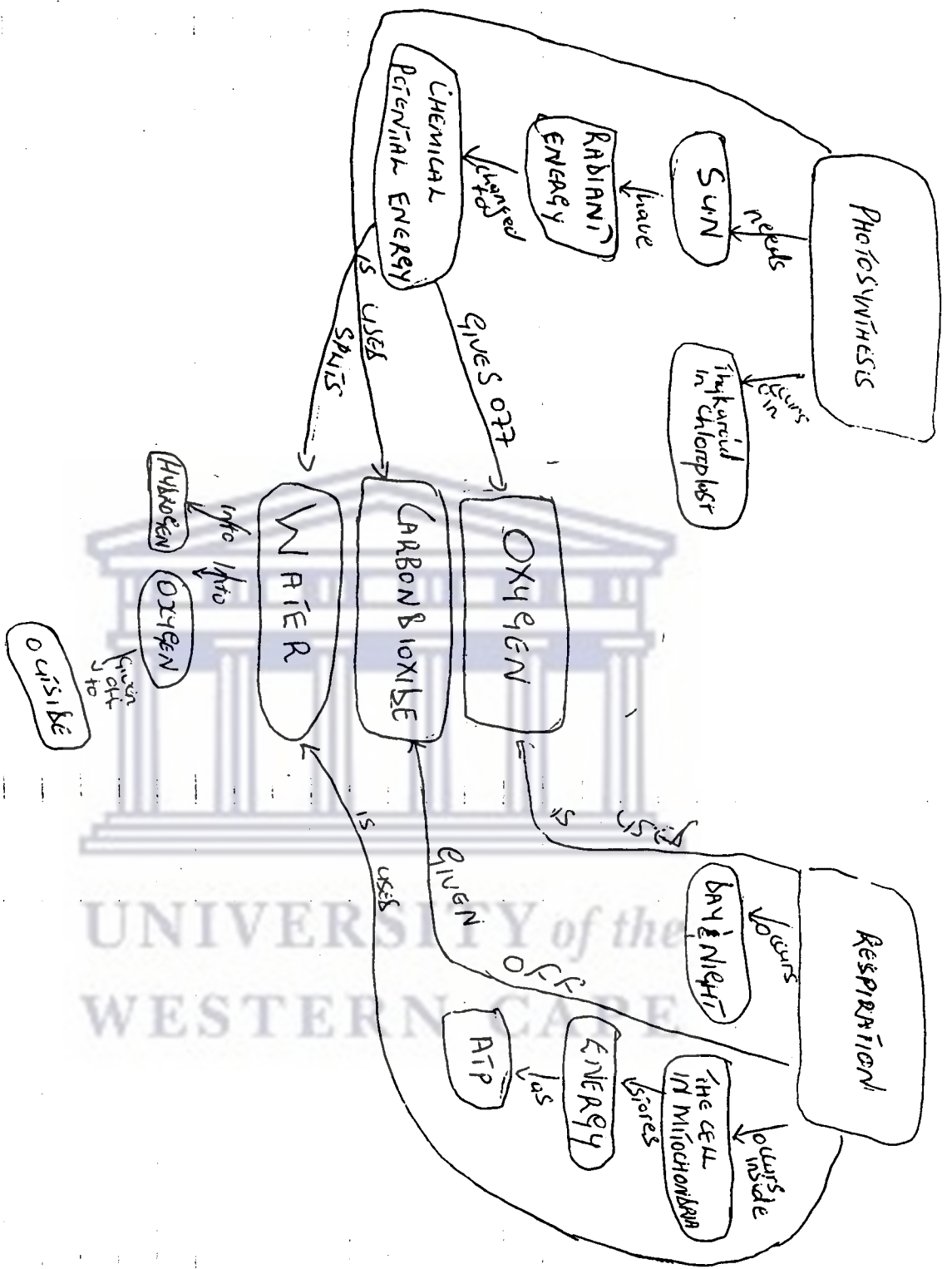
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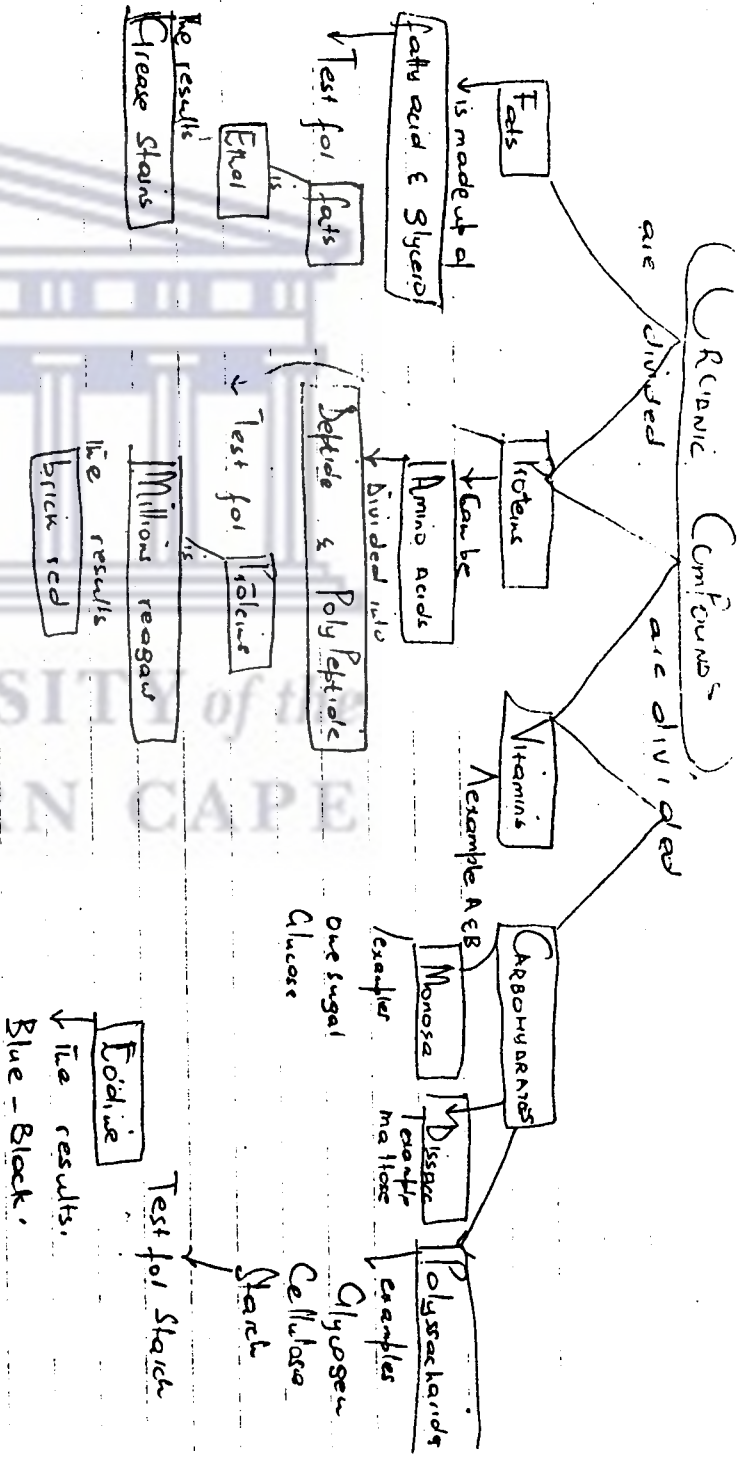
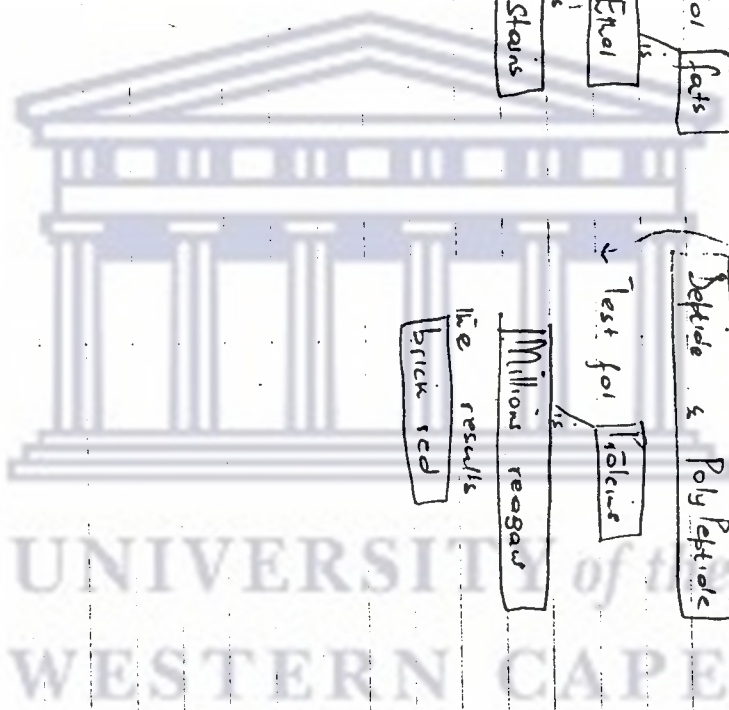


MS

W. E. ...

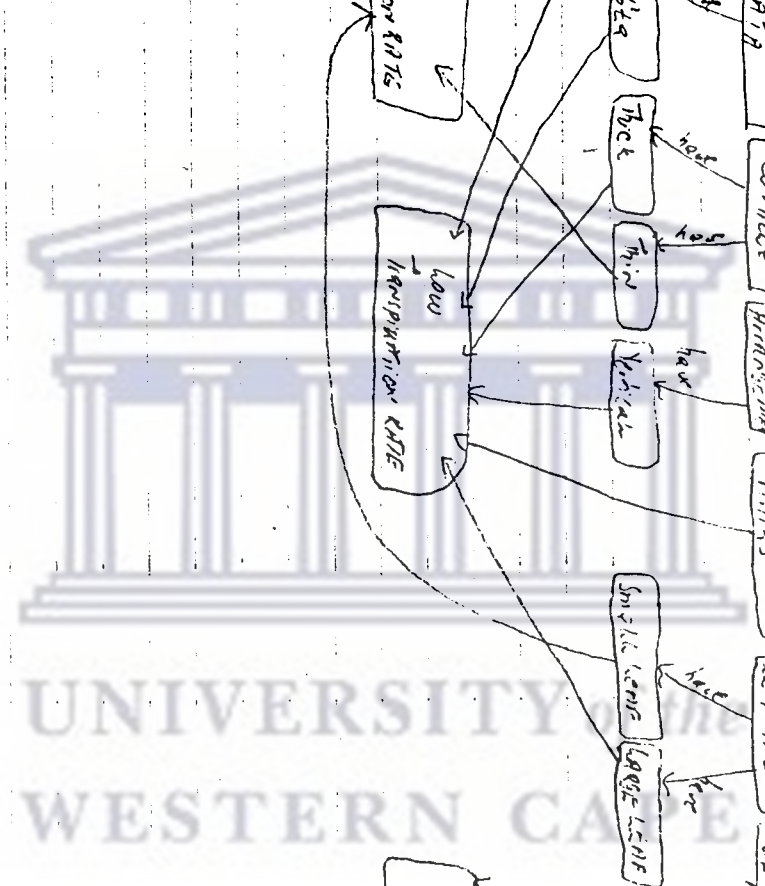
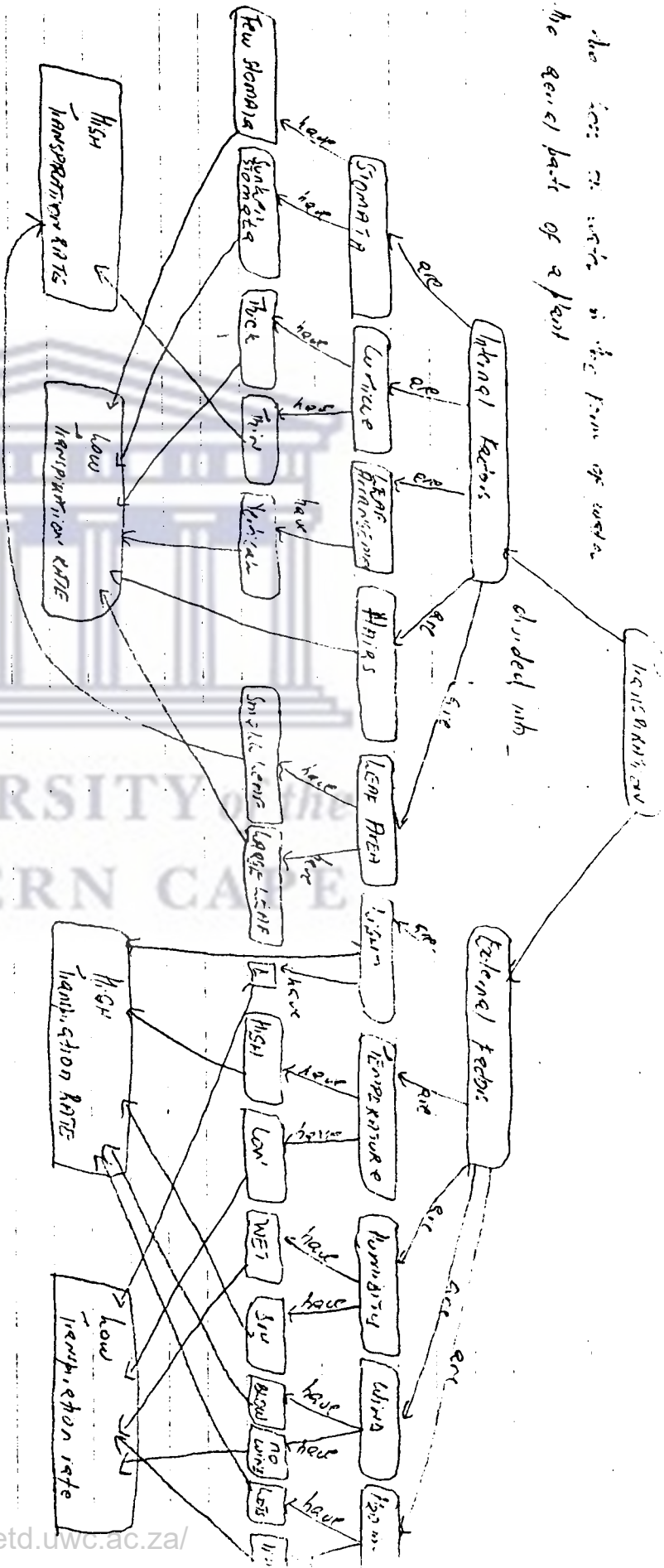


MS

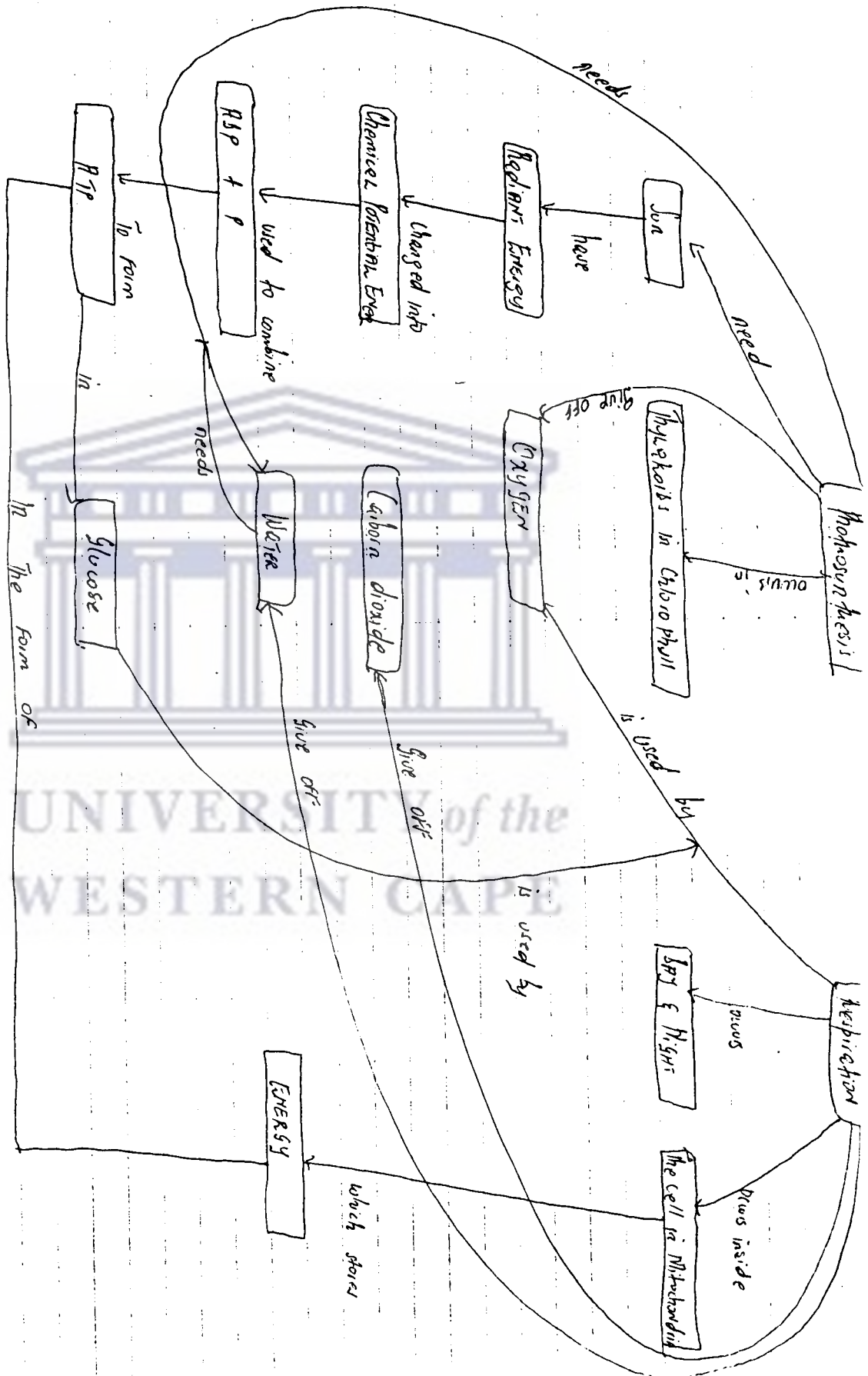


EM

Navigation : the way in which in the form of water
 flows, through the general base of a flood



