### Holistic – Analytic Style Dimension

<table>
<thead>
<tr>
<th>Style labels</th>
<th>Theorist</th>
<th>Basic description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field dependence (FD) – independence (FI)</td>
<td>Witkin (1962)</td>
<td>Field Dependence (FD) - rely on external frames of reference, prefer group interaction, like structure. Field Independence (FI) – rely on internal frames of reference, prefer to work on individual tasks, like to impose their own structure.</td>
</tr>
<tr>
<td>Impulsivity – Reflectivity</td>
<td>Kagan (1964)</td>
<td>Impulsive style characterised by quick responses to request to undertake task, whereas the reflective style will deliberate over the issue before providing a response.</td>
</tr>
<tr>
<td>Convergent - Divergent thinkers</td>
<td>Guilford (early 1950’s)</td>
<td>Convergent thinkers deal best with problems which require the ability to generate one correct answer, while divergent thinkers are perform well when required to generate several equally acceptable answers.</td>
</tr>
<tr>
<td>Levellers - Sharpeners</td>
<td>Holzman &amp; Klein (1954)</td>
<td>Focuses primarily on how a visual task is perceived. Levellers tend to perceive a task very simply and assimilate new events with previously stored ones, while sharpeners perceive a task in a complex and differentiated fashion, with little assimilation.</td>
</tr>
<tr>
<td>Holists - serialists</td>
<td>Pask (1972)</td>
<td>Holists will scan large amounts of data and look for patterns, while serialists will examine less data and use a step-by-step approach when completing a task.</td>
</tr>
</tbody>
</table>

### Verbaliser-Imager Style Dimension

<table>
<thead>
<tr>
<th>Style Label</th>
<th>Theorist</th>
<th>Basic description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbaliser - visualiser</td>
<td>Paivio (1971), Riding and Taylor (1976), Riding and Calvey (1981)</td>
<td>Visualisers better than verbalisers in the recall of high imagery material. Will use either verbal or visual strategies to represent knowledge and thinking.</td>
</tr>
</tbody>
</table>
APPENDIX B: LETTER REQUESTING PERMISSION TO CONDUCT THE STUDY AND LETTER PROVIDING THIS CONSENT

12 September 2005

Head of Department: Department of Physiology
Faculty of Health Sciences
Basic Medical Sciences Building – 9-8
University of Pretoria
0002

Dear Prof van Papendorp

PERMISSION TO CONDUCT PhD RESEARCH USING PHYSIOLOGY AS CONTEXT AND CONTENT

I am currently registered as a PhD student in the Faculty of Education at the University of Pretoria. My research proposal outlines a study which aims to investigate the relationship between cognitive load and cognitive styles when using animations as learning resources within a specific content domain. I attach an executive summary of my proposal. I successfully defended my proposal on the 22 April 2005.

My work in the field of multimedia development over the last five years has primarily been in the health sciences education field. This is a field which makes extensive use of multimedia learning resources. As such I would like to use the context of health sciences education in general, and physiology education in particular for my research. It is also my aim to base this research in a setting which is as authentic as possible – in other words, to take content which must be studied by all students who take physiology as part of their curriculum. Many research studies in this field use content which is not part of the student’s normal curriculum. There is a need for research which uses more authentic learning experiences.

I therefore request permission to develop multimedia content which covers various sections of the physiology of the renal system, and to use the students at UP who take physiology as a subject as participants in the study. On completion of the study all content developed will be given to the University of Pretoria.

There will be two phases in this research. The detail about the times and particular student groups are outlined on the table below.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Student group</th>
<th>No of participants</th>
<th>Time frame</th>
<th>Duration of experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot study</td>
<td>Students doing Physiology which is not part of the MBChB program</td>
<td>80 – 120</td>
<td>February 2006</td>
<td>2 sessions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>First – 20 – 30min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Second – 1.5 - 2 hours</td>
</tr>
<tr>
<td>Larger study</td>
<td>MBChB students – during</td>
<td>400 - 500</td>
<td>April / May 2006</td>
<td>2 sessions</td>
</tr>
</tbody>
</table>
I will therefore require approximately 2 hours of time from each student who participates in the study. These sessions will be conducted in the computer laboratories on with the Hatfield campus or the Prinshof campus. Participation will be voluntary. I furthermore request permission to approach the lecturers in your department who teach the physiology of the renal system to serve as the content experts who will guide the development. I will continue with the necessary application and ethical review with the appropriate committees should you give me permission to undertake this study.

Yours sincerely

Anne Strehler
Student No: 77006799
APPENDIX C: PERMISSION FROM SMITH (2007) TO USE DATA FROM HER STUDY

P O Box 74000
Lynnwood Ridge
0040
20 February 2008

Department of Statistics
University of Pretoria
Pretoria

Dr M v. d. Linde

I, M E Smith, hereby grant Anne Strehler permission to use any of the datasets from the research project DPG9077 - OD425993 - T06028 as required.

Regards

______________________________
M E Smith

Student nr 72224089
Appendix D: Pre Test / Posttest: Computer-Based Test

Knowledge questions

Pre-test

There are 9 questions in this test. Please try and answer all the questions. The questions will be scored, and the mark displayed at the end.

Instructions on how to answer each question are provided on the screen.

Click on the START button to begin. There is a time limit of 10 min for completing the test.

You CANNOT go back to a previous question.

Pre-test

Question 1: Which area of the brain is most directly involved in the reflex control of the autonomic system?

Select the answer in the drop-down list.

Click on the button to continue.

Correct answer / Score = 1

Image cropped for illustrative purposes

Time remaining: 00:09:57

Click here when you are finished
Pre-test

Question 2: Which organs are innervated mainly by the sympathetic system?

Select the answer(s) by clicking on the check box next to the option.

- Salivary glands
- Stomach glands **Correct answer / Score = 1**
- Sweat glands
- Blood vessels of the skin **Correct answer / Score = 1**
- Pancreas glands

Image cropped for illustrative purposes

Time remaining: 00:09:41

Click here when you are finished

---

Pre-test

Question 3: Click on the label and drag it to its place on the diagram.

