University of Huddersfield Repository

Burton, Rob, Barlow, Nichola and Barker, Caroline

Using Visual Tools for Analysis and Learning

Original Citation

Burton, Rob, Barlow, Nichola and Barker, Caroline (2010) Using Visual Tools for Analysis and Learning. University of Huddersfield. ISBN 9781862180802

This version is available at http://eprints.hud.ac.uk/7843/

Using Visual Tools for Analysis and Learning

Developed by:
Rob Burton
Nichola Barlow
Caroline Barker
School Of Human and Health Sciences

Contents:

Introduction to the pack

This pack is intended as a resource for lecturers and students to facilitate the further development of their learning and teaching strategies. Visual tools were initially introduced within a module of the Year 3 nursing curriculum within the University of Huddersfield by Dr Rob Burton.

Throughout the period of 2007-2008 a small team of lecturers with a keen interest in this teaching and learning strategy engaged in exploring and reviewing the literature. They also attended a series of local workshops held by Oliver Caviglioli, a keen author in relation to visual tools. The use of visual tools as a learning and teaching strategy is now being encouraged within both primary and secondary education. Therefore future students should have some experience of using them. Visual tools have been used as both formative and summative elements of student nurse assessment and are being used creatively within the school. Throughout the duration of this project, aspects of the work have received a positive response at both national and international conferences including HERDSA July 2007, Adelaide, Australia; International Nursing Research Conference, Malaysia March 2008 and Nurse Education Tomorrow (NET) Conference, Cambridge September 2008.

The pack contains information regarding the background, relevant theory and the development of visual tools. It has been designed to introduce you to the principles of using visual tools for analysis and adult learning. The main message is that the tools themselves form a systematic approach to be used in learning and teaching. It contains examples of various visual tools and a series of exercises to support you through the stages of the development of visual tools. It is hoped that this will enable you to develop visual tools within your own field of expertise. Within the pack there are some examples of visual tools, although these are not exhaustive.

We hope that you enjoy the pack and that it inspires you to further explore the wide variety of visual tools and their potential value within adult education.

What are Visual Tools?

There are a variety of visual tools which may be used for both analysis and learning. The process of developing visual tools may follow the three stages of "Generating", "Systematising" and "Evaluating" information utilising diagrammatic representations.

❑ Visual tools are commonly referred to by a range of terms including 'Mind maps', 'Learning maps', 'Thinking maps', 'Concept maps' and 'Diagrammatic representations'.

❑ They are regarded as powerful retention aids, which serve to increase understanding (Wolfe, 2004).

❑ Ideas and thought processes can be made visible through visual tools. They can be explored by seeing the parts and noticing the relationships between them (Margulies and Valenza, 2005).