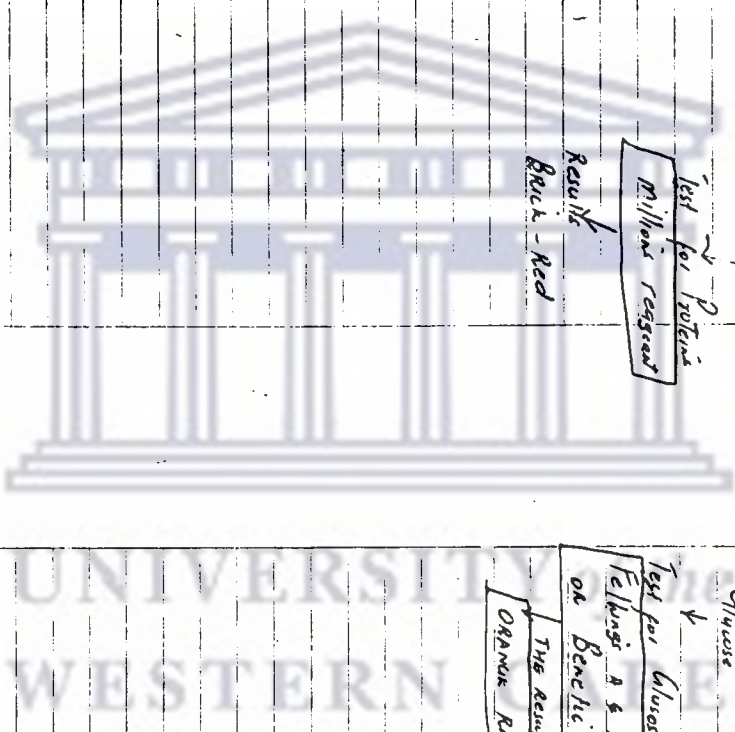
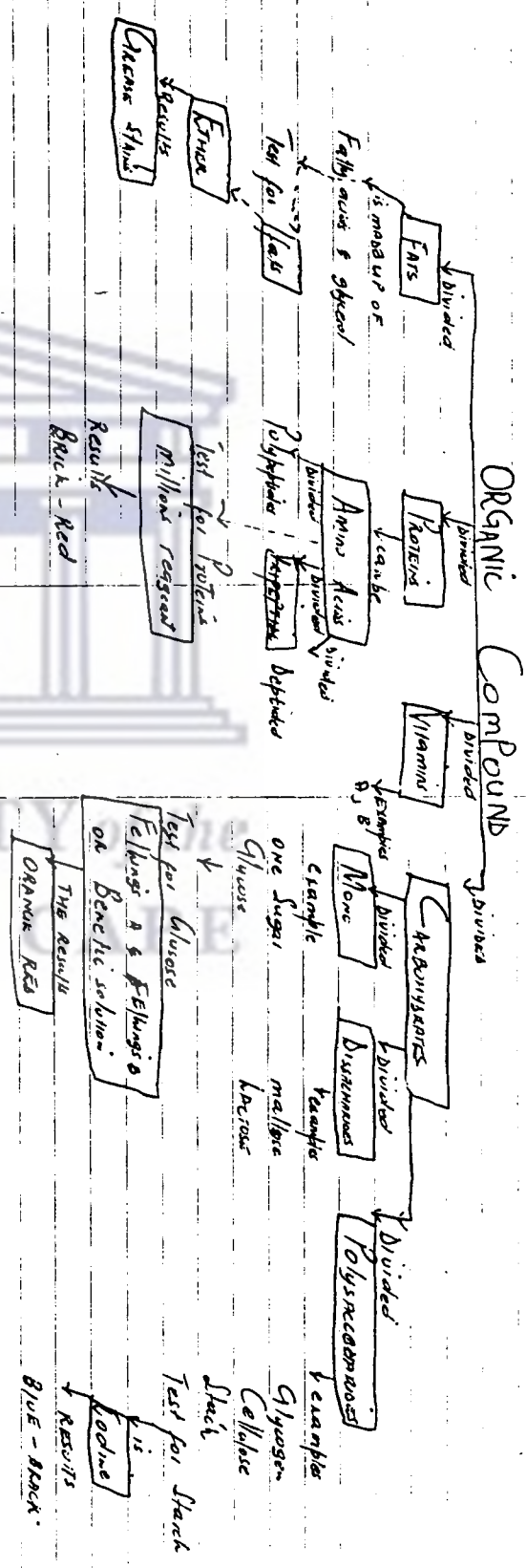
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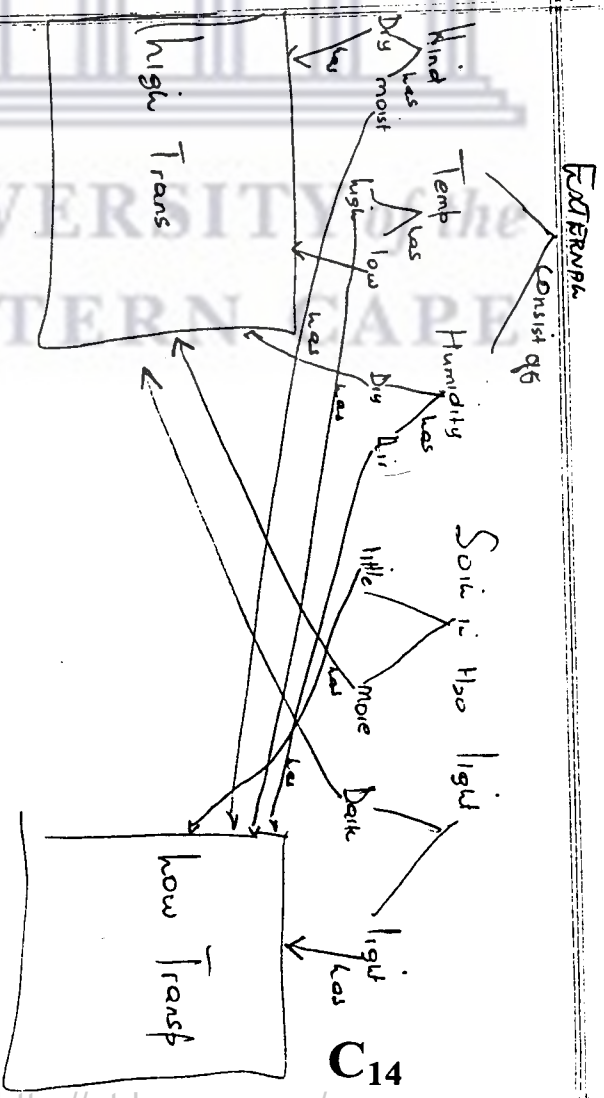
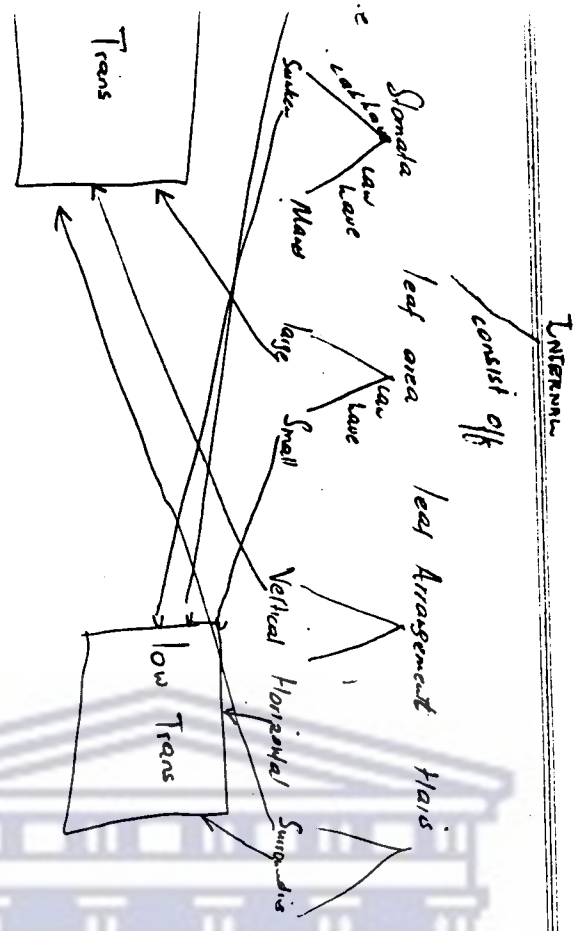


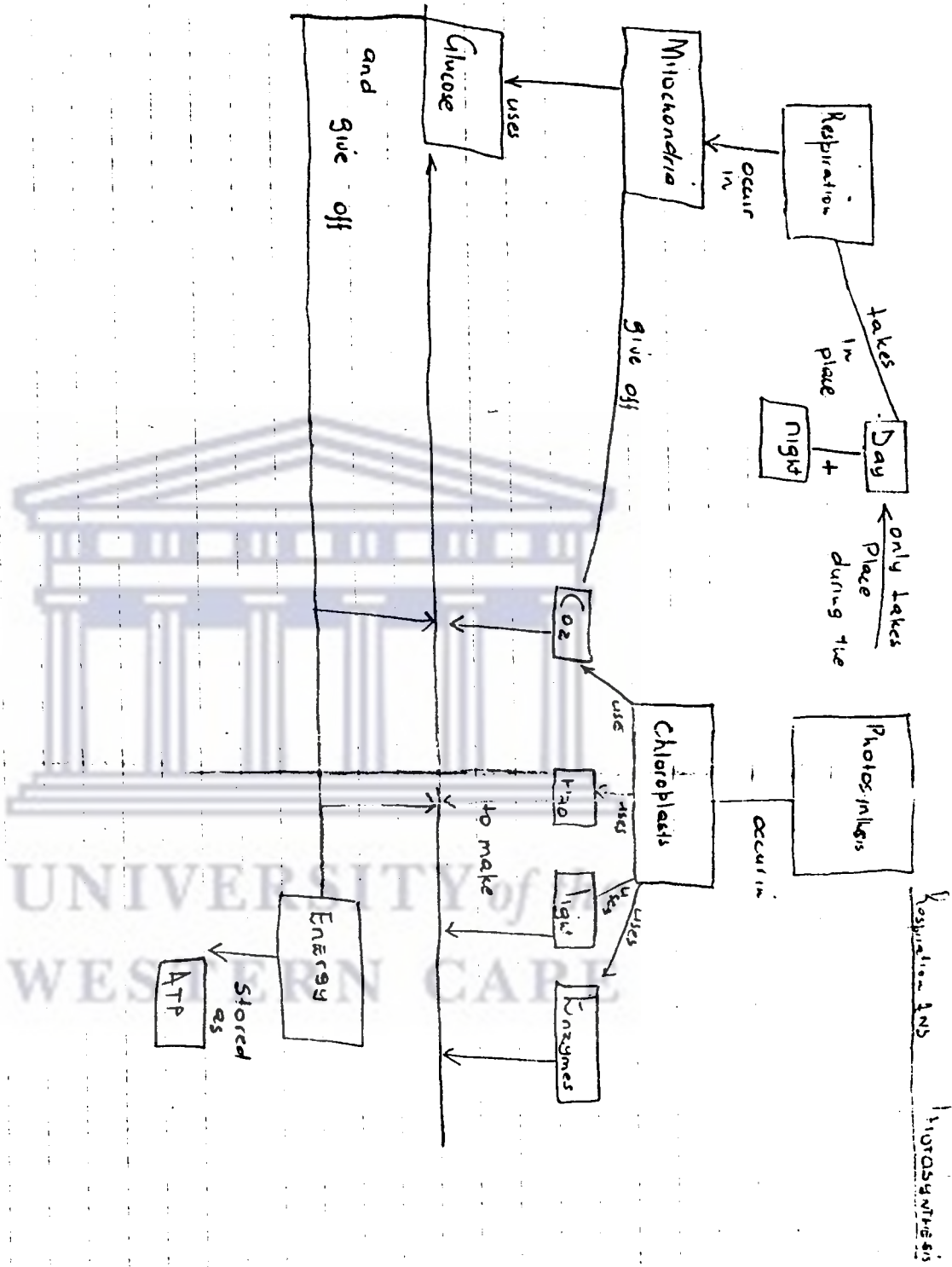
EM

Enzyme

Organic compound are biological compound which contains C, H, O







Respiration and Photosynthesis

T. Cini

C15

12

2141

ORGANIC COMPOUNDS

consists of

Protein

FATS

contains

contains

CHO N P S

CHO C

Made of

Made of

50 Amino Acid
Glyceral and 3 Fatty Acids

3 Fatty acid
Glycerol

Shape of protein is

Test of Fats

HELIUM

ETHER

Test for Protein

Results

Nillions Reagent

CRENSI MARK

Results

Brick Red
Precipitate

consists of

CARBOHYDRATES

VITAMINS

contains

contains

CHO

CHO

consists of

Monosaccharides

Disaccharides

Polyaccharides

Example

Example

Example

Glucose
fructose

Sucrose
Maltose

Starch
cellulose

Gelactose

Lactase

Glycogen

Test for Glucose

Test for starch

Benedict Solution
Fehling's A & B

Iodine Solution

Results

Results

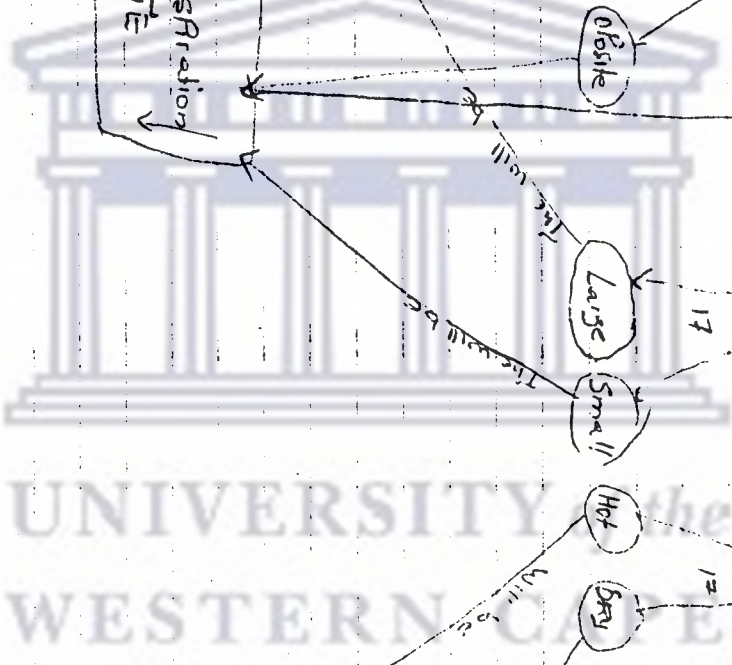
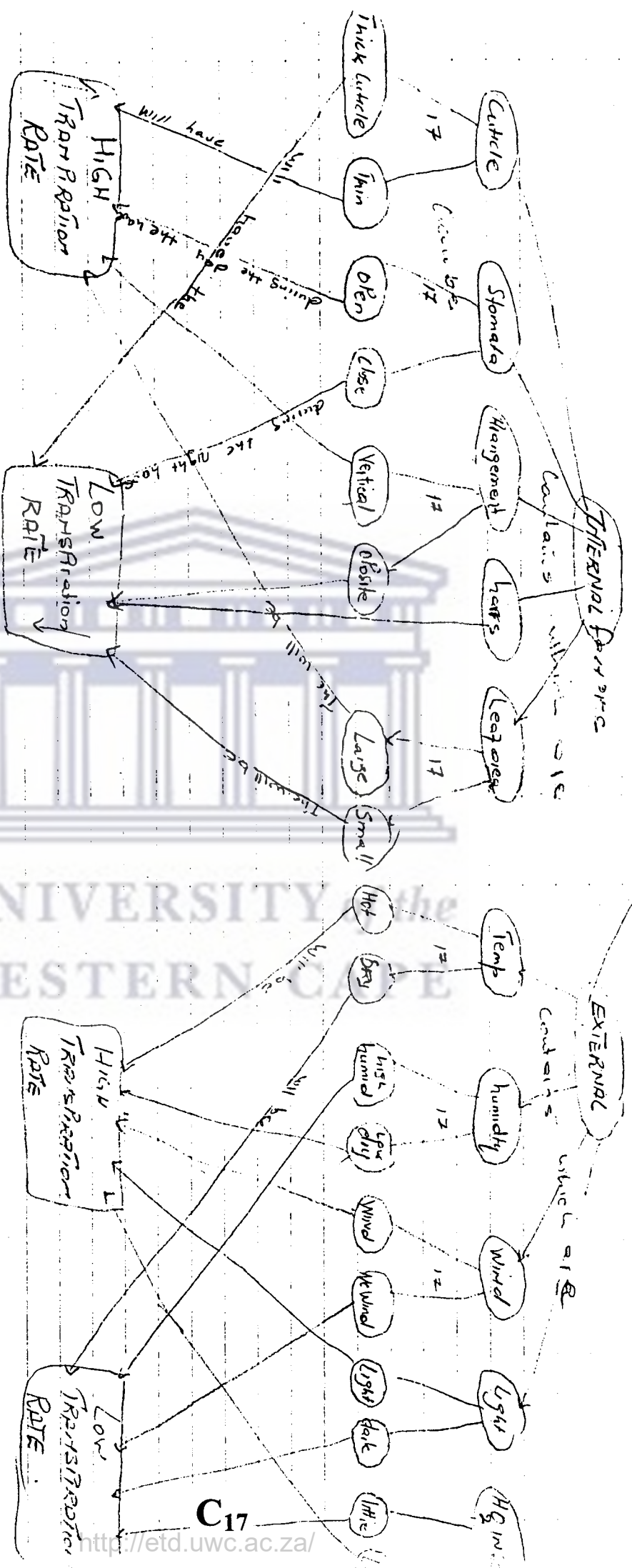
Branise Red

Blue Black

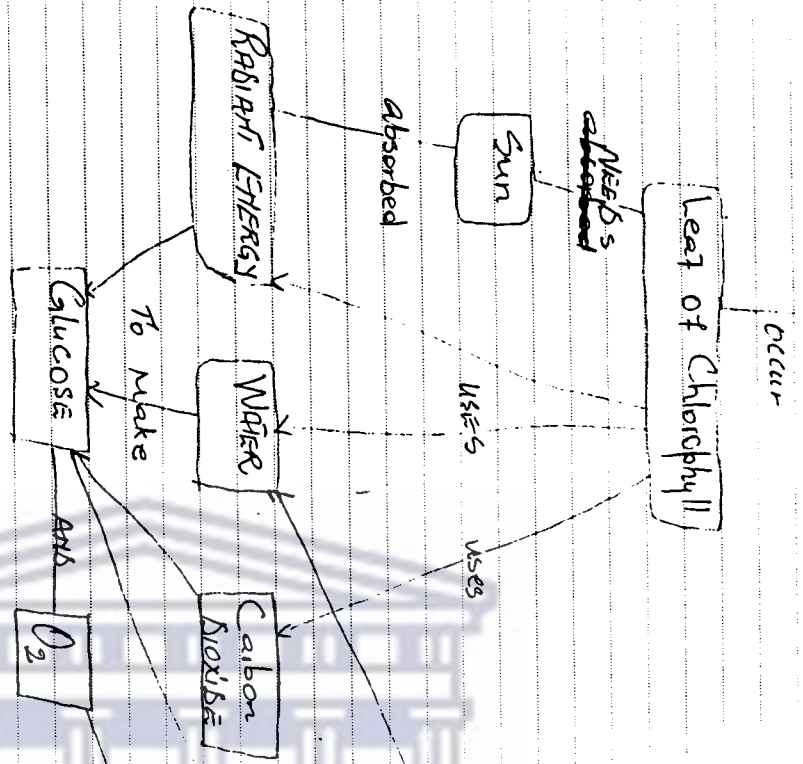
C_{16}

TRANSPIRATION

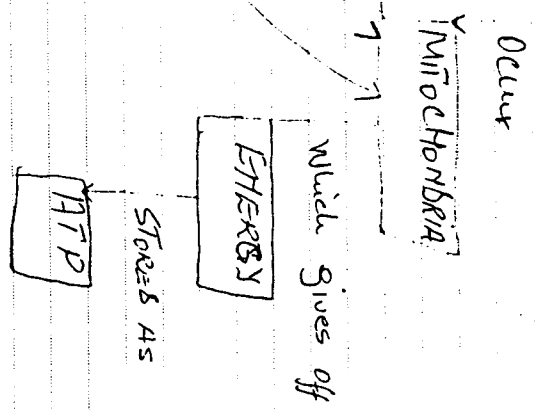
is affected by



PHOTOSYNTHESIS



RESPIRATION



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(25)

JENNIE

Appendix D



Post Concept-Mapping Writings

The logo of the University of the Western Cape, featuring a classical building with a pediment and six columns.

Organic Compounds

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D1

<http://etd.uwc.ac.za/>

Organic compound is the compound that contains the element Carbon, Hydrogen and Oxygen.

B. Organic compounds contains the following fats Carbohydrates vitamins and proteins. All the ~~has~~ this compound has C.H.O

FATS

fats contain the C.H.O that is they contain Carbon Hydrogen and Oxygen. fats consist of 3 fatty acid and 1 Glycerol molecule. to test for starch we used ether and the result are greasy substance in the filter paper.

Carbohydrates

Carbohydrates just like fats they contain C.H.O. Carbohydrates consist of monosaccharide, disaccharide, polysaccharide. monosaccharide e.g. Glucose, Galactose and fructose, disaccharide has lactose maltose and sucrose. ~~monosaccharide~~ Polypeptide has starch, cellulose and Glycogen. to test for starch we use Benedict solution and the result are ~~Orange~~ Orange precipitate

Protein

Protein just like all organic compounds contain C.H.O. Protein consist of dipeptide, tripeptide and polypeptide. to test for the presence of ~~protein~~ protein we use millon's reagent. the result are brick red precipitate

Vitamins

Vitamins like all organic compounds contain the ratio of C.H.O. e.g. Vitamin A, B, C

According to the above division of organic compounds we realise or we see how are the organic compounds are important in our body.