- Dorsal root ganglion
- Sympathetic ganglion
- Preganglionic neuron
- Postganglionic neuron
- Afferent sympathetic neuron
- Target organ

Labels in correct places
Score = 6

Time remaining: 00:09:18

Click here when you are finished
Appendix D

Section 2 | Pre-test

Pre-test

Question 4: Which group of receptors are stimulated when the bladder is full?

Select the answer in the drop-down list:

- Baroreceptors
- Stretch receptors
- Volume receptors

Correct answer / Score = 1

Image cropped for illustrative purposes

Time remaining: 00:08:01

Click here when you are finished

---

Section 2 | Pre-test

Pre-test

Question 5: Parasympathetic ganglia are located...

Select the answer from the drop-down list:

- In a chain parallel to the spinal cord
- In the spinal roots of spinal nerves
- Next to or within the organs innervated
- In the brain

Correct answer / Score = 1

Image cropped for illustrative purposes

Time remaining: 00:08:44

Click here when you are finished
Appendix D

Section 2 | Pre-test

Pre-test

Question 6: This diagram illustrates

- Convergence
- Divergence

Correct answer / Score = 1

Select the answer in the drop-down list.

Time remaining: 00:13:29

Click here when you are finished

Pre-test

Question 7: Which neurotransmitters are released by the neurons at the synapses in this diagram?

Type your answer in each field. Use the abbreviations provided in the legend. Use the TAB key to move from one field to the other.

Legend:
- Ach - Acetylcholine
- Nor - Norepinephrine
- Dop - Dopamine
- NO - Nitric Oxide

Parasympathetic

CNS

Preganglionic

Postganglionic

Adrenal

Parasympathetic

Preganglionic

Postganglionic

M₂ M₄ receptors

α₁ β₁ β₂ receptors

Time remaining: 00:08:11

Click here when you are finished
Section 2 | Pre-test

Pre-test

Question 8: What effect does increased sympathetic stimulation have on the following organs?

Select the answer from the drop-down list next to each organ.

- **Heart**
  - Increases heart rate [Correct answer / Score = 1]
  - Decreases heart rate

- **Pupils**
  - Constrict [Correct answer / Score = 1]
  - Dilate

- **Bladder**
  - Wall relaxes - bladder fills [Correct answer / Score = 1]
  - Wall contracts - bladder empties

- **Salivary glands**
  - No effect whatsoever
  - Secretes large amount of watery enzyme-rich saliva
  - Secretes small amounts of a thick mucous secretion [Correct answer / Score = 1]

Time remaining: 00:37:57

Click here when you are finished

---

Section 2 | Pre-test

Pre-test

Question 9:

This diagram illustrates the

- Autonomic Nervous System
- Enteric Nervous System
- Parasympathetic Nervous System
- Sympathetic Nervous System [Correct answer / Score = 1]

Select the answer in the drop-down list.

Click on the button to continue.

Time remaining: 00:37:02

Click here when you are finished
Pre-test results

Your score for this pre-test: 11 / 22

You are now going to work through the content of the lesson. You will be assessed again at the end of the lesson. You may go back to previous screens as often as you like in order to master the content. Take your time. You may use the paper provided to make notes - these will be collected before the next assessment.

Click on the button at the bottom of the screen to continue

Post-test results

Your score for the post-test was: 12 / 22

This is not your final score. The two open-ended questions must still be assessed. I will send the results to your lecturer, if you are interested in knowing what your final score was.

Did this score come close to your estimation at the start of the post-test?

There are another four screens to work through. You need to answer a series of questions about your experience today. Please read the question and the options carefully before your attempt to answer.

Click on the button at the bottom of the screen to continue
APPENDIX E: FINAL TWO QUESTIONS OF THE POST TEST

Student No: 

Question 10: You are on holiday at the sea. A swimmer narrowly escapes a shark attack. You go to see if you can help. Fortunately there are no injuries, but the person is very shocked.

Describe the clinical symptoms you would expect to see, and provide adequate information about what you see and why you see these symptoms? [10]

Answer:

Question 11 on the reverse side of the page
**Question 11**: You are assigned to the spinal unit during a clinical rotation. The rehabilitation of the paraplegic patients involves teaching them how to empty their bladder.

What neurological process makes this possible? [10]

**Answer:**
APPENDIX F: TITLE SCREEN AND PRACTICE SESSION SCREEN

A study in the use of multimedia in physiology

Anne Strehler
University of Pretoria
Feb 2006

Briefing for practice

During the briefing it was explained that there is a secondary task on some screens. There is one screen where you can see what will happen and respond - IF you see the letter change colour - by pressing the ENTER key on the keyboard. This colour change occurs more than once per screen. Press ENTER each time you see the colour changing.

However...the MOST important thing is not to watch for the colour change - it is to go ahead and STUDY the content.

Click on the forward button in the bottom right-hand corner of the screen to continue
This system was described by Gaskell and Langley around the end of the 19th - beginning of the 20th century. At first it was thought that the autonomic nervous system functioned independently of the central nervous system, but this is not the case.

The ANS is regulated by the central nervous system (CNS), especially the hypothalamus. We also know that cognitive and emotive processes from the higher brain centres also influence the ANS. The ANS plays an important role in homeostasis.

The autonomic nervous system is often seen only as an efferent or motor system, but there are afferent or sensory pathways and inflows to the central nervous structures, which are involved in the regulation of the efferent or motor function. We will now look at both these pathways in more detail in the next few screens.
APPENDIX G: MULTIMEDIA INTERVENTION: SCREENS COMMON TO BOTH FORMATS

The Autonomic Nervous System

Prof M Viljoen
Dr N Willemse
Mrs A Strehler

Lesson Overview

The structure of this lesson is provided here. You are busy with the section highlighted in blue.

Animation version: Screen 1/19 and Static images & text version: Screen 1/23

Animation version: Screen 2/19 and Static images & text version: Screen 2/23
Section 3 - Lesson 1 The Autonomic Nervous System | Learning Outcomes

Learning outcomes

The learning outcomes for this lesson are to:

- Describe the structure of the Autonomic Nervous System using basic illustrations.
- Understand the control of the Autonomic Nervous System.
- Compare the structure and function of the Sympathetic and Parasympathetic divisions.
- Describe the function of the Sympathetic Nervous System.
- Describe how the function of the Autonomic reflexes can apply to patient care management for selected problems.