Visual tools (2).mmap - 17/04/2008 -
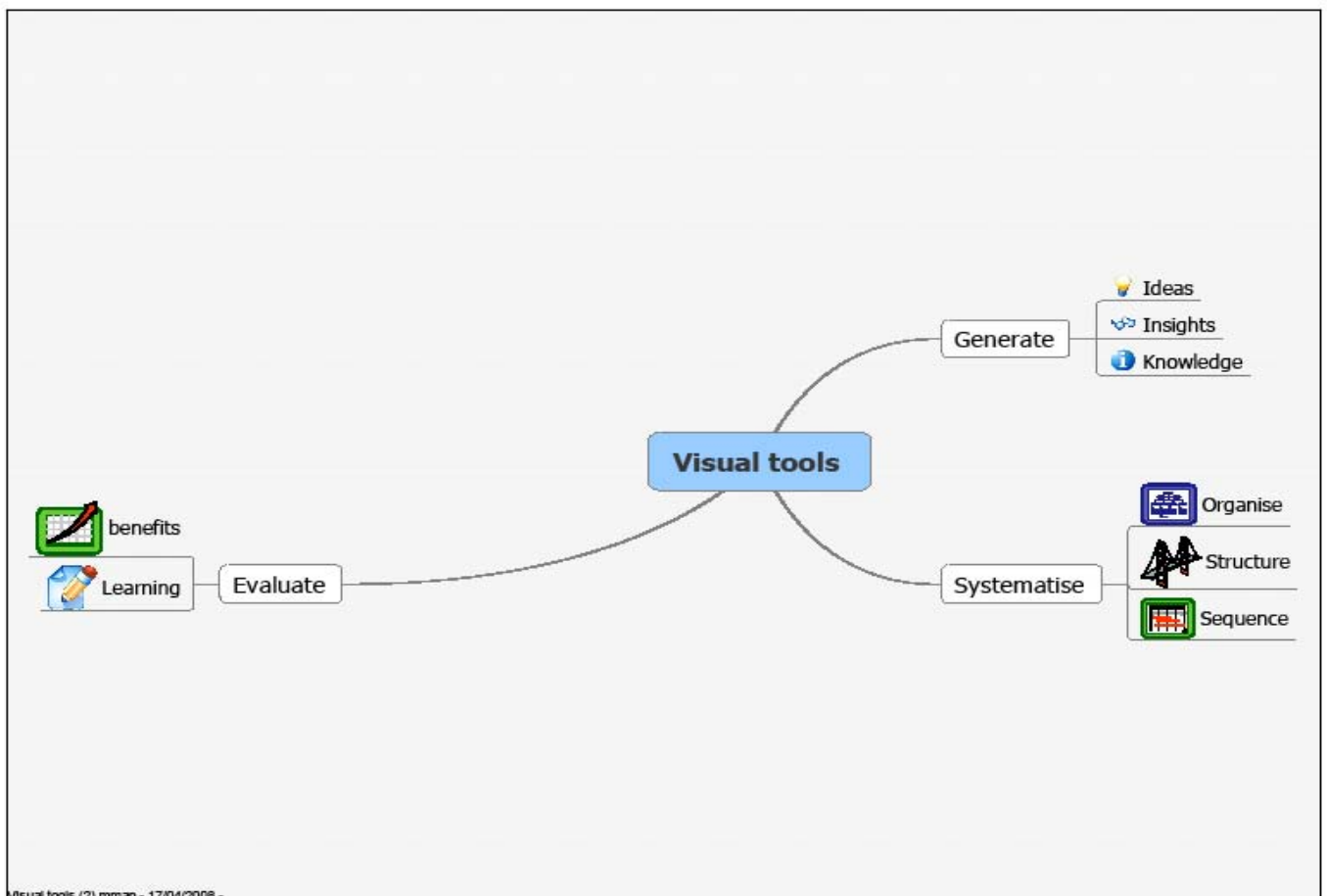
The Literature

The purpose of this review is to discuss visual tools, describing what they are, their origins, principles, and how they can be used within teaching and learning. It is recognised that visual tools are currently, and have been historically used within various disciplines including the sciences, architecture, engineering, mathematics, computing and design amongst others. It is the intention in this review to highlight how visual tools can be used in a systematic structured way to develop adult learning, particularly as visual tools are becoming increasingly used as a method to support and promote effective teaching and learning for pupils within many schools throughout the United Kingdom (UK). Therefore, in the future many potential students should be conversant in their use in order to generate, systematise and evaluate information.

What are Visual Tools?

It is difficult to define exactly what constitutes a visual tool. There are a variety of terms that can be used to mean the same thing, such as diagrammatic representations, pictorial illustrations, icons, thinking maps, concept maps and a whole range of others. This range of descriptions can add some confusion. In its simplest form a visual tool can be defined as a visual representation, which demonstrates properties, structures, order, processes and relationships of objects, events or concepts. This can include pictures, icons, maps, schemes, charts, blueprints and tables etc.

A definition provided by Hsu and Hsieh (2005) that related to concept maps (themselves a visual tool) can also be expanded to cover the whole range of visual tools. Therefore they can be defined as,

> '......A scheme representing visual knowledge' and '..... A hierarchical graphic network', (Hsu and Hsieh, 2005, p141).

Consequently it is important to note that the tool needs to create a balance between the graphic representation within it and the level of knowledge or understanding it conveys.

Blackwell (2001) uses the term diagrammatic representations to describe visual tools and states that they are becoming increasingly more common in everyday human experience. Having traditionally been used within science, mathematics, computing and other disciplines and subjects as outlined earlier, their uses are now being developed to enhance learning itself.