ORGANIC COMPOUNDS

1. Organic compounds are the substance usually contains C, H, O
Organic compounds consists of protein, vitamins, fats and carbohydrates.

Protein contains of C, H, O, N, P, S. Protein are made of 50 Amino acid. Amino acids consists of dipeptide bonds and polypeptide bond. Tests for protein multons reagent. The results is brick red precipitate.

Vitamins contains C, H, O. The examples of vitamins A, B and C

Fats contains C, H, O. Fats are made of Glycerol and 3 fatty acid. Test for fats ether. The results is grease mark

Carbohydrates contains C, H, O. Carbohydrates consists of Monosaccharide, Disaccharide and Polysaccharide. Examples of Monosaccharide glucose

fructose

galactose

Tests for glucose Benedict solution and Fehlings A and B

The results Orange red.

Examples of Disaccharide sucrose

Maltose

Lactose

Examples of Polysaccharide starch

Cellulose

Glycogen

Test for Iodine starch is Iodine solution. The results is Blue black

According to the above discussion of organic compound is important

ORGANIC COMPOUNDS

A. Organic Compounds are substance which always contain Carbon, Hydrogen and Oxygen elements.

B. The Organic Compounds have four examples or consist, namely: Fats, Proteins, Vitamins and Carbohydrates. Protein is the All these example contains C, H, O except protein where can find nitrogen, Sulphur and Phosphorus.

Discussion

The first example is fats

Or fats contains Carbon, Hydrogen and Oxygen as it is said in the introduction.

Fats are made up of 3 fatty acids and Glycerol
To test for the presence of fats we use ETHER
If the fats are present the results will be
Grease mark in a filter paper

PROTEINS

Proteins contains Carbon, Hydrogen, Oxygen, Nitrogen, Sulphur and also Phosphorus

Proteins are made up of amino acids

The amino acids are divided into Di-peptide, Tri-peptide, POLY-PEPTIDE

Test for protein we use MILLON'S REAGENT

If proteins are present the results will be BRICK RED PRECIP.

VITAMINS

Vitamins contains Carbon, Hydrogen and ~~O₂~~ OXYGEN

Examples of vitamins are Vit A, Vit B, Vit C, Vit D

CARBOHYDRATES

They contain Carbon, Hydrogen and Oxygen

CARBOHYDRATES CONSIST OF MONOSACCHARIDES, DISACCHARIDES AND POLYSACCHARIDE

Examples of Monosaccharides are: Glucose, Fructose & Galactose
To test for the presence of Glucose we use
Fehling's A & B OR Benedict's Solution
If Glucose is present results will be ORANGE RED

EXAMPLES OF DISACCHARIDES ARE: Sucrose, Maltose and Lactose

Examples of POLYSACCHARIDES ARE: STARCH, CELLULOSE AND GLYCOGEN

To test for the presence of starch use
IODINE SOLUTION
If it is present the results will be
BLUE BLACK

According to the above discussion we see
how the organic compounds are divided and
their tests are formed.

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Organic Compounds are compounds which consist of Carbon, Hydrogen and Oxygen. And it is divided into four, Fats, Protein, Carbohydrates and Vitamins.

Lipids Fats.

Fats contain Carbon, Hydrogen and Oxygen.

Fats consist of 1 Glycerol and 3 Fatty Acids.

For test of Fats we use either.

Results there will be Grease Mark that shows fat is present.

Proteins

Protein contain CHON.

Proteins are made of Amino Acids.

Amino acids is divided into Dipeptide, Tripeptide and Polypeptide.

We use Millon reagent for test present of Protein.

~~Later~~ etc Results, colour change into Brick Red.

It shows us there is a present of Proteins.

Carbohydrates contain CHO.

Carbohydrates is divided into Monosaccharides, Disaccharides & Polysaccharides.

Examples of Monosaccharides is Glucose, Fructose, Galactose

Examples of Disaccharides is Sucrose, Maltose, Lactose.

We use Iodine ~~for~~ A & B and Benedict solution

For test the present of Starch.

Result Orange red.

Vitamins

Vitamins contains C, H, O.

Example of Vitamins is Vitamin A, and B.

From the above you can see ^{organic compound} ~~carbohydrates~~ and carbohydrates
see how to work together.



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EM(2).

Organic compound are biological compound which contains C, H, O .
Examples of Organic compound CARBOHYDRATES, PROTEINS, VITAMINS & FATS.

Organic compound are divided into Fats.
Fats are made up of fatty acids & glycerol.
Test for fats we use Ether.
The results of ether will be Grease stain.

Organic compound are divided into Proteins.
Proteins can be Amino Acids.
Amino acid are divided into Polypeptides and Peptides.
Test for Proteins we use millon's reagent
The results will be brick-red.

Organic compound are divided into Vitamins
Examples of Vitamins A & B etc.

Organic compound are divided CARBOHYDRATES.
CARBOHYDRATES divided into Monosaccharides, & Disaccharides
POLYSACCHARIDES.
MONOSACCHARIDES examples is one Sugar is Glucose.
Test for Glucose is Fehling's A and Fehling's B or Benedict solution
The results will be ORANGE RES.

~~Polysaccharides~~ DISACCHARIDES have examples Maltose and LACTOSE.

POLYSACCHARIDES have examples Glycogen, Cellulose, Starch
Test for Starch is Iodine
The results of will be Blue-BLACK

The organic compound play an important role in the above of examples, to make it function properly.

ORGANIC COMPOUNDS

Organic compounds are substances usually ^{contains} made of CHO. Examples of organic compounds are Protein, fats, carbohydrates and vitamins.

Proteins contain CHO and N. Proteins are made up of 20 amino acids. Their shape of protein is helix. The test for protein is Millon's reagent and the result is brick red precipitate.

Fats contain CHO. Fats are made up of 3 fatty acids and glycerol. The test for fats is ether and the result is grease mark.

Carbohydrates contain CHO. Carbohydrates consist of three sugars which are monosaccharides, disaccharides and polysaccharides. The examples of monosaccharides are glucose, fructose and galactose. The test for glucose is Benedict's solution and Fehling's A and B and the result is orange red.

The examples of disaccharides are sucrose, maltose and lactose.

The examples of polysaccharides are starch, cellulose and glycogen. The test for starch is Iodine solution. The result is blue black.

Vitamins contain CHO. The examples of vitamins are A, B and C.

According to the above discussion, the organic compounds are important in the body.



Transpiration

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TRANSPIRATION

Why do you all understand by the term Transpiration & Explain to how the plants internal and external environment have an effect in the rate of transpiration.

Transpiration is the loss of water in the form of water vapour in the aerial parts of the leaf.

Transpiration ~~fact~~ consist of two features the external and internal which affect the rate of transpiration.

External.

Cuticle. The transpiration is determine by the size of the cuticle. If the cuticle is thick the rate of transpiration is low. While is thin the rate of transpiration is high.

Stomata

few stomata or sunken stomata reduce the rate of transpiration, while there is many stomata then rate of transpiration is high.

Leaf area.

When the leaf area is large there is an excess loss of water, while the leaf area is small there is low transpiration rate.

Hairs.

Root hairs prevent the loss of water during the wind, and if there are no hairs the leaf may loose water.

Leaf Arrangement.

LEAF ARRANGEMENT.

Here the transpiration is determined by the arrangement or the shape of the leaf.

EXTERNAL FACTORS.TEMPERATURE

When the temperature is high the rate of transpiration is high. But when it is cold the rate of transpiration is low.

LIGHT

When there is no light the rate of transpiration is low. And if there is light there is high ~~water potential~~ transpiration rate.

WIND

If there is high wind blowing there is high loss of water and if there is low ~~water~~ low wind there is low transpiration.

Humidity

When there is high water potential in the air the rate of transpiration is low. And if the air is dry there is great water loss.

H₂O avail

If the water potential is high in the soil the rate of transpiration increases. And if there is low water potential the rate of transpiration is low.

a) Transpiration is the loss of water in the form of water vapour through the aerial parts of the plant.

b) Transpiration is affected by External factors and Internal factors. External factors which are Temperature, humidity, wind light and water in soil.

Temperature when it is cold day the rate of transpiration is low. When it is hot day the rate of transpiration is high.

Humidity when it is cold the rate of transpiration is low. When it is wet rate of transpiration increase.

Wind when wind blows the rate of transpiration is high. When the day is no wind the rate of transpiration is low.

When it is light the rate of transpiration is high. When it is dark the rate of transpiration is low.

When water in soil is little the rate of transpiration is low. When lot of water the rate of transpiration is high.

Internal factors which are Cuticle, stomata, Arrangement of leaves, their and leaf area.

When cuticle is thick the rate of transpiration is low. When it is thin the rate of transpiration is high.

Arrangement of leaves when leaves are opposite the rate of transpiration is high. When leaves are vertical rate of transpiration is low.

Stomata when stomata are many the rate of transpiration is high. When stomata are sunken the rate of transpiration is low.

Hair if it is surrounding by guard cell the rate of transpiration is high.

Leaf Area If the leaf is small the rate of transpiration is low.

is low. If it is large, the rate of transpiration is high.



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TRANSPIRATION

(a) TRANSPIRATION: It is the loss of water in the form of water vapour through the aerial parts of the leaf.
ie mainly in stomata

(b) As it is defined that transpiration is the loss of water in the form of water vapour. It is also affected into external and internal factors. ie TRANSPIRATION RATE.

DISCUSSION

Transpiration is affected into INTERNAL and EXTERNAL factors.

THE INTERNAL FACTORS ARE HAVING STOMATA

The stomata is divided into few stomata and which decreases the rate of transpiration. Sunken stomata also decreases the rate of transpiration.

CUTICLE HAVE two different layers

The thick and thin cuticle.

Thick cuticle have low transpiration rate and
Thin cuticle have high transpiration rate

LEAF ARRANGEMENT ~~It~~ have a low transpiration rate

HAIRS HAVE a low transpiration rate

LEAF AREA.

The small leaf have a low transpiration rate

The large leaf have a high transpiration rate

EXTERNAL FACTORS ARE

LIGHT: It have a high rate of transpiration
Temperature:

High temperature have high transpiration rate
Low temperature have low transpiration rate

HUMIDITY HAVE WET and DRY AIR

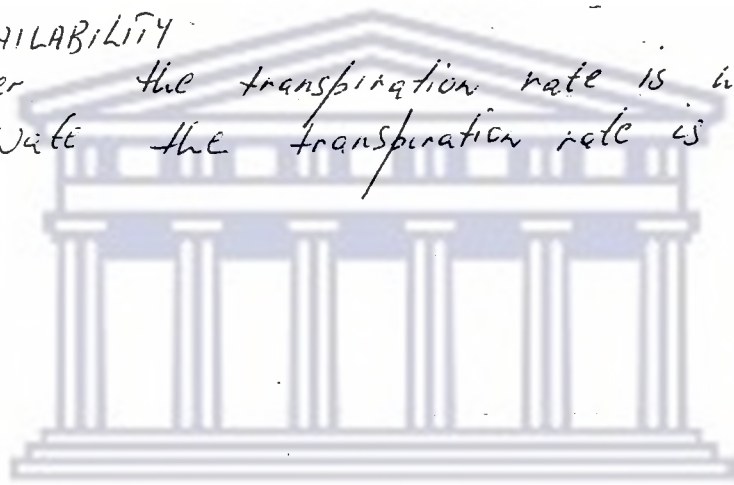
WET air have a low transpiration rate
Dry air have a high transpiration rate.

WIND: It have a high transpiration rate

Water AVAILABILITY

Little water the transpiration rate is high.

Lots of water the transpiration rate is low.



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Transpiration

Transpiration is the loss of water in the form of water vapour, through the aerial parts of a plant

Transpiration consist off Internal factors and External Factors

Internal factors are

Cuticle : If cuticle is thin transpiration rate increase
If cuticle is thick transpiration rate decrease

Stomata : When stomata open transpiration fast.
When stomata closed transpiration slow.

Leaf Arrangement : When the leaves are vertical transpiration increase
When the leaves rosette shape transpiration decrease

Hairs :

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Leaf Area : When leaves are small decrease transpiration
When the leaves are large increase transpiration.

External factors are

Light : When stomata open rate of transpiration can be quicker
When stomata closed rate of transpiration can be slow

Wind : When the wind blow transpiration rate increase
No wind transpiration rate decrease

Temperature : When it is hot transpiration rate increase
When it is cold transpiration rate decrease

Humidity : When air surround the leaves lots of water transpiration
rate decrease
When air is dry transpiration rate increase

H₂O in Soil : When little water transpiration rate decrease
When it is lots of water transpiration rate
increase.



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- (a) WHAT DO YOU UNDERSTAND BY THE TERM TRANSPIRATION
- (b) Explain How the plants internal structural features AND its External ENVIRONMENTAL factors HAVE AN EFFECT ON THE RATE OF Transpiration (20)

It is the losing off H_2O thru the leaves by Stomata.

Transpiration is ~~was~~ affected by two factors which are ~~Appor~~ Internal and External.

External Factors consist of Wind, Temperature, Humidity, Soil in H_2O light.

Wind

When Wind is dry transpiration rate Increase.

When Wind is H_2O transpiration rate

Temperature.

When a Temperature is high transpiration rate Increase

When a temperature is low transpiration rate Decrease.

Humidity

When Humidity low transpiration rate Decrease

When Humidity H_2O transpiration rate Increase.

Soil in H_2O

When there is little H_2O transpiration rate low.

When there is too much H_2O transpiration rate high

light

During light transpiration rate Increase.

During dark transpiration rate Decrease.

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Int INTERNAL FACTORS

(V.2)②

Internal factors consists of Cuticle Stomata, leaf Arrangement leaf area, Hairs

Cuticle

can have thick layer cause transpiration rate Decrease.

can have thin layer cause transpiration rate Increase.

Stomata

can have Many stomata cause transpiration Increase.

Stomata can have sunken cause transpiration Decrease.

LEAF ARRANGEMENT

A leaf have small leaves transpiration rate is low.

A leaf have Big leaves transpiration rate is High.

LEAF AREA

Hairs have a low transpiration rate.

Hairs

When hairs are short transpiration rate Decrease.

When hairs are long transpiration rate Increase.

a, What do you understand by the term "Transpiration"?

b, Explain how the plants internal structural features and it is external environmental factors have an effect on the rate of transpiration

a, Transpiration is the loss of water in the form of water vapour ~~by~~ through the aerial parts of the plants

b Transpiration is affected by two factors internal factors and External factors
Internal factors which are Cuticle
Cuticle can be thick - will ~~have~~ decrease in transpiration rate, Thin cuticle will increase in transpiration rate

Stomata can be open when the transpiration rate increase

Close stomata decrease during transpiration rate

Arrangement of leaf can be vertical when the transpiration rate increase

Opposite leaf decrease ~~when~~ ^{during} the transpiration rate

Hair have decrease in transpiration rate

Leaf area can be large ~~when~~ ^{when} the transpiration rate increase

Small Leaf area decrease during transpiration rate

EXTERNAL FACTORS which are Temperature
can be Hot when the transpiration rate increase
Dry Temperature decrease during transpiration rate

Humidity can be high when transpiration^{rate} decrease
Low humidity increase during transpiration rate

Wind can be bad when transpiration rate increase
No wind decrease during transpiration rate

Light can be light when Transpiration rate increase
Dark light decrease in transpiration rate

H_2O in Soil can be little H_2O when transpiration rate decrease

Loss of H_2O in Soil increase in Transpiration rate



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Photosynthesis &

Respiration

D23

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Photosynthesis

This process needs sun, light, H_2O and CO_2 . The sun come in radiant energy.

All the substances are needed to convert radiant energy to chemical energy.

The chemical energy is used to combine ADP+P to form the substance ATP found in the molecule of Glucose in the leaf.

Photosynthesis also give off the O_2 from the leaf.

Respiration also needs the ATP in the Glucose. Respiration also needs the O_2 in the mitochondrion. It need this substance to make the energy in the cell as stored ATP.

Respiration also give off H_2O and the CO_2 which photosynthesis can use.

This show the interrelated of the process to vital life in earth.

The photosynthesis take place in the chloroplast and the respiration take place in the day and night in the mitochondrion.

Photosynthesis & Respiration

Photosynthesis takes place in plants.
Respiration takes place in all cells.

Photosynthesis is a process which needs light from the sun, H_2O from the roots and CO_2 from outside. Photosynthesis all combine these substances to form O_2 and to form starch. Starch can be divided into disaccharides, Monosaccharides. Photosynthesis occurs in the thylakoids

Respiration occurs in the mitochondria. The O_2 from photosynthesis is used by this process. Also the monosaccharides from photosynthesis is used by this process. They are so inter-related when the respiration gives off the CO_2 and the H_2O so photosynthesis in the thylakoids can use them again. Respiration also give us and plants energy.

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PHOTOSYNTHESIS & RESPIRATION

Explain why photosynthesis and respiration can be regarded as 2 vital processes to life on earth and show they are interrelated.

PHOTOSYNTHESIS AND RESPIRATION

Photosynthesis is the making of carbohydrate from the raw materials CO_2 and H_2O using chlorophyll molecule
the formula: $\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{ENZYMES}]{\text{SUNLIGHT, CHLOROPHYLL}}$ $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
glucose

Photosynthesis needs sun.

Photosynthesis occurs in Thylakoid in chloroplast

It needs sun

The sun have radiant energy

The radiant energy is changed to chemical potential energy.

It splits water into H_2 and O_2

It gives off oxygen

It uses CO_2

RESPIRATION

Respiration occurs inside the cell in mitochondria

It occurs during day and night

It stores energy is stored as ATP molecule

Oxygen is used in respiration

Carbon dioxide is given off in respiration and water is used.

According to the above discussion we can see how photosynthesis and respiration are related. Each other helps the other one. they are also an important in life.

Photosynthesis and Respiration

Photosynthesis need the sun and takes place in the chloroplasts of the leaf. The sun has the radiant energy which is changed into chemical potential energy, which is used to combine ADP and P to form ATP. Photosynthesis also needs CO_2 and H_2O to take place.

Photosynthesis makes the O_2 and the glucose.

Respiration occurs in day and night. Respiration it takes place in the mitochondria in the cell.

Respiration it uses the O_2 from the photosynthesis. Respiration it uses the glucose from the photosynthesis. It then stores it as energy in the form of ATP.

Respiration then give off carbon dioxide and the H_2O . The CO_2 then can be used by the photosynthesis.

This can then be why the photosynthesis and respiration can be vital processes to life on earth.

Photosynthesis needs light, CO_2 , H_2O , Chlorophyll.
Photosynthesis occurs in Thylakoids in chloroplast.
Photosynthesis uses $\text{CO}_2 + \text{H}_2\text{O} + \text{light} + \text{enzymes}$ to make glucose in leaves.
It takes place in the day only.

Respiration occurs inside the mitochondria.
Respiration takes place in the night and the day.
It uses the glucose from the photosynthesis and gives CO_2 and H_2O . It also gives off the energy in the cell in the form of ATP.

Plants make the glucose and the cell uses it for energy.

Plants need the CO_2 from the cell.
The cell needs the O_2 from the plant.

Therefore they are interrelated with each other.

I think these processes have an important role in plants and animals to produce food and the other one to break down which was made.

PHOTOSYNTHESIS AND RESPIRATION


Photosynthesis occurs in the leaf chlorophyll of a plant. The leaf chlorophyll needs the sun as radiant energy. It needs the water and the carbon dioxide to make the glucose in leaf. It also makes the O_2 .

Respiration occurs in the mitochondria of cells. Mitochondria use glucose from photosynthesis. Mitochondria use the O_2 from leaves. This they use to make and give off energy which is stored as ATP in cells.

Men need glucose from plants and O_2 . This was made during photosynthesis process. It is interrelated because respiration needs O_2 and glucose. The plants need respiration for the CO_2 .

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Appendix E

The logo of the University of the Western Cape, featuring a classical building with a pediment and columns.