Click on the button to continue.

Section 3 - Lesson 1 The Autonomic Nervous System | Introduction

Introduction

The Autonomic Nervous System (ANS) is involved in maintaining homeostasis of the internal environment of the body through the regulation and modification of the following activities.

- All involuntary muscle tissue.
- The secretory activity of all endocrine glands.
- Some endocrine glands.
- Some adipose tissue.

The two main functions of the system are to:

- Regulate the activity of the visceral organs and glandular structures responsible for the basic (vegetative) bodily processes - during rest and digest.
- Respond to a stressor - also known as the typical ‘fight or flight’ response.

Click on the underlined text.

Examples of this type of tissue include the heart muscle, smooth muscle fibers.

Animation version: Screen 3/19 and Static images & text version: Screen 3/23

Animation version: Screen 4/19 and Static images & text version: Screen 4/23
The ANS has three parts, the:

- The sympathetic nervous system.
- The parasympathetic nervous system.
- The enteric system.

Many of the systems regulated by the ANS receive both excitatory and inhibitory signals from sympathetic and parasympathetic divisions. This provides fine control of the regulated system.

We will look at each of these in turn.

This system was described by Gaskell and Langley around the end of the 19th - beginning of the 20th century. At first it was thought that the autonomic nervous system functioned independently of the central nervous system, but this is not the case.

The ANS is regulated by the central nervous system (CNS), especially the hypothalamus. We also know that cognitive and emotive processes from the higher brain centres also influence the ANS. The ANS plays an important role in homeostasis.

The autonomic nervous system is often seen only as an efferent or motor system, but there are afferent or sensory pathways and inflows to the central nervous structures, which are involved in the regulation of the efferent or motor function. We will now look at both these pathways in more detail in the next few screens.
Appendix G

Section 3 - Lesson | The Autonomic Nervous System | Afferent pathways

**Afferent pathways**

Click on the underlined text

These autonomic fibres are unmyelinated C fibres. Stimulation is both internal and external.

**Internal stimulation**

The fibres originate in receptors that provide functions in the visceral organs. These receptors have further categorisation. This is summarised in the table.

<table>
<thead>
<tr>
<th>Pressure changes</th>
<th>Baroreceptors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stretch receptors</td>
</tr>
<tr>
<td></td>
<td>Volume receptors</td>
</tr>
<tr>
<td>Chemical changes</td>
<td>Chemoreceptors</td>
</tr>
<tr>
<td></td>
<td>Osmoreceptors</td>
</tr>
</tbody>
</table>

Unmyelinated C fibre

Each

Animation version: Screen 7/19 and Static images & text version: Screen 7/23

Section 3 - Lesson | The Autonomic Nervous System | Afferent pathways

**Activity: Afferent pathways**

Match the example with the type of receptor. Drag the example to the correct place in the table. Click on the Check Answer button to mark your effort.

<table>
<thead>
<tr>
<th>Pressure changes</th>
<th>Baroreceptors</th>
<th>Stimulated when the bowel is full</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stretch receptors</td>
<td>Decrease in O₂ saturation of blood</td>
<td></td>
</tr>
<tr>
<td>Volume receptors</td>
<td>Changes in electrolyte balance</td>
<td></td>
</tr>
<tr>
<td>Chemical changes</td>
<td>Chemoreceptors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Osmoreceptors</td>
<td></td>
</tr>
</tbody>
</table>

An increase in blood pressure

A full bladder

Animation version: Screen 8/19 and Static images & text version: Screen 8/23
Appendix G

Section 3 - Lesson | The Autonomic Nervous System | Afferent pathways

External stimulation
- Changes in the external environment can also stimulate the afferent pathways - temperature changes, extreme climates and environments e.g. underwater pressure during diving.
- Psychological stressors.

The afferent pathway is illustrated here (using blue).

---

Section 3 - Lesson | The Autonomic Nervous System | Efferent pathways

Efferent pathways

The functional unit of the efferent division of the autonomic nervous system is a two-neuron motor pathway, which consists of a preganglionic neuron and a postganglionic neuron. The preganglionic fibers are typically myelinated B fibres, whereas the postganglionic fibers are unmyelinated C fibres.

---

Animation version: Screen 9/19 and Static images & text version: Screen 9/23

Animation version: Screen 10/19 and Static images & text version: Screen 10/23
Introduction to the Structure of the SNS

Now that we have a broad overview of the ANS, we can look at the structure of the three divisions in more detail.

Each neuronal pathway, be it sympathetic or parasympathetic, has an origin, a synapse between a preganglionic and a postganglionic fibre and releases a neurotransmitter at both the synapse and the target or effector organ.

The sympathetic and parasympathetic divisions however, have distinct anatomical differences and release different neurotransmitters at their target sites.

We will now consider the Sympathetic Nervous System (SNS).

The sympathetic nervous system is continually active. This basal continuous rate of activity is known as the sympathetic tone. This feature enables the sympathetic system to either increase or decrease the sympathetic-regulated activity of the system - by either increasing or decreasing the stimulation.

A good example, illustrated here, is the control of the vascular diameter and thus blood pressure through...

- Increasing alpha-1 stimulation which results in a decrease in vascular diameter and thus an increase in blood pressure.

- Decreasing alpha-1 stimulation which results in an increase in vascular diameter and thus a decrease in blood pressure.
Control of the ANS

The activity of the sympathetic nervous system is controlled by:
- autonomic spinal reflexes - first level of control,
- autonomic centres in the brain stem - second level of control,
- the autonomic nuclei of the hypothalamus - third level of control,
- and
- by higher brain centres.

First level of control

Autonomic spinal reflexes represent the first level of control of sympathetic activity. The control centres involved at this level include:
- the preganglionic sympathetic nuclei in the intermediolateral grey matter,
- the autonomic ganglia in the paravertebral and prevertebral ganglia,
- and even the junction between the target organ and postganglionic fibre.