Post Concept-Mapping
Writing Analysis
Sheets

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Ayanda "Post CM Writing"	
Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Organic Compound:</p> <ul style="list-style-type: none"> Organic Compound is the compound that contains the elements Carbon, Hydrogen and Oxygen. Organic Compounds contains the following fats Carbohydrates vitamins and Proteins. all the this compound has C.H.O.
3. Definition (Own Explanation)	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> This process needs Sun, Light, H₂O and CO₂. The sun come in Radiant energy. All the substances are needed to convert radiant energy to chemical energy. The chemical energy is used to combine ADP + P to form the substance ATP found in the molecule of Glucose in the leaf. Photosynthesis also Give off the O₂ from the leaf.
4. Interrelations of Concepts	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Respiration also needs the ATP in the Glucose. Respiration also needs the O₂ in the mitochondrion. It need to make this substance to make the energy in the cell as stored ATP. Respiration also give off H₂O and the CO₂ which Photosynthesis can use.
5. Relevant Information to Topic & Correct Factual Recall	<p>Organic Compounds:</p> <p>Re: Fats</p> <ul style="list-style-type: none"> Fats contain the CHO. Fats consist of 3 fatty acid and 1 glycerol molecule. To test for starch we use ether . And the result are grease substance in the filter paper. <p>Re: Carbohydrates:</p> <ul style="list-style-type: none"> Carbohydrates consist of monossacharide, dissacharide, Polyssacharide. Monossacharide eg Glucose, Galactose and fructose. Dissacharide has lactose and maltose and sucrose. Polypeptide has Starch cellulose and Glycogen. To test for starch we use Benedict Solution . And the result sre Orange precipitate.. <p>Re: Protein</p> <ul style="list-style-type: none"> Protein consist of Dipeptide, tripeptide and polypeptide. To test for the presence of protein we use Millon's reagent. The result are brick red precipitate. <p>Re: Vitamins</p> <ul style="list-style-type: none"> eg. Vitamin A, B, C <p>Transpiration:</p>

	<p>Re: External factors:</p> <ul style="list-style-type: none"> • Cuticle : The transpiration is determine by the Size of the cuticle. If the cuticle is thick the rate of transpiration is low. While is thin the rate of transpiration is high. • Stomata: few stomata or Sunken stomata reduce the rate of transpiration. While there is many Stomata the rate of transpiration is high. • Leaf area: When the leaf area is large there is an excess loss of water. While the leaf area is small there is low transpiration rate. • Leaf arrangement: There the transpiration is determined by the arrangment or the shape of the leaf. <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • Temperature: When the temperature is high the rate of transpiration is high. But when is cold the rate of transpiration is low. • Light: When there is no light the rate of transpiration is low. And if there is light there is high transpiration rate. • Wind: When there is high wind blowing there is high loss of water and if there is low wind there is low transpiration. <p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • The photosynthesis take place in the chloroplast and the respiration take place in the day and night in the mitochondrion.
6. Relevant Information to Topic BUT InCorrect Factual Recall.	
7. Irrelevant Information to Topic.	
8. Unclear Expression of Idea.	
9. Term / Concept used Incorrectly.	<p>Transpiration:</p> <ul style="list-style-type: none"> • Root hairs prevent the lost of water during the wind. and if there are no hairs the leaf may loose water. • Humidity: When there is high water potential in the air the rate of transpiration is low. • H₂O Avail: If the water potential is high in the soil the rate of transpiration increase. And if there is low water potential the rate of transpiration is low.

Zoleka (ZM) " Post CM Writing	
Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Organic Compounds:</p> <ul style="list-style-type: none"> Organic compounds are the substance usually contains CHO. Organic compounds consists of protein, Vitamins, fats and Carbohydrates.
3. Definition (Own Explanation)	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Photosynthesis is a process which needs light from the sun, H₂O from the roots and CO₂ from outside. Photosynthesis all combine this substances to form O₂ and to form starch.
4. Interrelations of Concepts	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Respiration occurs in the mitochondria. The O₂ from photosynthesis is used by the process. Also the monosaccharides from photosynthesis is used by the process. They are so interrelated when the respiration gives off the CO₂ and the H₂O so photosynthesis in the thylakoids can used them again. Respiration also give us and plants energy.
5. Relevant Information to Topic & Correct Factual Recall	<p>Organic Compounds:</p> <p>Re: Proteins</p> <ul style="list-style-type: none"> Proteins contains of CHONPS. Proteins are made of 50 Amino acid. Tests for protein Millons reagent. The result is Brick red precipitate. <p>Re: Vitamins</p> <ul style="list-style-type: none"> Vitamins contain CHO. The examples of vitamins A, B and C. <p>Re: Fats</p> <ul style="list-style-type: none"> Fats contain CHO. Fats are made of Glycerol and 3 fatty acid. Test for fats Ether. The result is grease mark. <p>Re: Carbohydrates</p> <ul style="list-style-type: none"> Carbohydrates contain CHO. Carbohydrates consists of Monosaccharide, Disaccharide and Polysaccharide. Examples of Monosaccharide glucose, Fructose, galactose. Test for glucose Benedict solution and fehlings A and B.

	<ul style="list-style-type: none"> • The results Orange red • Examples of Disaccharide sucrose, maltose , lactose. • Examples of Polysaccharide starch, Cellulose, Glycogen. • Test for starch is Ioden solution. • The results is Blue black. <p>Transpiration: Re: External factors:</p> <ul style="list-style-type: none"> • Temperature when it is cold day the rate of transpiration is low. When it is hot day the rate of transpiration is high. • Wind when wind blows the rate of transpiration is high. When the day is no wind the rate of transpiration is low. • When it is light the rate of transpiration is high. When it is dark the rate of transpiration is low. • When water in soil is little the rate of transpiration is low. When lot of water the rate of transpiration is high. <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • When cuticle is thick the rat eof transpiration is low. When it is thin the rate of transpiration is high. • Stomata when stomata are many the rate of transpiration is high. When stomata are sunken the rate of transpiration is low. • Leaf area: If the leaf is small the rate of transpiration is low. If it is large the rate of transpiration is high. <p>Photosynthesis & Respiration</p> <ul style="list-style-type: none"> • Photosynthesis takes place in plants. • Respiration takes place in all cells.
<p>6. Relevant Information to Topic BUT InCorrect Factual Recall.</p>	<p>Transpiration:</p> <ul style="list-style-type: none"> • Humidity : When it is cold the rate of transpiration is low. • Arrangement of leaves: When leaves are opposite the rate of transpiration is high. • Hair: if is surrounded by guard cell the rate of transpiration is high.
<p>7. Irrelevant Information to Topic.</p>	
<p>8. Unclear Expression of Idea.</p>	<p>Transpiration:</p> <ul style="list-style-type: none"> • Arrangement of leaves: When leaves are opposite the rate of transpiration is high.

9. Term / Concept used Incorrectly.

Organic Compounds

- Amino acids consists of Dipeptide bonde and polypeptide bond.

Transpiration:

Re: Humidity : when it is cold the rate of transpiration is Low.



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Winterose (WS) " Post CM writing	
Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Organic Compounds:</p> <ul style="list-style-type: none"> Organic Compounds are substance which always contain Carbon, Hydrogen and Oxygen elements. <p>Transpiration:</p> <ul style="list-style-type: none"> Transpiration: It is the loss of water in the form of water vapour through the aerial parts of the leaf i.e mainly in stomata. <p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Photosynthesis is the making of Carbohydrate from the raw materials CO₂ and H₂O using chlorophyll molecule . the formula :- CO₂ + 6H₂O → sunlight, chlorophyll, Enzymes → C₆H₁₂O₆ + 6O₂.
3. Definition (Own Explanation)	
4. Interrelations of Concepts	
5. Relevant Information to Topic & Correct Factual Recall	<p>Organic Compounds:</p> <ul style="list-style-type: none"> The organic compounds have four examples or consist of namely : Fats, Proteins, Vitamins, and Carbohydrates. <p>Re: Fats.</p> <ul style="list-style-type: none"> Fats contain carbon, hydrogen and oxygen. Fats are made up of 3 fatty acids and glycerol. For test of the presence of fats we use ether. If the fats are present the results will be grease mark in a filter paper. <p>Re: Proteins</p> <ul style="list-style-type: none"> Proteins contains CARBON, HYDROGEN, OXYGEN, NITROGEN, SULPHUR and also PHOSPHORUS. Proteins are made up of amino acids. The amino acids are divided into Dipeptide, Tripeptide Polypeptide. Test for protein we use Million's Reagent. If proteins are present the results will be Brick Red precipitate. <p>Re: Vitamins</p> <ul style="list-style-type: none"> Vitamins contain carbon , hydrogen and oxygen. Examples of vitamins are Vit A , Vit B, Vit C, Vit D. <p>Re: Carbohydrates:</p> <ul style="list-style-type: none"> They contain carbon , hydrogen and oxygen. Carbohydrates consists of Monossacharides, Dissacharides and

	<p>Polyssacharide.</p> <ul style="list-style-type: none"> • Examples of dissacharides are : Sucrose, Maltose and Lactose. • Examples of Polyssacharides are : Starch, Cellulose and Glycogen. • To test for the presence of starch use Iodine solution. • If it is present the results will be Blue - Black. <p>Transpiration:</p> <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • Stomata: The stomata is divided into few stomata which decrease the rate of transpiration. Sunken stomata also decreases the rate of transpiration. • Cuticle have two different layers. The thick and the thin cuticle. Thick cuticle have low transpiration rate and Thin cuticle have high transpiration rate. • Leaf area: The small leaf have a low transpiration rate. The large leaf have a high transpiration rate. <p>Re: External factors:</p> <ul style="list-style-type: none"> • Light: It have a high rate of transpiration • Temperature: High temperature have high transpiration rate. Low temperature have a low transpiration rate. • Humidity: Wet air have a low transpiration rate. Dry air have a high transpiration rate. • Wind: It have a high transpiration rate. • Water availability: Little water the transpiration rate is high. Lots of water the transpiration rate is low. <p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> • Photosynthesis occurs in the thylakoid in chloroplast. It need sun. The sun have radiant energy. The radiant energy is changed to chemical Potential energy. - It splits water into H₂ and O₂. - It gives off oxygen - It uses carbon dioxide. <p>Re: Respiration:</p> <ul style="list-style-type: none"> • Respiration occurs inside the cell in mitochondria. • It occurs during Day and Night. • Energy is stored as ATP molecule. • Oxygen is used in Respiration.
6. Relevant Information to Topic BUT InCorrect Factual Recall.	<p>Photosynthesis & Respiration:</p> <p>Re: Respiration:</p> <ul style="list-style-type: none"> • Carbon dioxide is given off and water is used.
7. Irrelevant Information to Topic.	
8. Unclear Expression of Idea.	
9. Term / Concept used	

Incorrectly.	
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Eunice (EM) " Post CM Writing	
Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Organic Compounds:</p> <ul style="list-style-type: none"> Organic compounds are compounds which consists of Carbon, Hydrogen and Oxygen. And it is divided into four, Fats, Protein, Carbohydrated and Vitamins. <p>Transpiration:</p> <ul style="list-style-type: none"> Transpiration is the loss of water in the form of water vapour through the aerial parts of a plant.
3. Definition (Own Explanation)	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Photosynthesis need the sun and takes place in the thylakodes of the leaf. The sun has the radiant energy which is changed into chemical potential energy which used to combine ADP and P to form ATP. Photosynthesis also need CO₂ and H₂O to take place. Photosynthesis make the O₂ and the Glucose. Respiration occur in the day and night. Respiration it takes place in the mitochondrion in the cell.
4. Interrelations of Concepts	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Respiration it uses the O₂ from the Photosynthesis. Respiration it uses the glucose from the Photosynthesis. It then stores it as energy in the form of ATP. Respiration then give off Carbon dioxide and the H₂O . The CO₂ then can be used by the Photosynthesis.
5. Relevant Information to Topic & Correct Factual Recall	<p>Organic Compounds:</p> <p>Re: Fats</p> <ul style="list-style-type: none"> Fats contain Carbon, Hydrogen and Oxygen. Fats consists of 1 Glycerol and 3 fatty acids. For test of fats we use Ether. Results there will be Grease Mark that show fat is present. <p>Re: Proteins</p> <ul style="list-style-type: none"> Proteins contain CHON. Proteins are made of Amino-Acids. Amino-acids is divided into Dipeptide, Tripeptide and Polypeptide. We use Millon reagent for test present of protein. Results, colour change into brick-red. It shows us there is a present of proteins.

	<p>Re: Carbohydrates</p> <ul style="list-style-type: none"> • Carbohydrates contain CHO. • Carbohydrates is divided into Monosacharides, Disacharides and Polysacharides. • Examples of Monosacharides is Glucose, Fructose, Galactose. • Examples of Disacharides is Sucrose, Maltose, Lactose. • We use Felhings A & B and Benedicts solution for test the present of Starch. • Results Orange Red. <p>Re: Vitamins</p> <ul style="list-style-type: none"> • Vitamins contain CHO. • Examples of Vitamins is Vitamin A, and B <p>Transpiration:</p> <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • Cuticle: If cuticle is thin Transpiration rate increases. If cuticle is thick transpiration rate decrease. • Stomata: When stomata open Transpiration fast. When stomata closed transpiration slow. • Leaf arrangement: When the leaves are vertical transpiration increase. Whe the leaves rossette shape transpiration decrease. • Leaf Area: When leaves are small decrease transpiration. When the leaves are large increase transpiration. <p>: Re: External factors:</p> <ul style="list-style-type: none"> • Wind: When the wind blow transpiration rate increase. No wind transpiration rate decrease. • Temperature: When it is hot transpiration rate increase. When it's cold transpiration rate decrease. • Humidity: When air surround the leaves lots of water transpiration rate decrease. When the air is dry transpiration rate increase. • H₂O in the soil: When little water transpiration rate decrease. When it is lots of water transpiration rate increase.
6. Relevant Information to Topic BUT InCorrect Factual Recall.	<p>Transpiration:</p> <p>Re: External factors</p> <ul style="list-style-type: none"> • Light : When stomata open rate of transpiration can be quicker. When stomata closed rate of transpiration can be slow.
7. Irrelevant Information to Topic.	
8. Unclear Expression of Idea.	
9. Term / Concept used Incorrectly.	

Vuyokazi (VZ) - "Post - CM writing	
Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Organic Compounds:</p> <ul style="list-style-type: none"> Organic Compound are biological compound which contain C, H, O. Examples of Organic compound Carbohydrates, Protein, Vitamin and Fats.
3. Definition (Own Explanation)	<p>Transpiration:</p> <ul style="list-style-type: none"> It is the loosing off H₂O thru the leaves by Stomata. <p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Photosynthesis needs light , CO₂, H₂O , Chlorophyll. Photosynthesis occurs in Thylakoids in chloroplast. Photosynthesis uses CO₂ + Water + Light + Enzymes to make glucose in leaves.
4. Interrelations of Concepts	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> (Respiration) It uses the glucose from the photosynthesis and give CO₂ and H₂O. It also gives off energy in the form of ATP. Plants make the glucose and the cell uses it for energy. Plant need the CO₂ from the cell. The cell need the O₂ from the cell. I think these processes has an important role in plants and animals to produce food and the other one to break down which was made.
5. Relevant Information to Topic & Correct Factual Recall	<p>Organic Compounds:</p> <p>Re: Fats</p> <ul style="list-style-type: none"> Fats are made up of fatty acids and glycerol. Tests for fats we use ether. The result of ether will be grease stain. <p>Re: Proteins</p> <ul style="list-style-type: none"> Proteins can be amino acids Amino acids are divided into Polypeptides and amino acids. Test for proteins we use Millon's reagent. The results will be brick red. <p>Re: Vitamins</p> <ul style="list-style-type: none"> Examples od vitamins A & D etc. <p>Re: Carbohydrates</p> <ul style="list-style-type: none"> Carbohydrates divided into Monosaccharides, Disaccharides Polysaccharides. Monosachharide examples is one sugar eg Glucose. Test for glucose is Fehling's A and Fehling's B or Benedicts solution. The result will be Orange Red. Disaccharides have examples Maltose and Lactose. Polysaccharides have examples Glycogen, Cellulose, Starch. Test for starch is Iodine.

	<ul style="list-style-type: none"> • The result will be blue - black. <p>Transpiration: Re: External factors:</p> <ul style="list-style-type: none"> • Consists of Wind, Temperature, Humidity, Light, Soil in H₂O • Temperature: When a temperature is high transpiration rate increase. When temperature is low transpiration rate decrease. • Soil in water. When there is little H₂O transpiration rate low. When there is too much H₂O transpiration rate high. • Light: During light transpiration rate increase. During dark transpiration rate decrease. <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • Consists of Cuticle, Stomata, Leaf Arrangement, leaf area, Hairs. • Cuticle: can have thick layer cause transpiration rate Decrease. Can have thin layer cause transpiration rate Increase. • Stomata: can have many stomata cause transpiration Increase. Stomata can have sunken cause transpiration Decrease. • Leaf Arrangement: A leaf have small leaves transpiration rate is low. A leaf have big leaves transpiration rate is High. <p>Photosynthesis & Respiration</p> <ul style="list-style-type: none"> • Respiration occur inside the mitochondria. • Respiration take place in the night and day. • (Photosynthesis take place in the day only.)
<p>6. Relevant Information to Topic BUT InCorrect Factual Recall.</p>	<p>Transpiration:</p> <ul style="list-style-type: none"> • Leaf Area: Hair have a low transpiration rate
<p>7. Irrelevant Information to Topic.</p>	
<p>8. Unclear Expression of Idea.</p>	<p>Transpiration: Re: Internal Factors</p> <ul style="list-style-type: none"> • Arrangement of leaf can be vertical when the transpiration rate increase. • Opposite leaf decrease during transpiration rate.
<p>9. Term / Concept used Incorrectly.</p>	<p>Transpiration:</p> <ul style="list-style-type: none"> • Wind When wind is dry transpiration rate increase. • Hairs: When hairs are short transpiration rate Decrease. When hairs are long transpiration rate Increase

Ntombizodwa (NJ) " Post CM Writing

Feature	Examples
1. Alternate Conception/ Alternate Explanation	
2. Recall of Definitions (Verbatim)	<p>Organic Compound:</p> <ul style="list-style-type: none"> Organic Compound are substance usually contain of CHO. Examples of Organic Compound are Protein Fats Carbohydrates and Vitamins. <p>Transpiration:</p> <ul style="list-style-type: none"> Transpiration is the loss of water in the form of water vapour through the aerial parts of the plants.
3. Definition (Own Explanation)	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Photosynthesis occurs in the leaf chlorophyll of a plant. The leaf Chlorophyll needs the sun as Radiant Energy. It needs the water and the Carbon dioxide to make glucose in leaf. It also make the O₂.
4. Interrelations of Concepts	<p>Photosynthesis & Respiration:</p> <ul style="list-style-type: none"> Respiration occur in the mitochondrin of cells . Mitochondrion uses glucose from photosynthesis. Mitochondrion uses the O₂ from the leaf. This they use to make and give off energy which is stored as ATP in cells. Men need glucose from plants and O₂. This was made during photosynthesis process. It is interrelated because respiration needs O₂ and glucose. The plants need respiration for CO₂.
5. Relevant Information to Topic & Correct Factual Recall	<p>Organic Compounds:</p> <p>Re: Proteins</p> <ul style="list-style-type: none"> Proteins contain CHON/P/S. Proteins are made up of 50 amino-acids. Their shape of protein is helix. The test for protein is Millon's reagent and the result is brick-red precipitate. <p>Re: Fats</p> <ul style="list-style-type: none"> Fats contain CHO. Fats made up of 3 fatty acid and glycerol. The test for fats is ether and the results is grease stain. <p>Re: Carbohydrates</p> <ul style="list-style-type: none"> Carbohydrates contain CHO. Carbohydrates consists of three sugar which is Monosaccharides, disaccharides and Polysaccharides. The example of monosaccharides glucose, fructose and galactose. The test for glucose is benedict solution and fehling's A and B and the result is Orange red. The example of disaccharides is Sucrose, Maltose and Lactose. The examples of polysaccharides is Starch, Cellulose and Glycogen. The test for starch is Iodine . The results is blue black.

	<p>Re: Vitamins</p> <ul style="list-style-type: none"> • Vitamins contain CHO. • The examples of vitamins are A, B and C. <p>Transpiration:</p> <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • Cuticle: Cuticle can be thick - will decrease the transpiration rate. Thin cuticle will increase in transpiration rate. • Leaf area can be large when the transpiration rate increase. Small leaf area decrease during transpiration rate. • Hair have decrease in transpiration rate. <p>Re: External factors:</p> <ul style="list-style-type: none"> • Humidity can be high when transpiration rate decrease. Low humidity increase during transpiration rate. • Wind can be blow when transpiration rate increase. No wind decrease during transpiration rate. • Temperature: Can be hot when the transpiration rate increase. Dry temperature decrease during transpiration rate. • Light: Can be light when Transpiration rate increases. Dark light decrease in transpiration rate.
<p>6. Relevant Information to Topic BUT InCorrect Factual Recall.</p>	<p>Transpiration:</p> <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • Stomata can be open when the transpiration rate increase. Close stomata decrease during transpiration rate.
<p>7. Irrelevant Information to Topic.</p>	
<p>8. Unclear Expression of Idea.</p>	<p>Transpiration:</p> <p>Re: Internal factors:</p> <ul style="list-style-type: none"> • Arrangement of leaf can be vertical when the transpiration rate increase. Opposite leaf decrease during transpiration rate.
<p>9. Term / Concept used Incorrectly.</p>	

Appendix F



AN
Science Language Writing Item Analysis

Feature	Organic Compounds		Transpiration		Photosynthesis & Respiration	
	Pre	Post	Pre	Post	Pre	Post
Writings						
Number of Sentence Constructs	6	15	6	20	6	11
1. Alternate Conception/ Alternate Explanation						
2. Recall of Definition (Verbatim)		1	1		2	
3. Definition (Own Explanation)						5
4. Interrelation of Concepts		3				4
5. Relevant Information to Topic & Correct Factual Recall.		14	2	13	1	2
6. Relevant Information to Topic BUT Incorrect Factual Recall			1			
7. Irrelevant Information	5					
8. Unclear expression of Idea.					1	
9. Term/ Concept used Incorrectly.			1	4		

ZM
Science Language Writing Item Analysis

Feature	Organic Compounds		Transpiration		Photosynthesis & Respiration	
	Pre	Post	Pre	Post	Pre	Post
Writings						
Number of Sentence Constructs	3	23	3	23	22	11
1. Alternate Conception/ Alternate Explanation						
2. Recall of Definition (Verbatim)		2	1		14	
3. Definition (Own Explanation)						2
4. Interrelation of Concepts					4	5
5. Relevant Information to Topic & Correct Factual Recall.		20	1	14		2
6. Relevant Information to Topic BUT Incorrect Factual Recall			1	3		
7. Irrelevant Information						
8. Unclear expression of Idea.	2			1		
9. Term/ Concept used Incorrectly.		1		1		

WS
Science Language Writing Item Analysis

Feature	Organic Compounds		Transpiration		Photosynthesis & Respiration	
	Pre	Post	Pre	Post	Pre	Post
Writings						
Number of Sentence Constructs	28	25	22	23	15	16
1. Alternate Conception/ Alternate Explanation	2				2	
2. Recall of Definition (Verbatim)		1	1	1		2
3. Definition (Own Explanation)						
4. Interrelation of Concepts					4	
5. Relevant Information to Topic & Correct Factual Recall.	12	18	5	14	2	12
6. Relevant Information to Topic BUT Incorrect Factual Recall	4		2			1
7. Irrelevant Information	4		2			
8. Unclear expression of Idea.	2		1			
9. Term/ Concept used Incorrectly.						

EM
Science Language Writing Item Analysis

Feature	Organic Compounds		Transpiration		Photosynthesis & Respiration	
	Pre	Post	Pre	Post	Pre	Post
Writings						
Number of Sentence Constructs	6	22	6	20	11	12
1. Alternate Conception/ Alternate Explanation						
2. Recall of Definition (Verbatim)	1	2	1	1	10	
3. Definition (Own Explanation)			1			6
4. Interrelation of Concepts						5
5. Relevant Information to Topic & Correct Factual Recall.		17		16		
6. Relevant Information to Topic BUT Incorrect Factual Recall				2		
7. Irrelevant Information	2		4			
8. Unclear expression of Idea.						
9. Term/ Concept used Incorrectly.						

VZ
Science Language Writing Item Analysis

Feature	Organic Compounds		Transpiration		Photosynthesis & Respiration	
	Pre	Post	Pre	Post	Pre	Post
Writings						
Number of Sentence Constructs	25	23	18	23	14	13
1. Alternate Conception/ Alternate Explanation						
2. Recall of Definition (Verbatim)	1	2				
3. Definition (Own Explanation)			1	1		2
4. Interrelation of Concepts					3	6
5. Relevant Information to Topic & Correct Factual Recall.	9	16	1	14	3	3
6. Relevant Information to Topic BUT Incorrect Factual Recall	3		4	1		
7. Irrelevant Information	7		3			
8. Unclear expression of Idea.	1		1		2	
9. Term/ Concept used Incorrectly.			1	3		

NJ
Science Language Writing Item Analysis

Feature	Organic Compounds		Transpiration		Photosynthesis & Respiration	
	Pre	Post	Pre	Post	Pre	Post
Writings						
Number of Sentence Constructs	5	18	7	22	7	12
1. Alternate Conception/ Alternate Explanation						
2. Recall of Definition (Verbatim)		1	1	1	1	
3. Definition (Own Explanation)					2	4
4. Interrelation of Concepts						8
5. Relevant Information to Topic & Correct Factual Recall.		17		13		
6. Relevant Information to Topic BUT Incorrect Factual Recall	1			2	1	
7. Irrelevant Information	1					
8. Unclear expression of Idea.	2		4	2	3	
9. Term/ Concept used Incorrectly.						

The logo of the University of the Western Cape, featuring a classical building facade with a pediment and columns.

Transcripts of Interviews

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GO

<http://etd.uwc.ac.za/>

Transcript: Ayanda N.

SD: All right Ayanda, you had a chance to look now at the before and after writing., okay
Are there any differences between the way you wrote the first piece and the way you wrote the second piece ?

A.N: Yes there is a difference, Sir, because the first one has short description and the second one has long description.

SD: Has a longer description. Okay.

SD: What do mean here when you say that the Organic compounds are divided into two ,
Macro and micro compounds ?
Is there something called a macro compound?

A.N: No.

SD: And when you defined organic compounds in the second writing what do you say there?

A.N: In the second writing. I say that organic compounds is a compound that contains the element Carbon, Hydrogen and Oxygen.

S.D: Carbon, Hydrogen and Oxygen.
So which one was correct there?

A.N: The first one , eh the second one.

S.D : But why do you think you wrote it wrong in the first one ?

A.N: Because organic compounds are not divided in macro and micro compounds.

S.D: But where did you get that information from when you wrote it the first time ?

A.N: I think I have had heard this information wrong in agriculture.

S.D: mmhm

Are there any other differences that you noticed the way you wrote before and the way you wrote after ?

A.N: In the first one I have write only the points and I did'nt, I did not discuss them.

SD: Okay

A.N: In the second one I write them ,then I discuss them.

SD: If we look at the other topics for example as well which was Transpiration, do you notice any differences there , you way you wrote before and the way you wrote after?

AN: In the first one I only write the short description as the first one and in the second one I write long description and all the information.

SD: All right you say the first one you just write down...

AN: the short description.

SD: Short description

AN: and the second one I write the long description.

SD: And in the last topic which was photosynthesis and Respiration?
Do you notice any differences there ?

AN: In the last topic , I only write the facts. I divide the photosynthesis and respiration.
But in the second one I write both together as they are interrelated.

SD: Hmm. Now what do think, what , if you now look at the writing, your first piece of writing that we did right at the beginning when I saw you, and you look at the writing that you've done afterwards . What do think , what caused this difference for you to write the way you did in the first piece of writing , and caused you to write the way you did in the second piece of writing ?

A.N: I think the concept maps have done it to do like this....

SD: Hmm.

AN: cause in the second one I was not writing very clearly and

SD: In the which one ?

AN: In the first one . In the second one I was writing very clearly and I writing in points as it is.

SD: Hmm.

AN: That means that it the concept maps made me to improve a lot.

SD: So how did you think concept mapping helped you to write , to write ?

AN: The concept maps have helped me to write because in the , when you are doing concept maps you are just write the concepts and factors then you

SD: All right. For example okay lets see . Lets look at one of the maps that you drew.
There was the one on transpiration . How did you use this map to write your essay from?

AN: Firstly I write the definition of transpiration , then I write the external factors , I discuss the external factors, then I finish discuss the external factors. Then I write the external factors , then I finish to write the external factors.

SD: Now where did you get all this information from to write from, like your external factors and your internal factors, where did it come from ?

AN: Since I had made the concept map , I get all that information from the concept map.

SD: From the concept map... Okay

SD: Did concept mapping by any , in any way helped you to learn other topics or other subjects that you are doing this year, to learn it better ?

AN: Yes Sir, it had helped me much to .. from other subjects and to other chapters.

SD: In what way?

AN: Because a concept map is easy to read it and is easy to do the concept map. It improves the standard of reading and writing.

SD: Ok , you said , it standard of writing , what do you mean, I mean reading. What do you mean when you say reading , it helped you to read better.?

AN: Because when you are doing transpira, when you are doing concept map , we do not forget the information that you have written and write when you were doing the concept map.

SD: How does it help you to remember things ?

AN: It helps you to remember things because when you are doing concept maps you separate other things from the other things then you deal it separately for example maybe external factors and internal factors that make you do not forget what you have to do.

SD: Hmm. Would you say that concept mapping helps to organise before you write ?

AN: Yes.

SD: In what way ?

AN: Because when you have done concept map, then it , the time of writing an essay arrive , how you are going to do , you are going to remember what you have done in the concept map, then when you have organised all the information you start to write all the information will flow in your brain in your mind, then you write all the information that you have.

SD: Mmm. Okay . Thanks.



Transcript : Zoleka M.

SD: Zoleka Matywywa. You had a chance to look at your writing before and this writing after, okay ?

Do you notice that there are any differences between the two writings that you wrote ?

ZM: Yes. I noticed a difference.

SD: What difference do you notice ?

ZM: Before it is short and it is not clear .

SD: What do you mean by clear ?

ZM: It is not sense.

SD: You say there is no sense. What do you mean by no sense ?

ZM:

SD: In the pre you are saying that the organic compounds are the living organisms eg. plants , animals grass.
Compounds are always twice such as hydrogen and oxygen.

You say ...

What would you say that sentence says? Is it a clear idea or what ?

When you're saying compounds always twice such as hydrogen and oxygen.

ZM: It is not clear.

SD: It is not clear , okay ?

And in the writing afterwards..... the second one ?

ZM: It is longer and clear .

SD: It is longer, and what else ?

What else do you notice ?

ZM: It is in point form.

SD: It is in point form . What do you mean by point form ?

ZM:

SD: By point form what do you mean by point form? Do you mean point to be a heading ?

ZM: Yes.

SD: The sentences are ?

ZM: are short.

SD: are short. Okay .

I see here in your post writing that you are writing everything under a specific - everything that's got to do with the same thing together . Do you notice that ?

ZM: Yes .

SD: Here you got proteins , you discussing everything about proteins, Vitamins - everything about vitamins, fats - everything about fats, and then everything about carbohydrates - and it is all together . Okay you agree with me ?

ZM: Yes.

SD: Okay. If we look at some of the other writings that you've done as well ,..... you look on the one of transpiration , that's the pre , and the post, okay?

What do you notice about your pre writing about transpiration ?

ZM: It is short.

SD: It is short. What else ?

It is short.

I see here you give the headings for the internal factors and the external factors but you didn't explain it, why not ? in the pre writing .? Why didn't you explain it in the pre writing ?

ZM: I don't understand the way

SD: You don't understand ?

ZM: I don't understand the way you discuss

SD: You don't understand the way you discuss, okay.

Cause I see here in the post writing that you've actually - you've got your internal factors and you've got your external factors separately.

And then under each one you've got the factor and the explanation

ZM: Yes ...

SD: for that specific factor, okay ?

And if we look at the last one for photosynthesis and respiration .

SD: All right , what do you notice about your pre writing and your post writing ?

Right so if we look at the writing pre and post on photosynthesis and respiration , what do you notice ?

ZM: In the first one I do not write about photosynthesis and respiration together, I write separately.

SD: Mmm. So what did you put under respiration here ? Just the ?

Are these the importances of respiration and the importance of photosynthesis ?

ZM: Yes.

SD: But what do you notice in the post ?

ZM: The post I notice that I write photosynthesis and respiration together .

SD: Together ?

Okay .

So Zoleka , what do you think caused this difference ? What caused you to change the way you wrote before and how you wrote afterwards ? What do you think caused this difference in the way you wrote ?

ZM: The first differences caused by I don't understand

SD: When you say understand what do you mean by understand ?

ZM: I don't know the way of concept maps

SD: You didn't know concept mapping ?

ZM: Yes.

SD: So how do you think that concept mapping helped you to write better ?

ZM: Concept maps is better

SD: This is your concept map now okay ?

ZM: Yes.

SD: And mmm ,how do you think this concept map helped you to write better afterwards?

ZM: Concept map is better because I it is easy to write an essay

SD: Mmm. Easy to write an essay How?

How does this help you to write an essay better ?

So how do you think this concept mapping exercises actually helps you to write better ?

ZM: Concept maps is better because firstly you organise the ideas .

SD: For example if we look the Organic compounds here you said the organic compounds are divided into fats, proteins, carbohydrates and vitamins, okay ?

ZM: Yes.

SD: And if I look at your post writing now , I can see that you discussed all the fats underneath each other - together . All the proteins together - etc.

So you think - did this kind of structure help you to organise your ideas better before you wrote ?

ZM: Yes.

SD: Okay.

So how did you actually go about answering the question ?

ZM: You firstly looking at the map, and write essay by using these linking words.

SD: So have you actually used this concept mapping - did you see this concept mapping ?

Have you used this concept mapping in other topic or studies that you're doing ?

Is concept mapping actually helping you to learn things better ?

ZM: Yes.

SD: In what way ?

ZM:

SD: In other words how do you think concept mapping is helping you to learn better ?

ZM:

When you have done the concept map, you are looking at those answers when you write.

SD: Hmm. So what you saying is, before you write your essay you can actually see all the things that you must talk about or write about before you actually do start writing ?

ZM: Yes.

SD: Okay. Have you used concept mapping in the exam ?

ZM: Yes I used concept map.

SD: Did you find it useful for answering a question?

ZM: For answering transpiration.

SD: For answering transpiration ?

ZM: Yes.

SD: So did you have to draw a map in the exam - a rough map somewhere ?

ZM: Yes.

SD: And it helped you ?

ZM: Yes.

SD: Okay.



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Transcript Eunice M.

SD: Eunice Masinini let's go for it. Okay. You've read through the pre-test questions, right, and you looked through the posttest questions, okay. Do you notice any difference the way you wrote before and the one after ?

EM: It is short.

SD: You noticed. What did you notice ?

EM: In the pre writing it is not clear and is short.

SD: What do you mean by clear ?

EM: I did'nt writing in point form.

SD: You did'nt write in point form. What else ?

You said it was short. What do you mean by short ?

EM: I not finish write.

SD: You did'nt finish write, so did you cover everything that you wanted to cover ?

EM: No I don't cover everything.....

SD: Okay...

EM: In the post it is clear, and I write in point form and I finish write everything in the post.

SD: And you finish write everything you wanted in the post.?

EM: In the post yes.

SD: Okay, Is there anything else you noticed , the way you wrote before and the way you wrote after ?

Anything you can see just by looking at it, not the content , just by looking at the work.

EM:

SD: Any other topic you want to talk about before and after ? Transpiration and Photosynthesis ?

EM: In transpiration.

SD: In transpiration yes

What about the one in transpiration ? . Lets look at the one .. this was the one before and this one is the one after Okay ? What do you notice there ?

EM: I notice I don't write my answers in point form here .(Points to Pre)

SD: What do you mean by point form ?

EM: Like I mean to ... say ... like internal factors and external factors I don't write internal factors and external factors here ...

SD: So what you saying is that your headings were'nt clear before but your headings were clear afterwards .

EM: Clear Afterwards.

SD: and you wrote just about the things that should be under the headings... is that what you're saying ?

EM: Yes

SD: Okay ...
Anything else ?

SD: This was the pre on photosynthesis and respiration and this was the post after the one which you wrote afterwards . Anything which you want to say about this ?

EM:

SD: Okay , so what do you notice about the photosynthesis and respiration before and after?

EM: In the pre I write the facts but I do not write things together. In the post I write things together .

SD: Together , okay.

Now you know apart from all this now...mmm, okay now , like I said apart from all those things now okay, we've looked at the before and after writing , what do you think caused this difference ?

Before and after what happened and caused you write the way you did after than you did before ?

EM: I did'nt understand.

SD: What did'nt you understand ?

What do you mean when you say you did'nt understand it before ?

EM: Like I don't under like here in before I did not write like this in after because I don't understand how to write an essay on organic compounds, but after I understand how to write .

SD: But what do you mean by that word understand ?

EM: Like I don't understand the question... like example when you say write an essay on organic compounds, like I don't understand how to use words based on organic compounds , like in after when I am talking about organic compounds I must use , I must talk about fats and proteins .

SD: In other words you saying you , before you , the one that you wrote before ... if you look at the one before and the one after, which one looks more organised ?

EM: The after.

SD: The one after ...

EM: Yes.

SD: Okay . Now what do you think caused this for you to be so organised ?
What caused things to be so clear in front of you ?

EM: The concept map.

SD: The Concept Mapping that we've done ,?
Okay

So how do you think this concept mapping helped you to write better ?

EM: I think it helps me because I know how to write or how to use words, how to use words in point form.

SD: When you say in point form ,do you say like mmm,

EM: In order...

SD: In order , headings

EM: In order yes ... and how to use linking words also ...

SD: So how did the linking words help you ?

EM: Linking words helped me to write an essay .

SD: So exactly how did you go about writing from the concept map..... so you drew a concept map, so how did you go about drawing or writing from that concept map ?

All right you have your concept map in front of you there , right, so how did you use this concept map now to write ?

EM: I looked at the headings

SD: Yes. By the heading you mean what ... ,the main ?

EM: The main

SD: The main concept .

EM: The main concept.

SD: Okay, and then you have all these concepts underneath ... so how did you use that when you wrote ?

EM: I first talking about fats, when I finish talk about fats, I talk about proteins , when I'm finish I'm talking about Vitamins and also when I'm finish I talk about carbohydrates.

SD: And in this way what did that help you to do ?

EM: It helped to to write and

SD: Clearly ? or what ?

EM: Clearly

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SD: Clearly and

EM: and understand

SD: Understand.

Okay now if you look at this map for example now right, you say it helped to to understand . What did that mean.?

Here you've got fats . We busy with the concept map on organic compounds, right. You got your fats, and then you said that the fats consists of, or is made of fatty acids and glycerol right? , and when you want to test for that fats you use ether and the results will be a grease stain, okay?

So you say understand, how did that now help you to make you understand fats better ?

EM: It's the Concept map.

SD: It's the concept map , yes, but you had to break it down into it's smaller pieces. Can you see here ?

The fat is the big thing, smaller components , and then you talk about how to test for it.

EM: Okay.

SD: Okay . If you look at your protein one here you say the proteins can be amino-acids which are then divided into di peptides and poly peptides. And then you go on to talk about the test for proteins and what the results will be.

Again I can see here that you are breaking it down from something which is big to

EM: to small

SD: To small.

And do you think that helped you to understand the things better?

EM: Yes.

SD: when you did the other concept maps ?

EM: Yes I think I understand it ... it helped me.

SD: Right, do you think that concept mapping actually helped you to learn topics better ?

EM: Yes.

SD: In what way ?

EM: Because I don't think too much ...

SD: When you say you don't think too much what do you mean ?

EM: It means that if I learn about a topiclike for example Endocrine , I won't notice the important words

SD: The important concepts .

EM: The important concepts before and I draw my concept map and break into smaller

SD: Into smaller bits,

EM: Into smaller bits

SD: from the big ideas to the smaller ideas.

EM: from the big ideas into the smaller ideas. And I look at my linking words and I start to practice my essay.

SD: Have you used concept mapping in the exam ?

EM: Yes.

SD: that you wrote now ?

EM: Yes.

SD: For which topic if you can still remember ?

EM: Transpiration.

SD: So the one on transpiration , question number 5 .

And did you find that it helped you there to ?..... In what way ? It was.....

EM: That question talk about Internal , external I don't remember ?

SD: It was the internal factorsI think.