The first level of control can be influenced by the second level of control.
Second level of control

The second level of control is the reticular formation in the brain stem and spinal cord that include the

- nucleus tractus solitarius, and the
- nucleus paragigantocellularis.

These autonomic centres of the midbrain, pons, medulla and spinal cord are in turn under the influence of the third level, that is, the hypothalamus.

Third level of control

The autonomic nuclei of the hypothalamus represents the third level of control. The hypothalamus can in a sense be seen as the head autonomic ganglion and consists of clusters of nuclei that control endocrine and autonomic nervous system function. The hypothalamus can, however, be influenced by the higher brain centres.

Control by higher brain

Higher brain centres can influence autonomic control by the hypothalamus and brain stem through descending tracts associated with the paraventricular nucleus, the central noradrenergic system, the raphe nuclei and others. Cognitive and emotional events can in this way alter sympathetic activity and chronic stress can through conditions of sustained sympathetic stimulation even shorten the life time of humans and animals.

The degree to which external and cortico-limbic inputs activate the sympathetic system is largely determined by the individual's perception of the situation, which is often a function of previous experience and conditioning.
Animation version: Screen 17/19 and Static images & text version: Screen xx/23 – opening view

Three views of the innervation of the eye
First view of the lung

Innervation by the Sympathetic Nervous System

Innervation by the Parasympathetic Nervous System
First view of the GIT system

Innervation by the Sympathetic Nervous System

Innervation by the Parasympathetic Nervous System
APPENDIX H: MULTIMEDIA INTERVENTION: DIFFERENT STRATEGIES TO DISPLAY SAME CONTENT

Animation version – Screen 13

Divergence and convergence

There are two phenomena in the sympathetic nervous system, known respectively as:

- Divergence
- Convergence

Click on each concept for an illustrated explanation

---

Divergence

This is the phenomenon where a single preganglionic neuron synapses with an average of ten postganglionic neurons in the sympathetic ganglion. This simultaneously activates more organ systems. Divergence occurs primarily in the sympathetic nervous system (SNS).

This mass activation of the sympathetic nervous system - the so-called mass discharge or ‘fight-or-flight’ response - plays an important role in stress responses when there is a need to coordinate changes in a broad range of systems. Because of mass activation the SNS can (activation as a single unit) affect all of its effector organs at the same time.

---

Convergence

This is the phenomenon where many preganglionic neurons converge on one postganglionic cell body in the sympathetic ganglion.

Convergence allows for modulation and integration of control.
Divergence and convergence

There are two phenomena in the sympathetic nervous system, known respectively as:
- Divergence
- Convergence

Divergence
This is the phenomenon where a single preganglionic neuron synapses with an average of ten postganglionic neurones in the sympathetic ganglion. This SIMULTANEOUSLY activates more organ systems. Divergence occurs primarily in the SNS.

This mass activation of the sympathetic nervous system - the so-called mass discharge or 'fight-or-flight' response - plays an important role in stress responses when there is a need to coordinate changes in a broad range of systems. Because of mass activation (activation as a single unit) the SNS can affect all of its effector organs at the same time.

Convergence

This is the phenomenon where many preganglionic neurones converge on one postganglionic cell body in the sympathetic ganglion.

Convergence allows for modulation and integration of control.
APPENDIX I: MULTIMEDIA: ANIMATION VERSUS STATIC IMAGES

Animation version: Screen 12 (Animation)

Static images & text version: Screens 12 – 16

This section will take you through a step-by-step, illustrated explanation of the structure of the sympathetic nervous system. There are a total of 7 screens. You need to work through all 7 screens, and return to this screen to continue.

The content, displayed schematically here, is explained in three sections:

- The origins of the efferent fibres
- The ganglia and synaptic connections
- The effector organs

Follow the instructions on the screen. Explore the content on your own as well. Rolling the mouse over the images will often display more information.

Click on the white text below to get to the different sections. When you have completed a section you will see the word ‘Completed’ under the relevant section. Once all are complete you can use the forward button to move on in the lesson.
The preganglionic neurons originate from the autonomic centres located in the pars intermedia of the grey matter of the thoracic and upper two lumbar segments of the spinal cord.

Roll mouse over this area of the spinal cord T1 - T12 for more detail.
Section 3 - Lesson | The Autonomic Nervous System | The Sympathetic Nervous System | Structure of the system

You are studying the section highlighted in blue

The preganglionic neurons which originate from the CNS terminate in autonomic ganglia where they form synaptic connections with neurons in the ganglia. These autonomic ganglia are located in three areas - illustrated here in the diagram and on the next screen.

Roll mouse over the diagram for more detail
The preganglionic neurons which originate from the CNS terminate in autonomic ganglia where they form synaptic connections with neurons in the ganglia. These autonomic ganglia are located in three areas – illustrated here in the diagram and on the next screen.

Roll mouse over the diagram for more detail

The sympathetic ganglia. These are two paravertebral or sympathetic chains, one on each side of the spinal cord. Each chain consists of about 22 ganglia. Most of the preganglionic fibres terminate in neurons within the ganglia, but some may pass up or down the chain before establishing synaptic connections.

Paravertebral chain ganglia

In this example.....

When it enters the region of the chain of autonomic ganglia it passes downwards in this chain.....
The preganglionic fibres (illustrated in green) leave the spinal cord and pass directly to the medulla of the adrenal gland, which can be likened to a modified sympathetic ganglion. This is the third area where there is a synaptic connection. The cells of the adrenal medulla (illustrated in the magnified area) are innervated by the preganglionic sympathetic fibers.

This section will take you through a step-by-step, illustrated explanation of the structure of the sympathetic nervous system. There are a total of 7 screens. You need to work through all 7 screens, and return to this screen to continue.

The content, displayed schematically here, is explained in three sections:

- The origins of the efferent fibres
- The ganglia and synaptic connections
- The effector organs

Follow the instructions on the screen. Explore the content on your own as well. Rolling the mouse over the images will often display more information.

Click on the white text below to get to the different sections. When you have completed a section you will see the word ‘Completed’ under the relevant section. Once all are complete you can use the forward button to move on in the lesson.
## APPENDIX J: MULTIMEDIA INTERVENTION: WHOLE VIEW VERSUS PARTS VIEW

### Animation version – Screen 18

**Summary of the Autonomic Nerve Supply and effects on visceral organs**

<table>
<thead>
<tr>
<th>A. Organs with dual supply</th>
<th>Sympathetic effects</th>
<th>Parasympathetic effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ine</td>
<td>Pupil dilation</td>
<td>Pupil constriction</td>
</tr>
<tr>
<td>Bronchioles</td>
<td>Dilation</td>
<td>Construction</td>
</tr>
<tr>
<td>Heart</td>
<td>Rate</td>
<td>Rate</td>
</tr>
<tr>
<td>Digestive system</td>
<td>Motility</td>
<td>Motility</td>
</tr>
<tr>
<td>Sphincters of digestive tract</td>
<td>Contraction</td>
<td>Relaxation</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>Relaxation of wall → filling</td>
<td>Contraction of wall → emptying</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Organs with mainly sympathetic supply</th>
<th>Absence of sympathetic activity</th>
<th>Increased sympathetic activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blood vessels of skin</td>
<td>Vasodilation</td>
<td>Vasoconstriction</td>
</tr>
<tr>
<td>Sweat glands</td>
<td>None</td>
<td>Secretion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Organs with mainly parasympathetic supply</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Organ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salivary glands</td>
<td>Secretion of large amounts of watery enzyme-rich saliva (Stimulation of sympathetic fibres produce small amounts of a thick, viscous secretion)</td>
<td></td>
</tr>
<tr>
<td>Stomach glands</td>
<td>Secretion of enzyme-rich gastric juice</td>
<td></td>
</tr>
<tr>
<td>Pancreas glands</td>
<td>Secretion of enzyme-rich pancreatic juices</td>
<td></td>
</tr>
<tr>
<td>Sex organs</td>
<td>Vasodilation in erectile tissue → erection</td>
<td></td>
</tr>
</tbody>
</table>

All information presented in one table
Summary of the ANS and effects in visceral organs

Visceral organs have:
- Both sympathetic and parasympathetic supply
- Mainly sympathetic supply
- Mainly parasympathetic supply

Information accessed by clicking on bulleted text

Information provided in smaller chunks with text and visual material
Summary of the ANS and effects in visceral organs

Visceral organs have:

- Both sympathetic and parasympathetic supply

MAINLY Sympathetic
- Absence of sympathetic activity
  - Vasodilate
  - No secretion

MAINLY Parasympathetic
- Increased activity
  - Vasoconstrict
  - Secretion

Salivary glands
- Secret large amounts of watery, enzyme-rich saliva

Stomach glands
- Secretion of enzyme-rich gastric juice

Pancreas
- Secretion of enzyme-rich pancreatic juices

Sex organs
- Vasodilation in erectile tissue
  - Erection
<table>
<thead>
<tr>
<th>Instrument</th>
<th>Section in multimedia</th>
<th>Appendix</th>
<th>It will measure...</th>
<th>Development</th>
<th>No of times administered</th>
<th>Source</th>
<th>Alignment with research sub-question / Purpose of this instrument</th>
</tr>
</thead>
</table>
| Cognitive Style Analysis (CSA)     | Not included          | Not included | Cognitive style    | Existing instrument | Once                     | License to use CSA purchased from Learning & Training Technology, UK   | What are the cognitive styles of the participants taking part in the study?  
What is the relationship between cognitive style and cognitive load when learning with multimedia? |
| Practice secondary task            | 1                     | Appendix G | Self-developed     | Once – at beginning of multimedia | Not applicable | This was included to expose the participants to the direct measurement technique for measuring cognitive load. This was an attempt to control the potential extraneous cognitive load caused by this secondary task. |
| Demographic questionnaire          | 2                     | Appendix M | Demographic profile of sample | Self-developed    | Once                     | Not applicable | Provides data for other potential covariates. |
| Self-report rating scale           | 2                     | Appendix N | Self-rating of Verbaliser-Imager dimension of cognitive style | Modified an existing instrument | Once                     | Adaptation of Mayer’s instrument (Mayer & Massa, 2003)  | What are the cognitive styles of the participants taking part in the study?  
The data collected will be used to determine the correlation between self-report measures of the style dimension and the measure obtained using Riding’s Cognitive Style Analysis. |
<table>
<thead>
<tr>
<th>Instrument</th>
<th>Section in multimedia</th>
<th>Appendix</th>
<th>It will measure...</th>
<th>Development</th>
<th>No of times administered</th>
<th>Source</th>
<th>Alignment with research sub-question / Purpose of this instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>3</td>
<td>Appendix E</td>
<td>Prior knowledge of learning outcomes. First step in assessing extent of the learning gain.</td>
<td>Self-developed</td>
<td>Once</td>
<td>Physiology textbooks Validated by subject matter experts for content validity</td>
<td>How do participants with different cognitive styles perform when using the same content with different cognitive load?</td>
</tr>
<tr>
<td>Self-rating questionnaire</td>
<td>4</td>
<td>Appendix F</td>
<td>Self-report rating of mental load</td>
<td>Embedded at selected points in the program. Existing instrument</td>
<td>Version 1 Five (5) times Version 2 Six (6) times</td>
<td>Developed by Paas (1994)</td>
<td>What is the correlation between the participant's self-report of cognitive load and the direct measure of the cognitive load of the content?</td>
</tr>
<tr>
<td>Posttest - Section 1</td>
<td>5</td>
<td>Appendix F</td>
<td>Knowledge and achievement of learning outcomes.</td>
<td>Self-developed</td>
<td>Once</td>
<td>Same test as pretest</td>
<td>How do participants with different cognitive styles perform when using the same content with different cognitive load?</td>
</tr>
<tr>
<td>Posttest - Section 2</td>
<td>Not included in multimedia</td>
<td></td>
<td>Test ability to apply knowledge.</td>
<td>Self-developed - pencil and paper test</td>
<td>Once</td>
<td>Validated by subject matter experts for content validity</td>
<td>Which presentation format was instructionally more efficient?</td>
</tr>
</tbody>
</table>

Appendix K
APPENDIX L: ELECTRONIC QUESTIONNAIRE TO COLLECT DEMOGRAPHIC DATA

I need some personal information

Please complete all the fields and click on the button when you are finished. Use the TAB key to move from field to field. Select the most appropriate options from the drop-down lists.