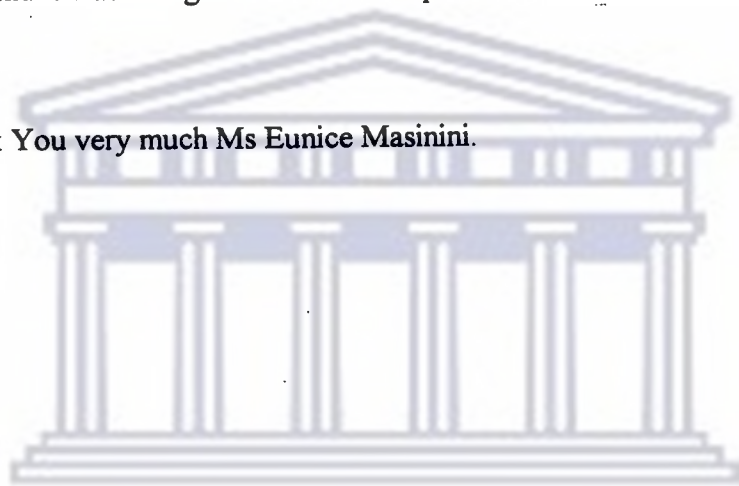
And hmm, did you use a concept map there ?

EM: Yes , I used it

SD: And you found it was all right to answer the question in that way ?

EM: Yes.

SD: Okay Thank You very much Ms Eunice Masinini.



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Transcript : Vuyiseka Z.

SD: All right so you had a chance to look at both those two writings right?

VZ: Hmm.

SD: You had the writing ,the first piece of writing and the second piece of writing, okay?
Were there any differences that you noticed between the two ?

VZ: Yes.

SD: What , what kinds of differences did you notice between the way you wrote the first part ,the first piece and the second piece ?

VZ: The first piece is not clearly there are no linking words ... no linking words and no ways of writing what I am have to say.

SD: When you say that it is not clear, what do you mean ?

VZ: I meanthey are not in right position.

SD: What is not in the right position?

Things like what is not in the right position?

VZ: Like there are no

SD: All right, if you compare the first piece right, with your second piece, I see there here in your second piece you've got Organic Compounds are divided into proteins , then you discuss everything about proteins, right, and then you say that Organic compounds are divided into Vitamins for example, then you discuss the vitamins, then you say in the your next paragraph, organic compounds are divided into carbohydrates and you went to go and explain everything that you know about the carbohydrates, . This is in the second piece of writing .

If we compare that to your first piece of writing , we see you start off by talking about... the test for starch , the test for fats, right ?, and then you've Millon's reagent coming in here. Okay. ?

What do you notice about the way you wrote this stuff here , the topics, and the topics over here in your second piece. ?

VZ: There are no headingsin the first.

SD: There are no. So you say there are no headings in the first piece and in the second

piece?

VZ: There are headings.

SD: There are headings. Okay?

Is there anything else notice about the way you wrote?.

That was the one on organic compounds, right.? Let's have a look at the one on transpiration.

Okay, lets have a look at those two.

Okay if I look at the transpiration one, the first piece now I see here that you talk about give a definition at the beginning, right, and then you say " In transpiration there are three types of transpiration - Root pressure, capillary , suction force" .

Now if you look at that now is that really true what you said there ?

VZ: No.

SD: Hmm?

True or false ?

VZ: True.

SD: The three types of transpiration, Root Pressure, Cappillary and suction force.

And then after that you talk about the internal factors, Wind , Temperature and Humidity, right?

VZ: Yes

SD: Now if you look at the piece afterwards, the second piece that you wrote, what do you notice that's different here?

SD: Headings..

So what do you notice about the one before and after (regarding headings)?

VZ: The first one was too big ... was a lot of things which can see in this and this is a short and they have a meaning .

SD: Right. So what you saying is here in the first piece the stuff is all together, okay,

you've got wind , temperature, humidity and you're discussing them . Whereas in the second piece you've got wind as a heading, temperature as a heading , humidity as a heading, water in the soil as a heading and then you discussed it underneath., Okay.

Do you agree with that ?

VZ: Yes.

SD: If you look at the one on Photosynthesis and Respiration, what do you notice there ?

So what do you notice between the two writings on Photosynthesis . Photosynthesis is the first piece . What do you see there ?

VZ: In the first one I was writing things which are not needed, which are not necessary. There are no headings. In the second one there is things which are needed and are necessary as specified.

SD: So mmm. Once you look at these things now , what would you say , what would you say caused this difference in the way you wrote before, this first piece and the second piece ?

VZ: In the first piece I was writing what I was reading, I not understand but I just read and read and read again and write it. In the second one I was reading and understand and doing concept map and linking words.
That's why they helped me in this essay to write.

SD: When you say understand what do you mean by that word ? You understand it better ?

VZ: I understand what they tell me but not only I think I understand what I am writing.

SD: So do think that concept mapping actually then therefore helped you to write better on these specific topics that we've done ?

VZ: Yes.

SD: In what way ?

VZ: In the way of putting things in their right way and essays .

SD: So how did you use concept mapping to write, for example if you look at one of your

concept maps on say organic compounds ?

How did you go about, You had the question first, right ? , and you drew your map, and then how did you go about from the map now to go and write this piece from there?

SD: Yes....?

VZ: I just looking at the concept maps and the headings and linking words and I just write it.

SD: Hmm.

And what else could you see while you were writing ?

VZ: I see

SD: I can see these arrows going here What does these arrows tell you ?

VZ: They are interconnected with each other.

SD: They are interconnected with each other. Hmm.

Re: Photosynthesis Maps:

SD: But I can see arrows going here between the mitochondria gives off carbon dioxide right, and here you say that chlorophyll uses the carbon dioxide .

Would you say that what you doing here is you are linking what's happening in the mitochondria and what's happening in the chloroplast , the two of them are joined together ?... or have a relation between them ?

VZ: Yes.

SD: Okay And this I can see from your map here

You've also here got mmm...On the map you also have from photosynthesis you got arrows going to respiration again, right ? , Photosynthesis gives the glucose and here you are saying that the respiration

It what ?

VZ: it uses glucose.

SD: It uses the glucose, okay.

Did you find that you also used concept mapping in learning other topics in other subjects that you had ?

VZ: Yes.

SD: How did it help you ?

VZ: It helped me to understand ...things clearly and to write an essays without taking a lot of things just briefly and ...

SD: When you say lot of things what do mean by a lot of things, like mm necessary or unnecessary things ?

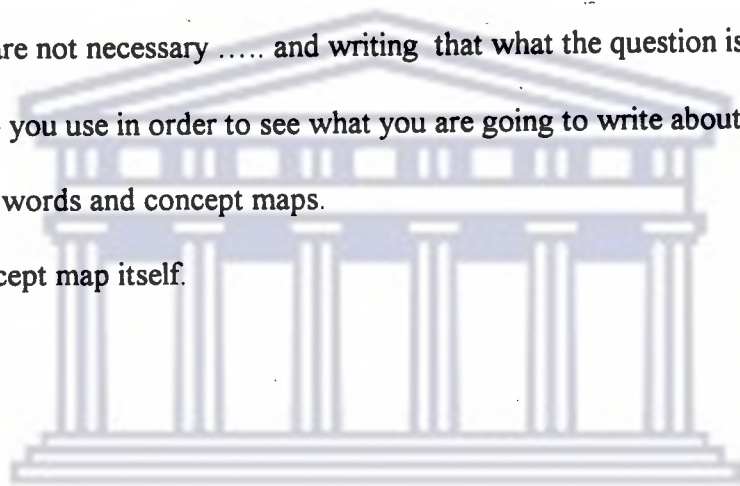
VZ: Things that are not necessary and writing that what the question is asking to do.

SD: And what do you use in order to see what you are going to write about ?

VZ: I use linking words and concept maps.

SD: And the concept map itself.

Okay.



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Transcript : Ntombizodwa J.

SD: All right Ntombizodwa Jantjies , you've now had a chance to look at your writing before and you had a chance to look at your writing after, okay ?.

Do you notice that there are any differences between the writing before and the writing after ?

NJ: Yes I noticed that .

SD: What , what do you notice ?

NJ: My writing before is too short and after it is too long, because I

SD: When you say after it is too long , what do you mean by that ?

NJ: It is too long , cause the after one I know how I write about, and in the before I just write all about that ... all about that I think compound .

SD: Okay.

So would you say you did any planning before you wrote for the before ?

NJ: I not planning , I'm just write

SD: And the after ?

NJ: I'm planned that.

SD: All right you said you planned there .

What else do you notice about the differences in the way the information is presented before and after ?

NJ: After I'm write in point form.

SD: What do you mean by point form ?

NJ: I'm just write about that heading which is there and another just like that . And there (Pretest) I just mixed up.

SD: So in the before you say just mixed everything together . ?

NJ: Yes.

SD: Okay. So what else do you notice ?

We can look at some other writings as well, that's the one on transpiration before and this is the one on transpiration after, okay?

What do you notice here ?

SD: This one here is transpiration before and , transpiration after.

NJ: In transpiration before I just write about transpiration and internal factors and don't not discuss about internal factors and external factors.

And in this transpiration after, I write about transpiration and then I discuss about internal factors what they contains and the external factors.

SD: Hmm. But why do you think you wrote like this before ?

NJ: I just write the factors what is there in transpiration but not explain them.

SD: But why did'nt you explain them, for example.

NJ: I don't understand (laughter) I don't know how

SD: You did'nt know how to explain it ?

You say did'nt understand, what do you mean when you say that you did;nt understand it before ?

NJ: I'm just write and then write

SD: So are you saying

NJ: without understanding

SD: before you wrote you just wrote what came to your mind ?

NJ: Yes.

SD: Is that what you did ?

NJ: Yes.

SD: And afterwards ?

NJ: After I just write and I organise my mind that what is going on in this transpiration

SD: So what do you think caused this difference in the way you wrote before and after ?

NJ: It causes the difference because if you write you must organise what is the thing all about , you don't just writing.

SD: So what did you use to organise your thoughts ?

NJ: You must use the concept map to plan the things what happen and what go on.

SD: Okay . So you say you use the concept map to plan , to plan what ?

NJ: To plan how to write the essay.

SD: Not how to write the essay, but how to

NJ: Write about that headings (Concepts) .

SD: How to write about the headings Transpiration.

So how do you think concept mapping actually helped you then ? to write ?

NJ: It helped me to write because you write just what transpiration is all about .

Because it has linking words and the facts then you must organise how to not write all of them together.

SD: Okay. So how did you go about writing an essay using a concept map?

NJ: I'm writing an essay by using a concept map. You just put the heading

SD: What do you mean by a heading ?

NJ: the topic. And you must plan put the linking words and the first what it contains.

SD: I see.

So just briefly how would you say for example on this organic compound one , how did you go about writing from the concept map ?

NJ: I say organic compounds

SD: For example here proteins

NJ: Proteins - must have how the organic compounds contains about consists of . I say organic compounds consists of proteins and proteins which contains carbon, hydrogen and oxygen, which are made up of 50 amino-acids . The shape of a protein is the helix and the test for protein is Millon's reagent and the result is brick and red precipitate. (This she explained by refering to the map)

SD: And how did you do the next one in the same way ? Under a separate heading.?

NJ: Yes.

SD: Okay.

Did you use concept mapping in the exam ?

NJ: Yes I planned the concept map in the exam but not in the question paper in the answer sheet. In the question paper I planned them but it is too small.

In the question paper they asking how water is transported by into the xylem. I write it is from the root which send water enters from the root to the xylem.

SD: So what kind of map did you use there ? A different kind of map ?

NJ: A different kind of map.

SD: What kind ? A flow map ?

NJ: Flow map ?

Yes.

SD: So do you really think that concept mapping actually changed the way you learn certain topics now or topics in general ?

NJ: Yes it changed it .

SD: In what way ?

NJ: Because first I without a concept map I did'nt plan my essay , I just write it. And in by using concept mapping you must plan the essay.

SD: Okay . Thanks.

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Appendix H

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Transcript Categorisation Analysis

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Interview Transcript	
Features of differences	
A1 Pre Writing:	<p>AN ... the first one has short description. In the first one I have write only the points and I did'nt, I did not discuss them. In the first one I was not writing very clearly</p> <p>NJ My writing before is too short... And there (Prewriting) I just mix up (Information)</p> <p>EM In the pre writing it is not clear and short. I did'nt write in point form (no headings) I not finish write. No I did not finish write</p> <p>VZ The first piece is not clearly and no way of writing what I have to say. There are no headings in the first. The first one was too big (long) (there) was a lot of things.</p> <p>ZM Before it is short and not clear. It is not sense.</p>
A2 Post Writing	<p>ANthe second one has long description. In the second one I write them, then I discuss them In the second one I was writing very clearly and I writing in points as it is.</p> <p>NJ: After it is too long After I'm write in point form. (Headings & Explanations)</p> <p>EM In the post it is clear and I write in point form (headings) and I finish write everything in the post.</p> <p>VZ There are headings.</p>

	<p>And this is short and they have meaning.</p> <p>ZM It is longer. It is in point form. (headings)</p>
Account for differences	
B1 Pre Writing	<p>AN In the first one I only write the short description In the last topic I write only the facts. I divide (the photosynthesis and respiration (discuss them individually)).</p> <p>NJ I not planning I just write. In transpiration before I just write about transpiration and internal factors and don't not discuss about internal and external factors. And in this transpiration after, I write about transpiration and I discuss about internal factors what they contains and external factors. I just the factors what is there in transpiration but not explain them. I'm just write and then write without understanding (what comes to mind) It cause the difference because if you write you must organise what is the thing all about , you don't just writing.</p> <p>EM I notice I don't write my answers in point(under headings) form. In the pre I write the facts but I do not write things together (do not interrelate).</p> <p>VZ In the first one I was writing things which are not needed, which are not necessary . There are no headings. In the first piece I was writing what I was reading, I not understand but I just read and read again and write it.</p> <p>ZM I don't understand the way you discuss In the first one I do not write about photosynthesis and</p>

	<p>respiration together, I write separately (no interrelations) The first differences caused by I don't understand. I don't know the way of concept maps</p>
B2 Post Writing	<p>AN ... in the second one I write long description and all the features. But in the second one I write them both together as they are interrelated.</p> <p>NJ I planned that After I just write and I organise my mind that what is going on in this transpiration.</p> <p>EM: (Headings) clear afterwards. In the post I write things together (do interrelate) In the second one there is things which are needed and are necessary ... as specified.</p> <p>VZ In the second one I was reading and understand and doing concept map and linking words.</p> <p>ZM The post I notice that I write photosynthesis and respiration together (interrelate concepts)</p>
Causes of Writing Differences	
CM	<p>AN I think the concept map have done it to do like this It helps you to remember things because when you are doing concept maps you separate other things from other things then you deal with it separately for eg. Maybe external factors and internal factors, that make you do not forget what you have to do. Because when you have done concept map, then it , the time of writing arrive, how you are going to do, you are going to remember what you have done in the concept map, then when you have organised all the information, you start to write all the information.....</p>

	<p>NJ You must use the concept map to plan the things what happen and what go on.</p> <p>EM: The concept map/</p>
<p>How CM Helped</p>	
<p>D1 Writing</p>	<p>AN: The concept map have helped me to improve a lot Since I had made the concept map , I get all that information from the concept map. It improves the standard of reading and writing.</p> <p>NJ To plan how to write about that concepts. It helped me to write because you write just what transpiration is all about. Because it has linking words and the facts and you must then organise how to (not) write them all together Because first I without a concept map I did'nt plan my essay, I just write it. And in by using concept mapping you must plan the essay.</p> <p>EM I think it helps me because I know how to write or how to use words (concepts) in point form (in an organised way). Linking words helped me to write an essay. It helped me to write clearlyand understand.</p> <p>(para) I draw my concept map and break the concepts into smaller bits from the big ideas into the smaller ideas. And I look at my linking words and then write my essay.</p>

VZ

In the way of putting things in the write way (organise ideas).

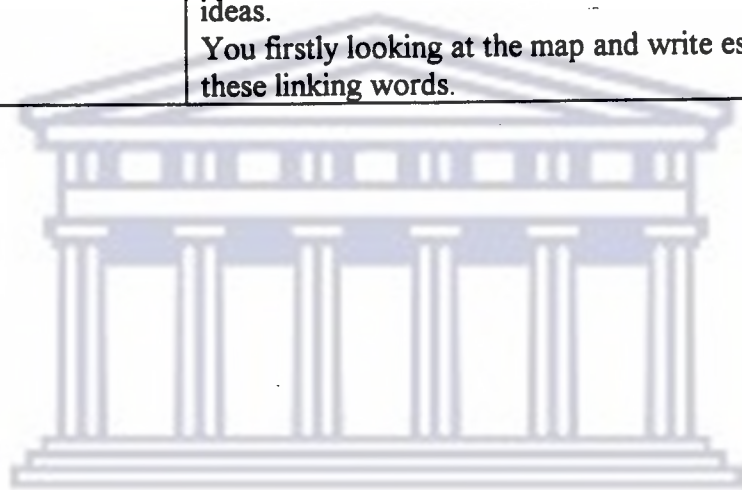
I just looking at the concept maps and the headings(concepts) and the linking words and I just write it.

It helped me to understand clearly and to write an essay without things that are not necessary and writing that what the question is asking to do.

ZM

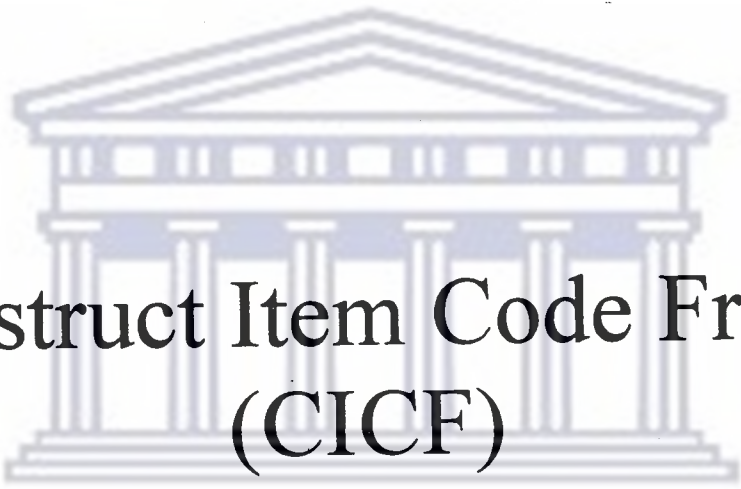
Concept maps is better because firstly you organise your ideas.

You firstly looking at the map and write essay by using these linking words.



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Appendix I

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Construct Item Code Frame (CICF)

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Construct Item Code Frame (CICF)

Feature/ Category	Organic Compounds	Transpiration	Photosynthesis & Respiration
1. Alternate Conception/ Alternate Explanation			
2. Recall of Definition (Verbatim)			
3. Definition (Own Explanation)			
4. Interrelation of Concepts			
5. Relevant Information to Topic & Correct Factual Recall.			
6. Relevant Information to Topic BUT Incorrect Factual Recall			
7. Irrelevant Information			
8. Unclear expression of Idea.			
9. Term/ Concept used Incorrectly.			

Construct Item Code Frame

Criteria/ Delimitation of Features:

Feature	Delimitation
1. Alternate Conception/ Alternate Explanation	Explanation is not true in terms of the acceptable scientific explanation.
2. Recall Definition (Verbatim)	Definition is recalled in the exact form eg from notes or texts.
3. Definition (Own Explanation)	Definition is explained in writer's own words.
4. Interrelate Concepts	Shows interrelation between concepts under discussion.
5. Relevant Information to Topic & Correct Factual Recall.	Uses relevant information to the topic under discussion & Recalls valid facts to substantiate information.
6. Relevant Information to Topic BUT Incorrect Factual Recall.	Uses relevant information to the topic under discussion BUT Recalls Invalid facts to substantiate information.
7. Irrelevant Information.	Uses information which does not have relevance to the topic under discussion.
8. Unclear expression of Idea.	Connections between ideas are confusing or missing
9. Terms / Concepts used incorrectly.	Terms / Concepts used are invalid to describe a particular process.

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Appendix J

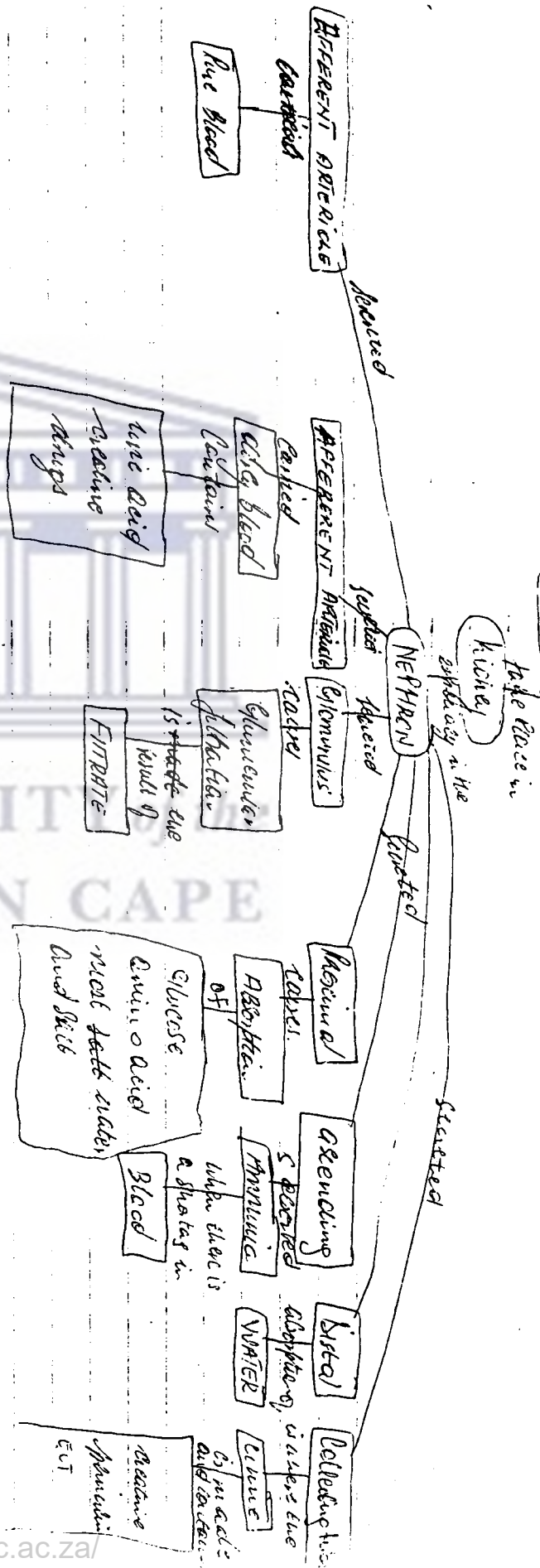


Concept Mapping Training

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EXCRETORY SYSTEM

NEURONS: A

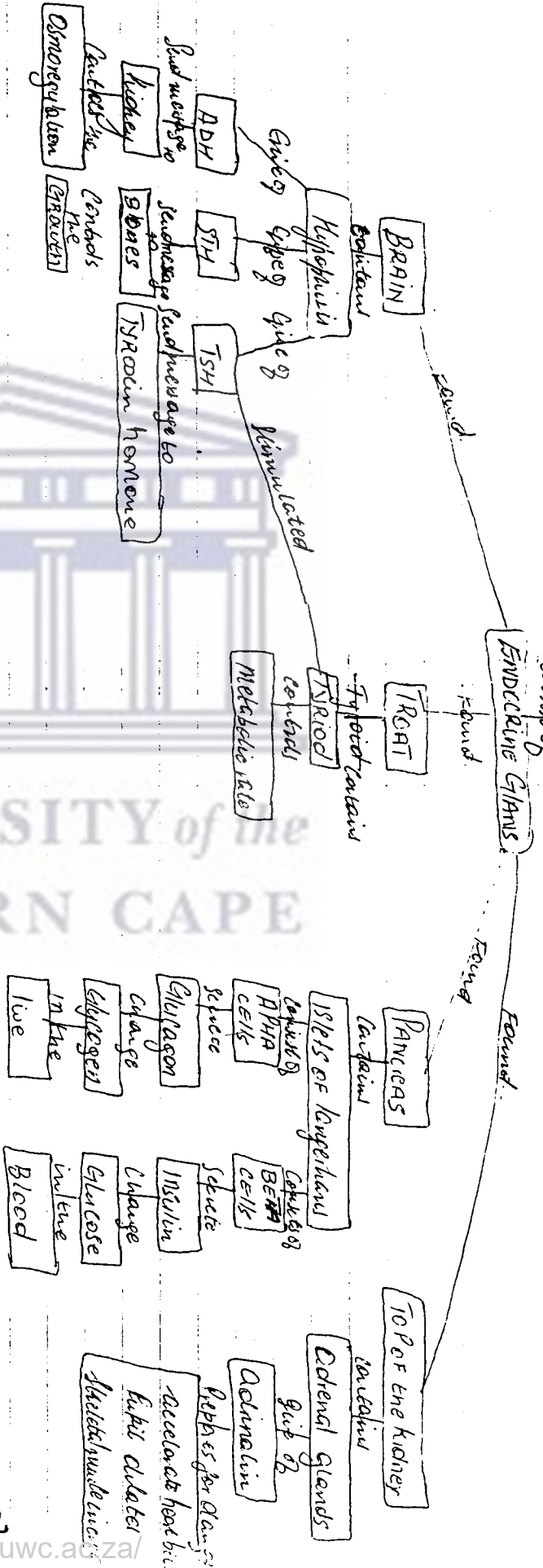


AN

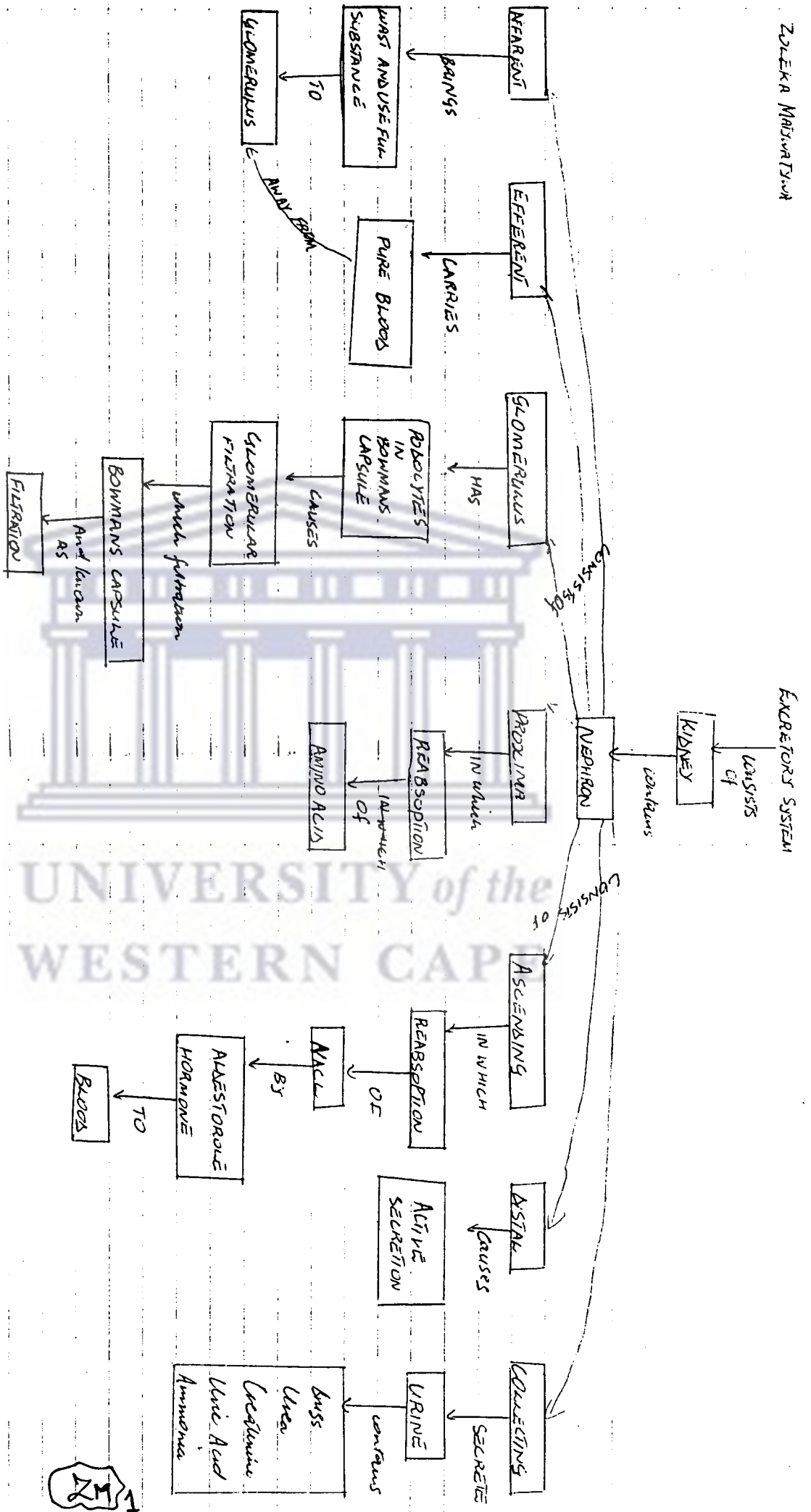
AN 1

ENDOCRINE SYSTEM

F. NEUSMANE



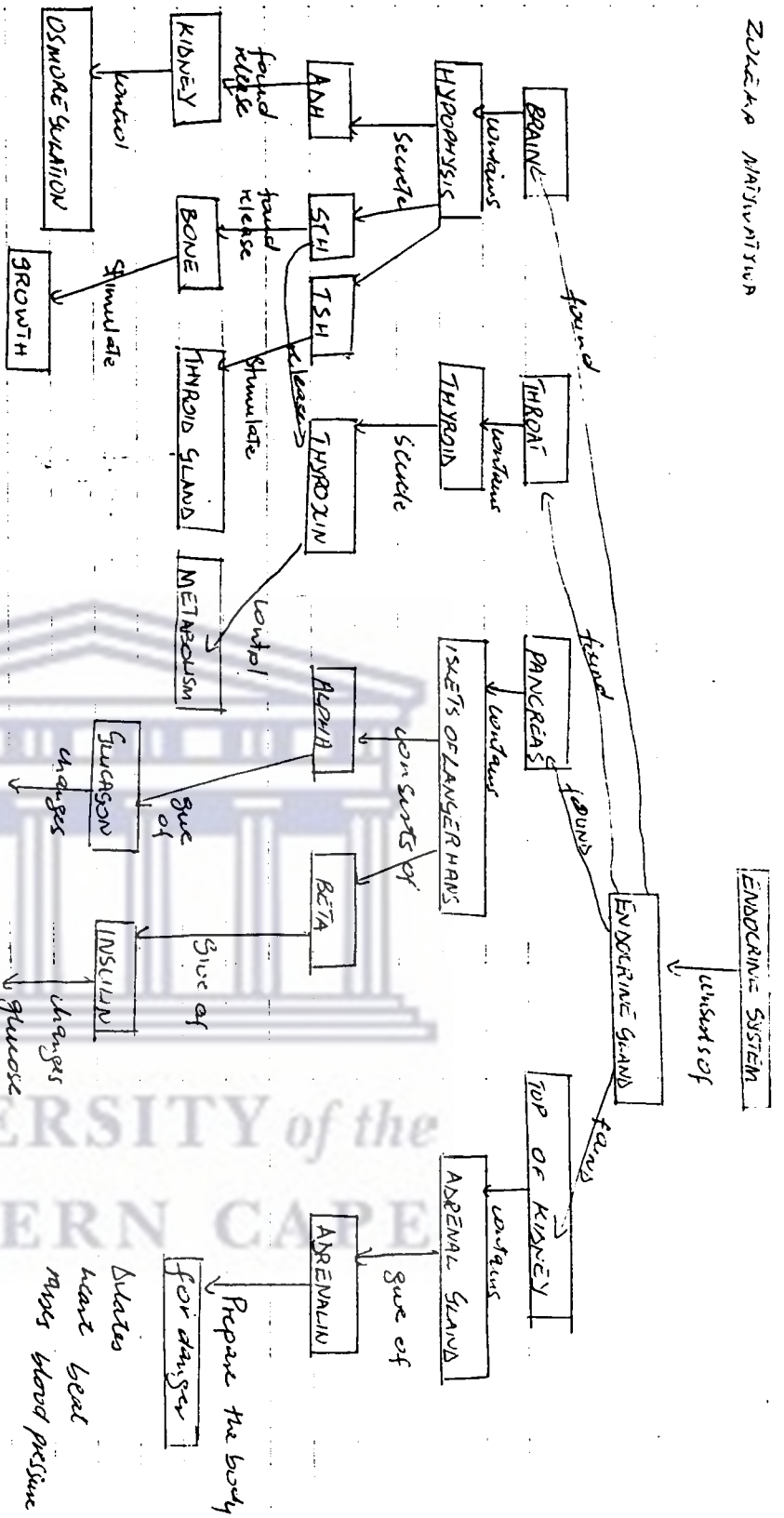
UNIVERSITY of the
WESTERN CAPE



UNIVERSITY of the WESTERN CAPE

24

24



ZM

ZM2

EXCRETORY SYSTEM

consist of

KIDNEYS

consists

NEPHRONS

consist of

APPAREN ARTERIOLE

brings

Waste & useful substances

Glomerulus

EFFERENT ARTERIOLE

carries

Pure blood

carry blood from

Glomerulus

have

PODOCYTES in Bowman's Capsule

causes

Glomerular Filtration

H₂O & Nutrients

Re-Absorption