Personal information

Age (enter only the number e.g. 24):

Gender:

- Male
- Female

Which cultural group best describes you?
(Select the option from the drop-down list)

- Black
- Coloured
- Indian
- White

Information about your course

What programme are you registered for (e.g. MEngE): 

What is your year of study? (enter only the number e.g. 3):

Information about the lesson

Have you previously studied the physiology of the Autonomic Nervous System? (Y for Yes, N for No)

Rate your own knowledge and understanding of the physiology of the Autonomic Nervous System

I think I know & understand (select the best option from the drop-down list)

1. absolutely nothing about the topic
2. the basic concepts of the topic
3. the concepts beyond a basic understanding
4. about the topic at an expert level

Information about your language skills:

English is my

(select the best option from the drop-down list)

1st - home
2nd - second
3rd - third
4th - fourth

Page 2/4
## APPENDIX M: ALLOCATION OF GROUPS FOR THE MAIN STUDY

<table>
<thead>
<tr>
<th>Session 1</th>
<th>Animation version 10:30 – 12:30</th>
<th>Static images &amp; text version 12:30 – 14:30</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWS Lab</td>
<td>Lesson 1</td>
<td>HWS Lab</td>
</tr>
<tr>
<td>Group 1</td>
<td>Lesson 2</td>
<td>Lesson 3</td>
</tr>
<tr>
<td>Sample size: n = 17</td>
<td>Group 16</td>
<td>Sample size: n = 17</td>
</tr>
<tr>
<td>BMW Lab</td>
<td>Lesson 2</td>
<td>BMW Lab</td>
</tr>
<tr>
<td>Group 2</td>
<td>Lesson 3</td>
<td>Lesson 4</td>
</tr>
<tr>
<td>Sample size: n = 16</td>
<td>Group 15</td>
<td>Sample size: n = 16</td>
</tr>
<tr>
<td>BMW Lab</td>
<td>Lesson 1</td>
<td>BMW Lab</td>
</tr>
<tr>
<td>Group 3</td>
<td>Lesson 2</td>
<td>Lesson 4</td>
</tr>
<tr>
<td>Sample size: n = 16</td>
<td>Group 14</td>
<td>Sample size: n = 16</td>
</tr>
<tr>
<td>BMW Lab</td>
<td>Lesson 1</td>
<td>BMW Lab</td>
</tr>
<tr>
<td>Group 4</td>
<td>Lesson 2</td>
<td>Lesson 3</td>
</tr>
<tr>
<td>Sample size: n = 16</td>
<td>Group 13</td>
<td>Sample size: n = 17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Session 2</th>
<th>Animation version 10:30 – 12:30</th>
<th>Static images &amp; text version 12:30 – 14:30</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWS Lab</td>
<td>Lesson 1</td>
<td>HWS Lab</td>
</tr>
<tr>
<td>Group 2</td>
<td>Lesson 2</td>
<td>Lesson 3</td>
</tr>
<tr>
<td>Sample size: n = 16</td>
<td>Group 14</td>
<td>Sample size: n = 17</td>
</tr>
<tr>
<td>BMW Lab</td>
<td>Lesson 1</td>
<td>BMW Lab</td>
</tr>
<tr>
<td>Group 4</td>
<td>Lesson 2</td>
<td>Lesson 4</td>
</tr>
<tr>
<td>Sample size: n = 16</td>
<td>Group 13</td>
<td>Sample size: n = 17</td>
</tr>
</tbody>
</table>
APPENDIX N: EXAMPLE OF DATA FOR A SINGLE PARTICIPANT - WRITTEN OUT TO AN .INI FILE

[Bookmark]
Last screen=\att04

[Accessed Lesson Date]
Date=02/27/06

[Accessed Lesson Time]
Time=10:59:46

[Exited Lesson Time]
Time=11:54:57

[XXXXXXXX] - Student number removed to protect identity of participant
02/27/06
Student No V1=XXXXXXXX - Student number removed to protect identity of participant

[Demographic Data2]
Version V2=1

[Demographic Data3]
Age V3=18

[Demographic Data4]
Gender V4=2

[Demographic Data5]
Culture V5=3

[Course Detail 1]
Programme V6=MBCHB

[Course Detail 2]
Year of study V7=2

[Lesson Detail]
Prior Know V8=0

[Self rating]
Self rating V9=2

[Language]
Language V10=
Language V10=2

[SBCSQ1]
SBCSQ1 V11=5

[SBCSQ2]
SBCSQ2 V12=4

[SBCSQ3]
SBCSQ3 V13=4

[SBCSQ4]
SBCSQ4 V14=4
Appendix N

[SBCSQ5]
SBCSQ5 V15=5

[SBCSQ6]
SBCSQ6 V16=5

[SBCSQ7]
SBCSQ7 V17=3

[ScreenData -Screen 1]
Screen No=Using this multimedia

[ScreenData -Screen 1_2]
Date in=02/27/06

[ScreenData -Screen 1_3]
Time in=10:44:23

[ScreenData -Screen 1_4]
Time out=10:45:50

[ScreenData -Screen 2]
Screen No=Using this multimedia 2

[ScreenData -Screen 2_2]
Date in=02/27/06

[ScreenData -Screen 2_3]
Time in=10:45:50

[ScreenData -Screen 2_4]
Time out=10:47:33

[Pretest Q1]
V18=0

[Pretest Q2.1]
V19=1

[Pretest Q2.2]
V20=1

[Pretest Q3.1]
V21=1

[Pretest Q3.2]
V22=1

[Pretest Q3.3]
V23=1

[Pretest Q3.4]
V24=1

[Pretest Q3.5]
V25=1

[Pretest Q3.6]
V26=1

[Pretest Q4]
V27=1

[Pretest Q5]
V28=1

[Pretest Q6]
V29=0

[Pretest Q7.1]
V30=0

[Pretest Q7.2]
V31=0

[Pretest Q7.3]
V32=1

[Pretest Q7.4]
V33=0

[Pretest Q7.5]
V34=0

[Pretest Q8.1]
V35=1

[Pretest Q8.2]
V36=1

[Pretest Q8.3]
V37=1

[Pretest Q8.4]
V38=0

[Pretest Q9]
V39=0

[Pretest Total]
Total=

[CL01]
Cognitive load V40=7

[CL02]
Cognitive load V41=8

[CL03]
Cognitive load V42=6

[CL04]
Cognitive load V43=.

[CL05]
Cognitive load V44=8

[CL06]
Cognitive load V45=not tested

[CL07]
Cognitive load V46=not tested
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[Trigger1_2]
Trigger2=11:01:1411:04:06

[Trigger1_3]
Trigger3=11:01:2411:04:16

[Trigger1_4]
Trigger4=11:01:3411:04:26

[Trigger2_1]
Trigger1=11:03:4811:05:28

[Trigger2_2]
Trigger2=11:05:38

[Trigger2_3]
Trigger3=11:05:48

[Trigger3_1]
Trigger1=11:12:15

[Trigger3_2]
Trigger2=11:12:25

[Trigger3_3]
Trigger3=11:12:35

[Trigger3_4]
Trigger4=11:12:44

[Trigger4_1]
Trigger1=11:16:48

[Trigger4_2]
Trigger2=11:16:58

[Trigger4_3]
Trigger3=11:17:08

[Trigger5_1]
Trigger1=11:19:22

[Trigger5_2]
Trigger2=11:19:32

[Trigger5_3]
Trigger3=11:19:42

[Trigger6_1]
Trigger1=11:22:03

[Trigger6_2]
Trigger2=11:22:13

[Trigger6_3]
Trigger3=11:22:23
[Trigger6_4]
Trigger4=11:22:33

[Trigger6_5]
Trigger5=11:22:43

[Trigger6_6]
Trigger6=11:22:53

[Trigger6_7]
Trigger7=11:23:03

[Trigger6_8]
Trigger8=11:23:13

[Trigger7_1]
Trigger1=11:31:09

[Trigger7_2]
Trigger2=11:31:19

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Trigger3=11:31:29

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[Trigger7_5]
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Trigger1=11:32:52

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Trigger2=11:33:02

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Trigger3=11:33:12

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Trigger1=11:46:12

[Trigger9_2]
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Trigger5=11:46:53

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Trigger6=11:46:52

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Trigger2=11:49:53

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[Trigger10_5]
Trigger5=11:50:23

[Trigger10_6]
Trigger6=11:50:33

[Trigger10_7]
Trigger7=11:50:43

[Trigger10_8]
Trigger8=11:50:53

[Meta Cog 1]
V47=3

[Meta Cog 2]
V48=.

[Meta Cog 3]
V49=19

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V50=0

[Posttest Q2.1]
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[Posttest Q2.2]
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[Posttest Q3.1]
V53=1

[Posttest Q3.2]
V54=1

[Posttest Q3.3]
V55=1

[Posttest Q3.4]
V56=1

[Posttest Q3.5]
V57=1

[Posttest Q3.6]
V58=1

[Posttest Q4]
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V60=0

[Posttest Q6]
V61=1

[Posttest Q7.1]
V62=1

[Posttest Q7.2]
V63=1

[Posttest Q7.3]
V64=1

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V65=1

[Posttest Q7.5]
V66=0

[Posttest Q8.1]
V67=1

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V68=1

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V69=1

[Posttest Q8.4]
V70=0

[Posttest Q9]
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[Posttest Open1]
V72=.

[Posttest Open 2]
V73=.

[Survey S1.1]
V74=4

[Survey S1.2]
V75=5

[Survey S1.3]
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V77=5

[Survey S1.5]
V78=5

[Survey S1.6]
V79=5
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<tr>
<th>Survey</th>
<th>Value</th>
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<tbody>
<tr>
<td>S1.7</td>
<td>V80=5</td>
</tr>
<tr>
<td>S2.1</td>
<td>V81=5</td>
</tr>
<tr>
<td>S2.2</td>
<td>V82=4</td>
</tr>
<tr>
<td>S2.3</td>
<td>V83=6</td>
</tr>
<tr>
<td>S2.4</td>
<td>V84=5</td>
</tr>
<tr>
<td>S2.5</td>
<td>V85=5</td>
</tr>
<tr>
<td>S2.6</td>
<td>V86=5</td>
</tr>
<tr>
<td>S2.7</td>
<td>V87=4</td>
</tr>
<tr>
<td>S3.1</td>
<td>V88=5</td>
</tr>
<tr>
<td>S3.2</td>
<td>V89=5</td>
</tr>
<tr>
<td>S3.3</td>
<td>V90=5</td>
</tr>
<tr>
<td>S3.4</td>
<td>V91=5</td>
</tr>
<tr>
<td>S4.1</td>
<td>V92=5</td>
</tr>
<tr>
<td>S4.2</td>
<td>V93=3</td>
</tr>
<tr>
<td>S4.3</td>
<td>V94=3</td>
</tr>
<tr>
<td>S4.4</td>
<td>V95=3</td>
</tr>
<tr>
<td>S4.5</td>
<td>V96=2</td>
</tr>
<tr>
<td>S4.6</td>
<td>V97=5</td>
</tr>
<tr>
<td>S4.7</td>
<td>V98=4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trigger</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger1</td>
<td>10:41:18</td>
</tr>
<tr>
<td>Trigger2</td>
<td>10:41:28</td>
</tr>
<tr>
<td>Trigger3</td>
<td>10:41:38</td>
</tr>
</tbody>
</table>
Appendix N

Trigger4=10:41:48

[sScreen01]
10:59:51=Exited

[sScreen02]
10:59:51=Accessed
11:00:35=Exited

[sScreen03]
11:00:35=Accessed
11:01:00=Exited

[sScreen04]
11:01:00=Accessed
11:03:44=Exited
11:03:52=Accessed
11:05:24=Exited

[Responses1_2]
11:01:14=Hit space bar
11:04:08=Hit space bar

[Responses1_3]
11:01:25=Hit space bar
11:04:17=Hit space bar
11:04:18=Hit space bar