Amino Acids & Glucose

Re-Absorption

NaCl

aldosterone hormone

Blood is reabsorbed

PROXIMAL CONVULATED TUBULE

ASCENDING LOOP

DISTAL CONVULATED TUBULE

COLLECTING TUBULE

Process

Process

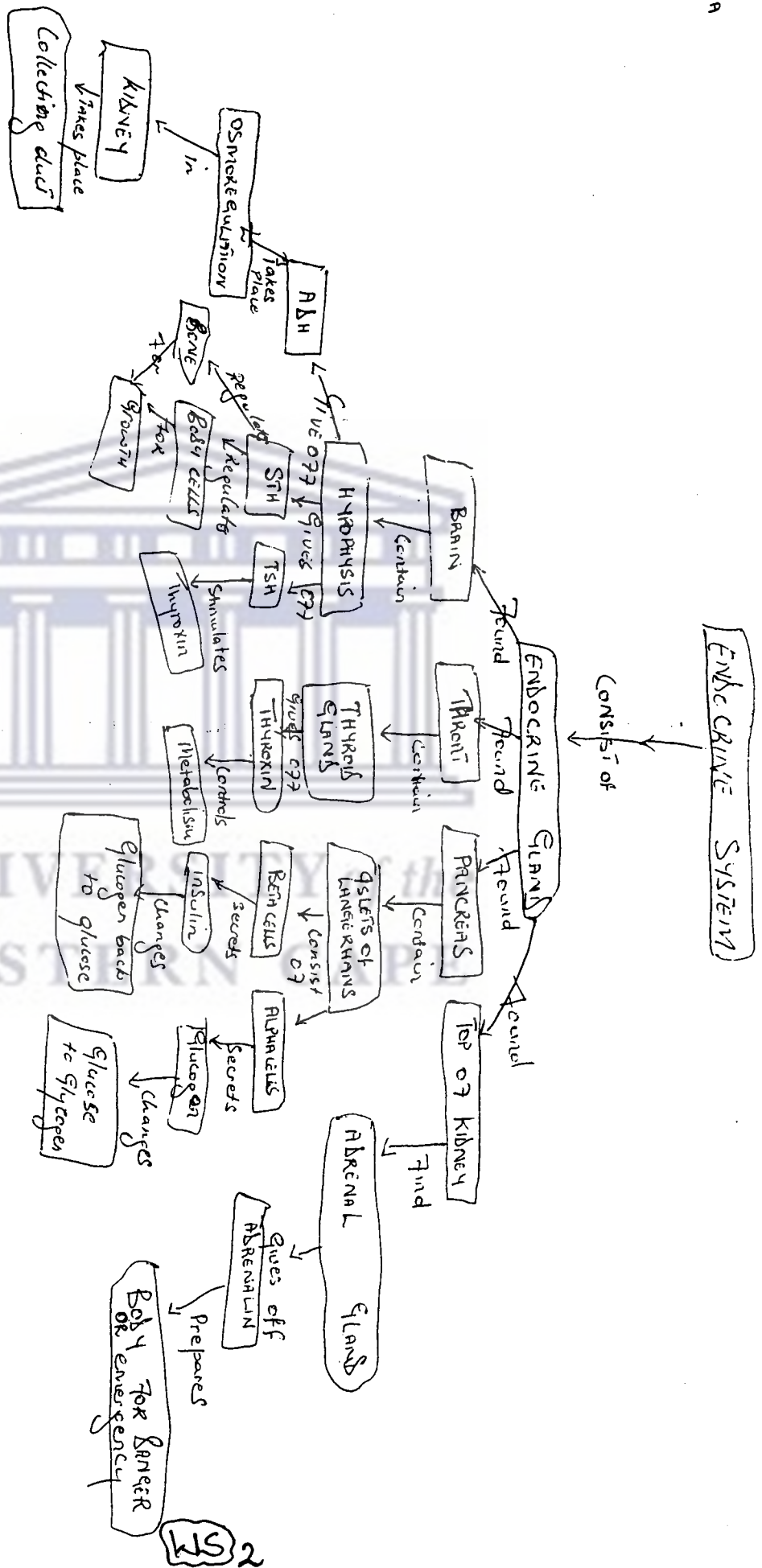
Process

Process

FORMATION OF URINE

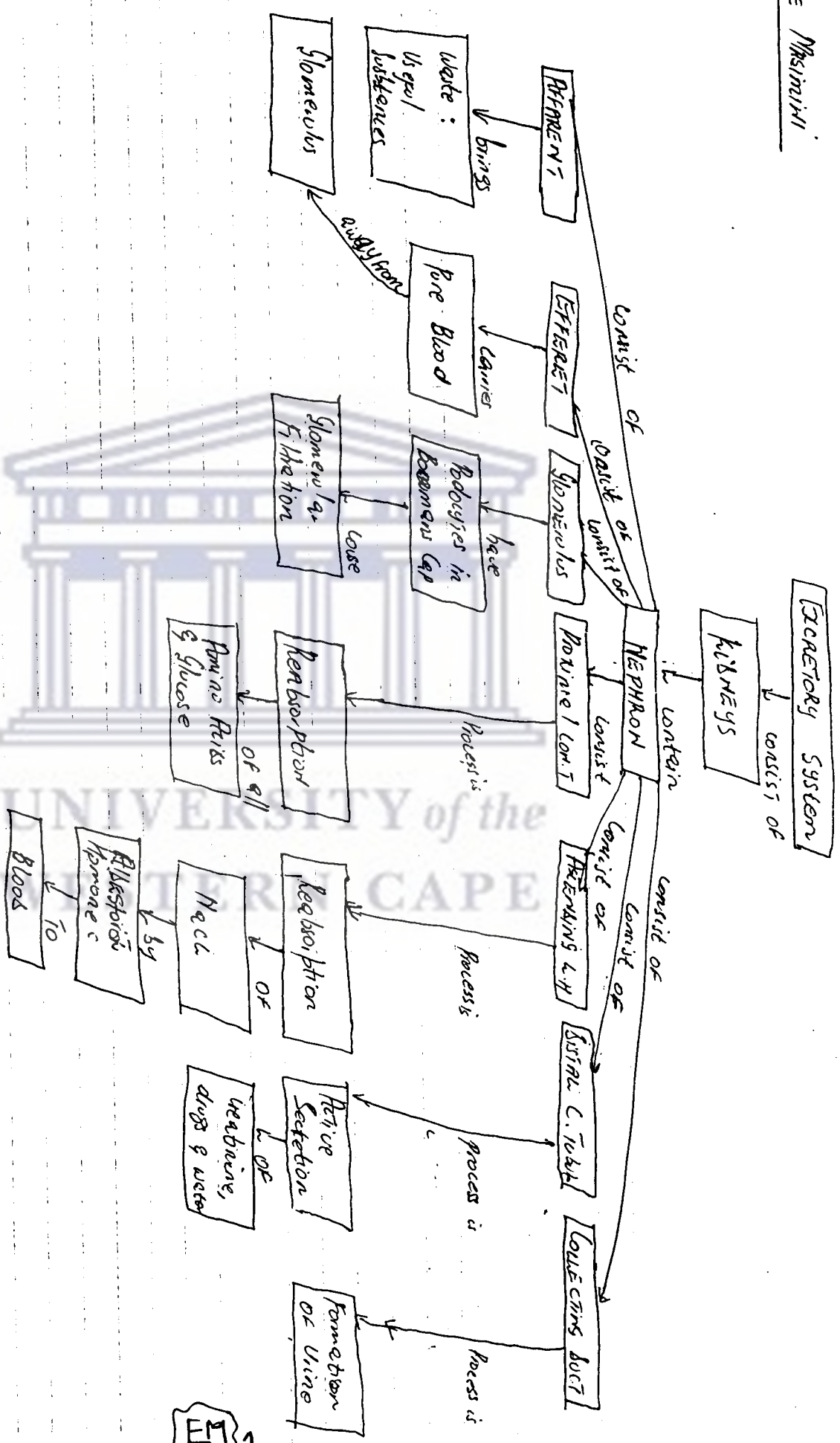
MSM

MS



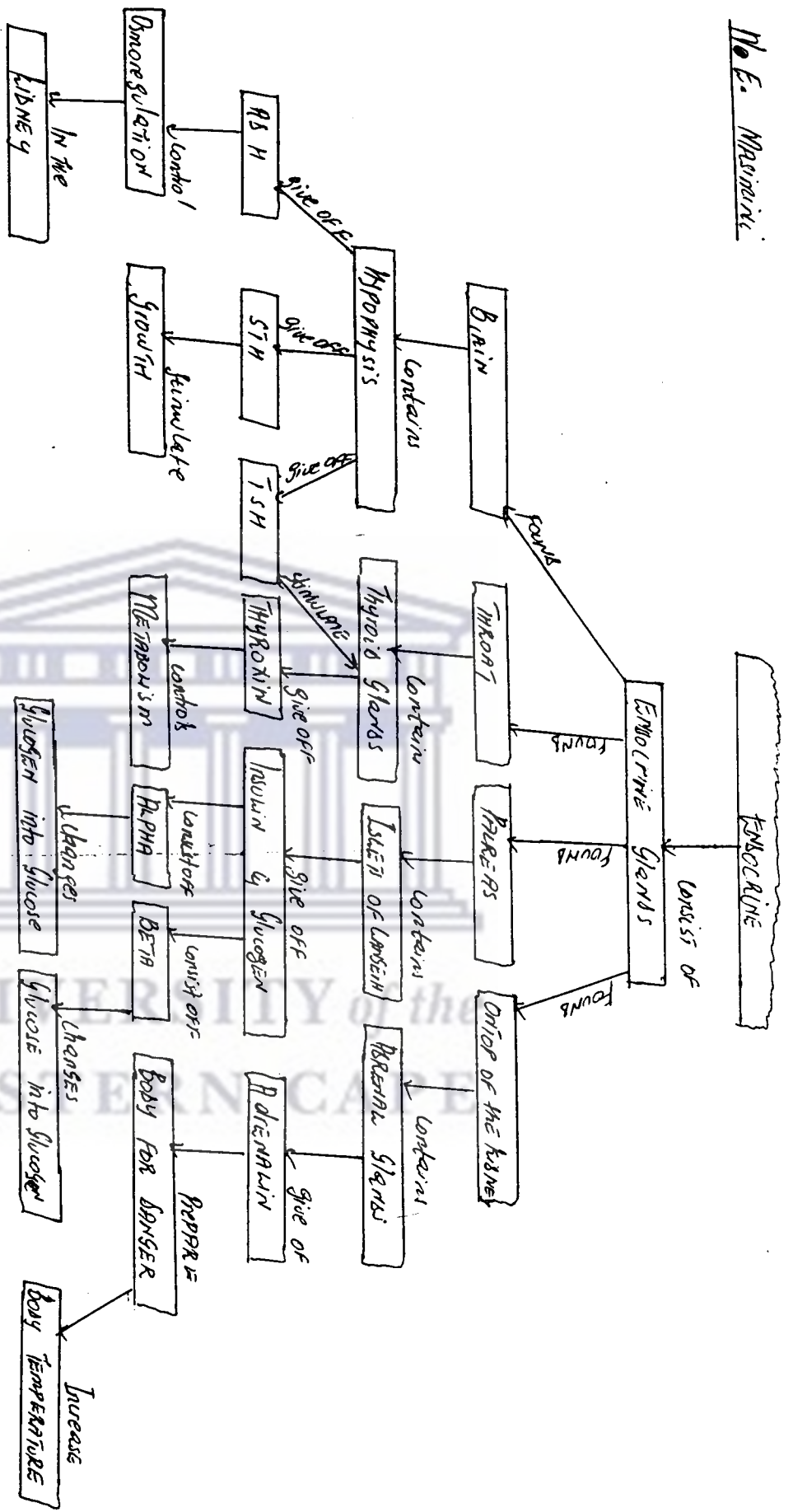
MIS

MS 2



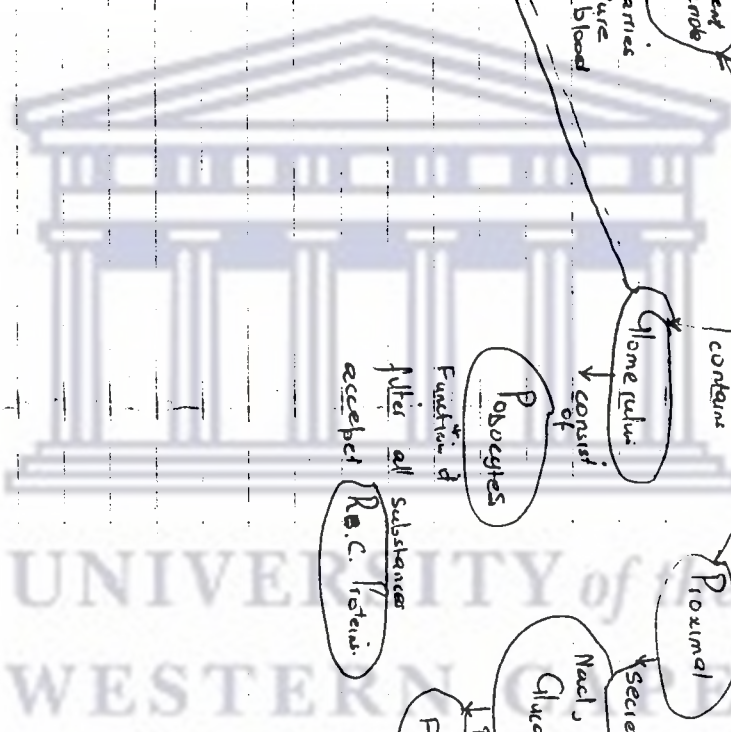
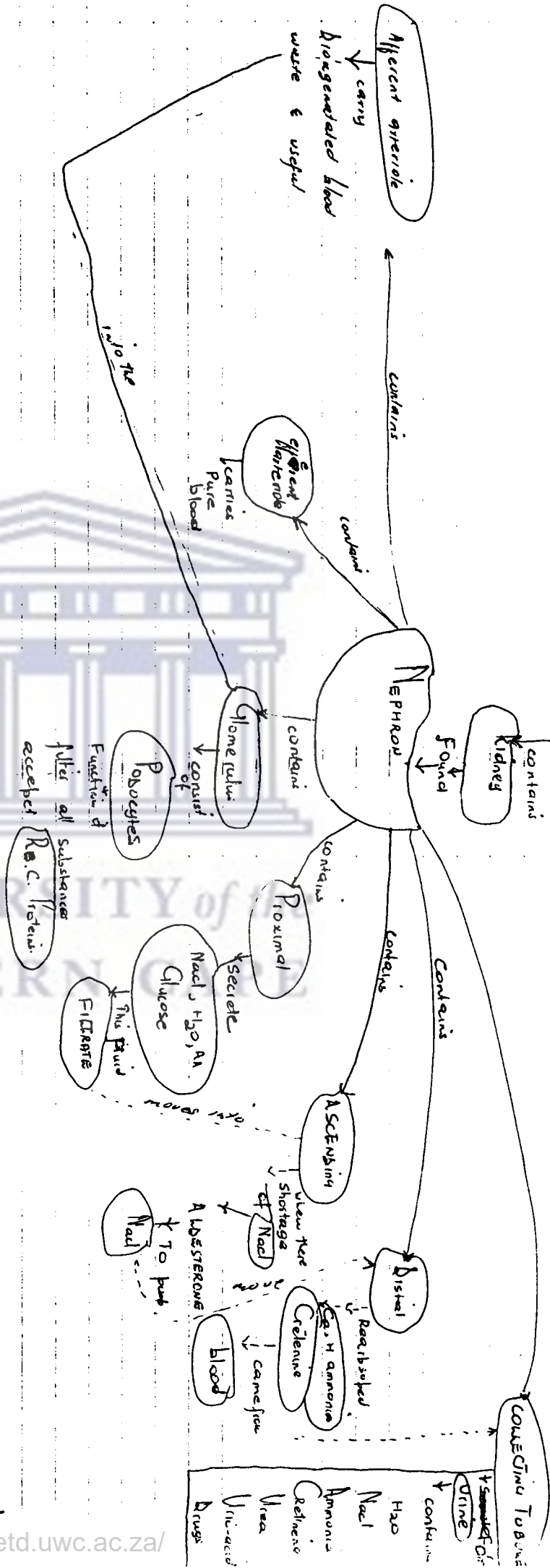
EM

EM



EM1

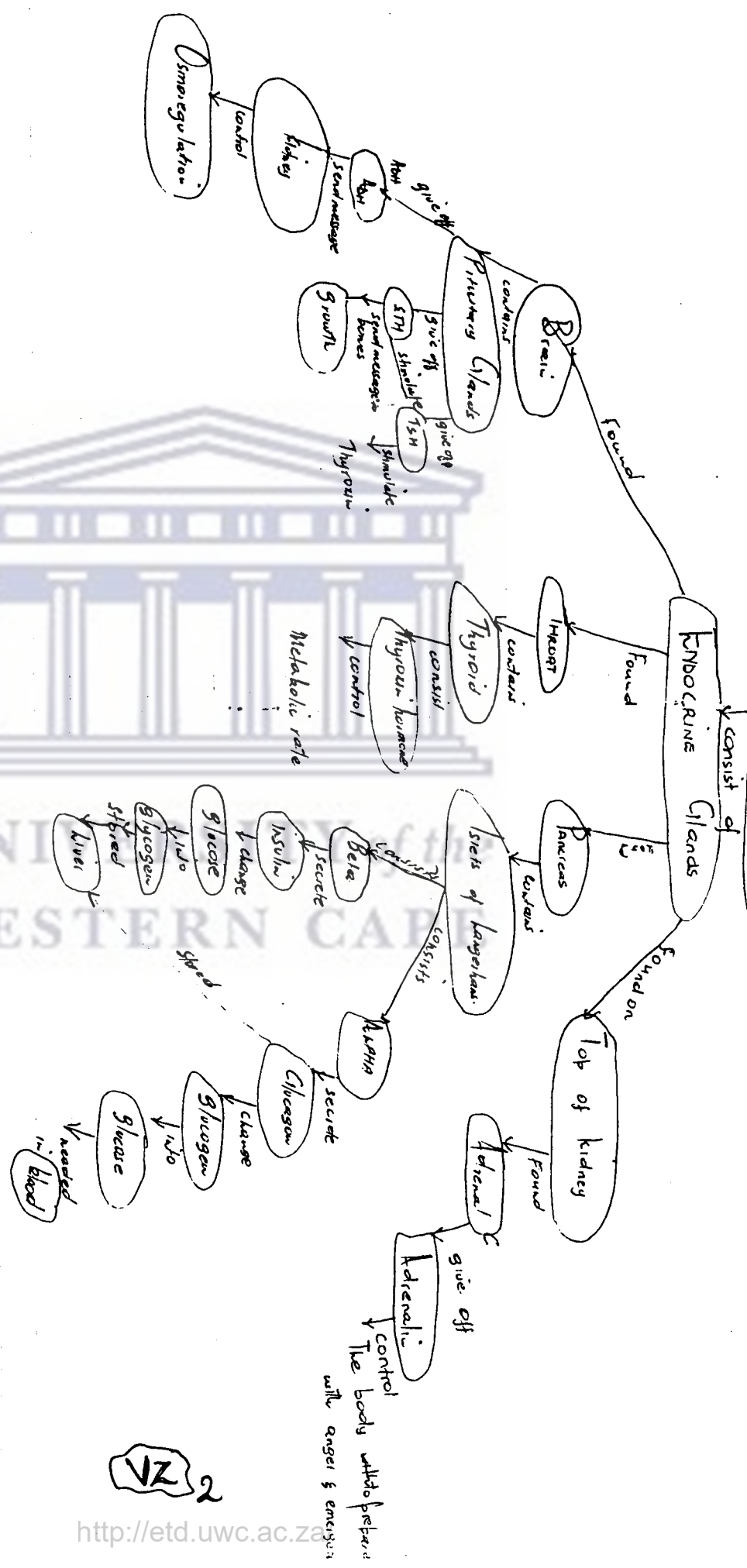
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NZ

NZ

ENDOCRINE SYSTEM

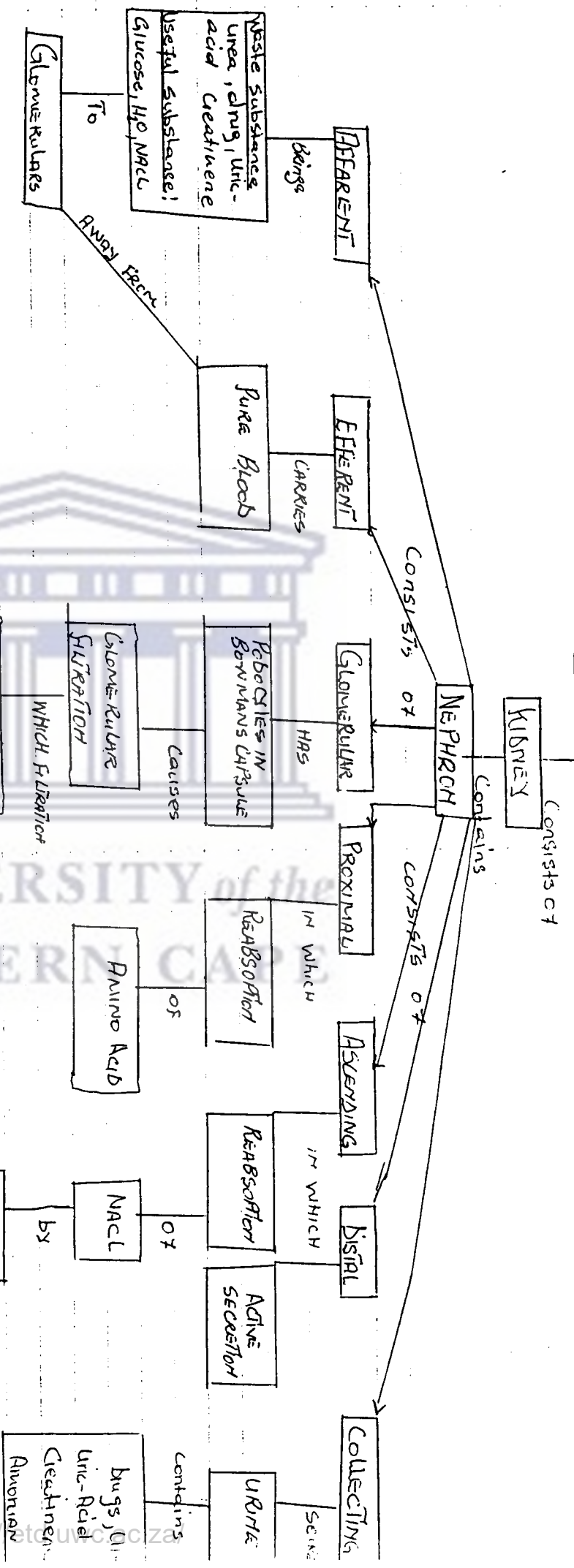


VZ

VZ 2

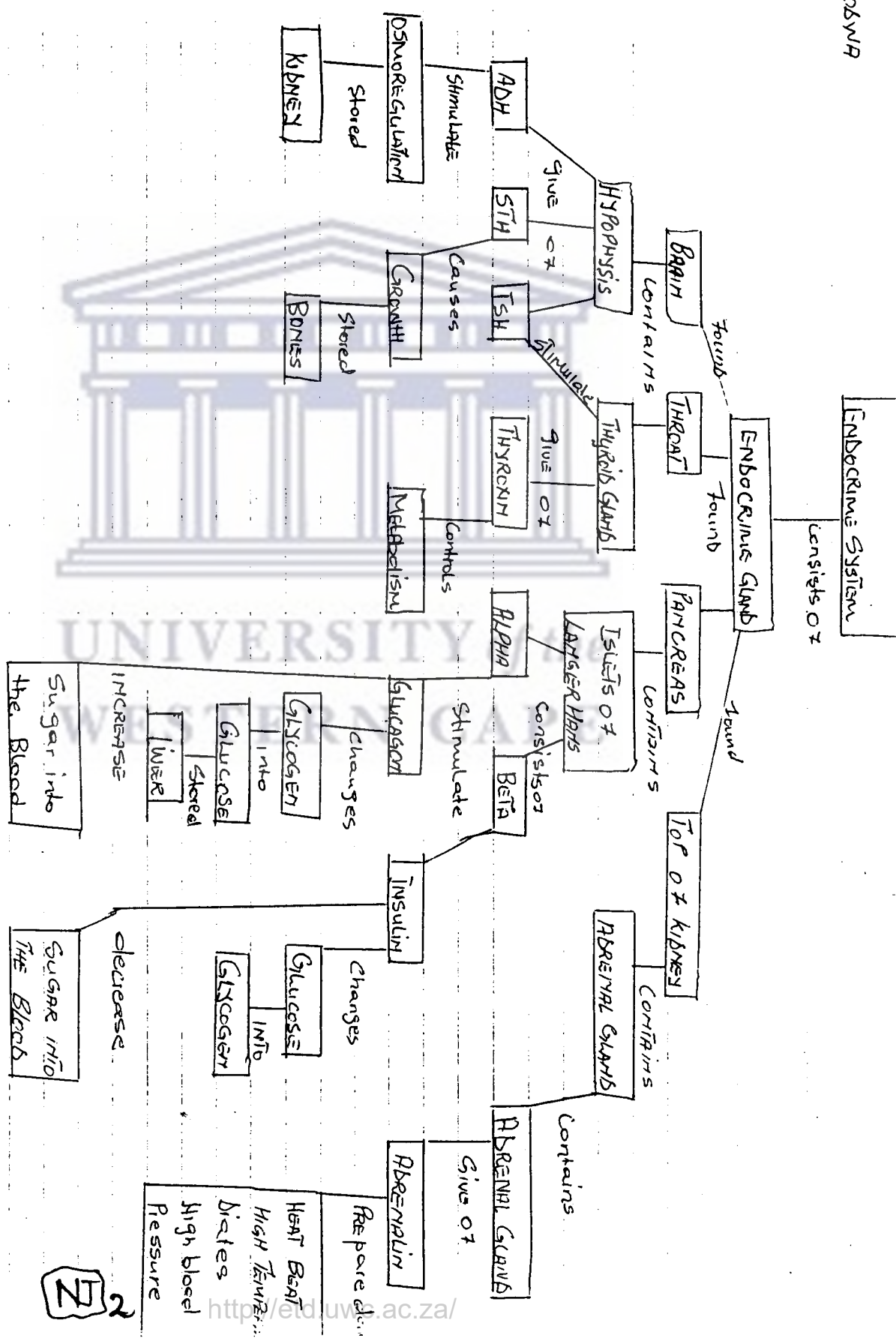
EXCRETORY SYSTEM

UNIT 15 Nephron



1 2

25



(2)

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