[Responses1_4]
11:01:34=Hit space bar
11:04:27=Hit space bar

[sScreen05]
11:03:44=Accessed
11:03:52=Exited
11:05:24=Accessed
11:08:05=Exited

[Responses1_1]
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[sScreen06]
11:08:21=Accessed
11:08:27=Exited
11:08:30=Accessed
11:08:38=Exited

[sScreen07]
11:08:27=Accessed
11:08:30=Exited
11:08:38=Accessed
11:12:10=Exited

[sScreen08]
11:12:10=Accessed
11:14:42=Exited

[Responses3_2]
11:12:25=Hit space bar

[Responses3_3]
APPENDIX O: STUDENT HANDOUT - PARTICIPATION IN THE STUDY

Letter of consent

The relationship between cognitive load, cognitive style and multimedia learning

A study in the use of multimedia in physiology

Dear Participant

You are invited to participate in a research project aimed at exploring the role which cognitive load and cognitive style play in the successful achievement of learning outcomes when using animations as multimedia learning resources within the higher education sector. The study will also investigate the interrelationship between cognitive load, which is influenced by both the nature of the content and the specific design strategies used, and the cognitive style of the person using the multimedia.

Your participation in this research project is voluntary and confidential. You will not be asked to reveal any information that will allow your identity to be established by persons reading the results of the study. At this stage no follow-up interviews are planned. Attached to this letter is a document explaining your role in this research process. It includes the information provided to you during the briefing. The results from this study will be used to improve existing / extend the range of design guidelines for developing multimedia which makes extensive use of animation and images. The results will also inform designers of the extent to which the design should accommodate different cognitive styles.

If you are willing to participate in this study, please sign this letter as a declaration of your consent, i.e. that you participate in this project willingly and that you understand that you may withdraw from the research project at any time. Participation in this phase of the project does not obligate you to participate in follow up individual interviews, however, should you decide to participate in follow-up interviews your participation is still voluntary and you may withdraw at any time. Under no circumstances will the identity of interview participants be made known to the Faculty of Health Sciences or your individual lecturers. The research is done in fulfillment of the requirements for a doctoral degree in the department of Teaching and Training Studies, University of Pretoria.

Participant’s signature: ........................................ Date: ........................................

Student No: ........................................

Researcher’s signature: ........................................ Date: ........................................

Yours sincerely

Anne Strehler
Accessing the work

Open Windows Explorer

Cognitive styles analysis

- There is a folder on the C: drive – C:/CSA.
- There are two files in this folder.
- Click on the file CSA.EXE.
- Read the instructions carefully.

Before you close the program – call the research assistant to write down your scores

Opening the Lesson

- There is a folder on the C: drive – C:/Lesson1 OR C:/Lesson2 OR C:/Lesson2 OR C:/Lesson2.
- There are several files in this folder.
- Click on the file Lesson1.exe OR Lesson2.exe OR Lesson3.exe OR Lesson4.exe.
- The program will take a few seconds to open – please be patient.
- Start as soon as it is open.
- Read the instructions carefully.
Participation in the study – What the researcher expects from you

1. You have already been assigned to a particular session and the number of the lesson you must do. The way research participants are assigned is VERY important and affects the validity of the data.
2. Please do NOT swop with anyone.
3. Write your student number on each page of the handout.
4. Read all instructions carefully – everything you need to know is displayed ON THE SCREEN.
5. Do BOTH the Cognitive Styles Analysis and the lesson.
6. Please take this session seriously.
7. Answer EVERY question on every screen – including the ones embedded in between the content of the lesson.
8. Work individually – once the session starts PLEASE do NOT confer with your peers or talk to each other.
9. If you need help – ASK.
10. If the program bombs out – log in again – it is bookmarked and you can continue where you left off.
11. STUDY the content on the screen – this is a STUDY session – some of the content is not going to be repeated in your Block 3.
12. Follow ALL the links.
Results of Cognitive Style Analysis

<table>
<thead>
<tr>
<th>Student Number</th>
<th>WA Ratio</th>
<th>VI Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Scribble page

Use this page to make any notes / mind maps etc while you study the content in the multimedia

Student No: ..........................................................................................................................................................
APPENDIX P: RIDING’S COGNITIVE STYLES ANALYSIS

The CSA provides a score for each dimension in the cognitive style model. The ratios for each style dimension typically range from 0.4 through to 4.0 with a central value around 1.0. But for descriptive convenience, the dimensions may be divided into groupings and given labels (Riding, 2005a).

Riding clearly states:

Since each dimension is a continuum, the labels are used only for descriptive convenience, and are not meant to imply that there are style ‘types’ in any absolute sense. There is no requirement to use the same cut-off points as those given by the CSA, as long as the cut-offs are clearly reported in the research report.

Riding (2005a, page 7).

The cut-off points suggested by Riding (2005a) for the ratios on each dimension are given below.

<table>
<thead>
<tr>
<th></th>
<th>&gt;1.35</th>
<th>&gt;1.02 and &lt;=1.35</th>
<th>&lt;=1.02</th>
<th>&lt;=0.98</th>
<th>&gt;0.98 and &lt;=1.09</th>
<th>&gt;1.09</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHOLIST-ANALYTIC</td>
<td>Analytic Verbaliser</td>
<td>Intermediate Verbaliser</td>
<td>Wholist Verbaliser</td>
<td>&lt;=0.98</td>
<td>&gt;0.98 and &lt;=1.09</td>
<td>&gt;1.09</td>
</tr>
<tr>
<td></td>
<td>Analytic Bimodal</td>
<td>Intermediate Bimodal</td>
<td>Wholist Bimodal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analytic Imager</td>
<td>Intermediate Imager</td>
<td>Wholist Imager</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There are researchers who divide the style only into two categories with the following ranges: Wholists <0.99 and Analytics >1.00; Verbalisers < 0.93 and Imagers > 1.00 (Riding, Glass & Douglas, 1993).