The visual aspect of the tools is important. Enns (2004) highlights how our visual experiences are so immediate and obvious that we assume they hardly need an explanation. Rose and Nicholl (1997) outline that seventy percent of the body's sensory receptors are located in the eyes. Marieb (1991) also outlined that the largest of all of the brain's cortical areas are related to receiving and processing visual information. In support of this, Jensen (2000) states that between eighty and ninety percent of information absorbed by the brain is visual in nature. This

demonstrates that as humans we are physically developed to depend on and utilise visual information from our environment. However what these suggestions allude to is that visualisation is not just an external sensory experience, but also an internal sensory experience. Therefore visual tools become a mechanism that an individual can utilise to express how they have structured and ordered their thoughts internally to an external party (via a diagrammatic representation).

This notion of internal representations or schema is significant. According to Caviglioli et al. (2002) our thoughts may be organised as objects, and as such we can manipulate them, move them about, and even forget about them. All of this takes place within our own minds. Therefore it is apparent that a considerable amount of the capacity of the brain is devoted to receiving and processing visual stimuli. It is only a short leap to find a relatively simple way of expressing or re-expressing the structure of these thoughts externally through a visual tool. The work in the field of multiple intelligences, developed by Gardner (1993) highlights the need to ensure that visual intelligence (among others) is accounted for in our teaching and learning approaches. Visual tools are one example of a vehicle through which to achieve this. Consequently, visual tools offer a further choice as a learning and teaching method in order to meet what Garnett (2005) describes as the diverse needs of a range of learners in a variety of settings.

Visual tools are not new; as discussed earlier, humans have used diagrams, maps, charts, matrices, icons and pictures for centuries. However, to use all of these within a single tool box to promote thinking is a relatively new concept. Just as a range of tools exist such as screwdrivers, pliers and penknives; we now see examples of how these tools have been put together to form multipurpose tools. Hence diagrammatic representations from differing disciplines can be brought together as a package to aid teaching and learning in the same way. According to Enns (2004) seeing and thinking are ideas that seem to need no special definition. It could be argued that to link the two could be beneficial. Therefore, visual tools are important as they operate in the domain where the Visual (graphic) and Verbal (linguistic, cognitive and hierarchical) properties of concepts and understanding overlap (Shimojima, 2001).

Origins

It is difficult to identify when visual tools were initially used. After all, there are examples of cave paintings and the use of icons and hieroglyphics from cultures of millennia ago, in fact pictorial images were recognised as the original type of written communication (Margulies and Valenza, 2005). Indeed, where there is a language barrier universal symbols have been developed to ensure that there is understanding of meaning. The use of visual symbols is growing, when it is considered that the symbols, representations and icons used in computing, multimedia and the internet. According to Caviglioli (2002) historically, written language, as opposed to pictorial/diagrammatic language was restricted to the elite of society and therefore a way of gate keeping and maintaining power. As we have entered an age of globalisation and human equality, the use of symbols and visual information to express ideas is increasing. There remain examples where written language restricts access (legal and medical documents are notoriously difficult to understand

for the lay person). Diagrams and graphical representations have also been specialised and utilised for centuries by certain subject disciplines such as mathematics, science design and engineering. Burton and Bodenhamer (2000) suggest that humans internally or cognitively represent concepts/experiences in the form of nominal (sorted into categories), ordinal (compared or ranked against the qualities of other representations), interval (comparison with even more detail) and ratio data (highlighting interrelationships and meaning between representations). A note of caution is needed however, as Ewenstein and Whyte (2007) point out that although visual representations (or tools) are useful for both symbolic and for communicative dimensions, there may be issues of power (deciding what, how and whom to show materials to) and some differing cultural or indeed professional interpretations of these. Politicians are often renowned at displaying the same statistics in different formats to persuade members of the public of their case. If the tools are selected carefully and with integrity they can display the right information in the right format whilst demonstrating the hierarchical level of knowledge and relationships of concepts.

How are they Used

Caviglioli et al (2002) state that we all have schema formed by our external and internal experiences. An interesting factor, however is that by using Visual tools a person is able to recreate such schema and maps from their internal representations in the public domain and compare and contrast them with others. By representing schema externally they can be added to adapted and changed. Particular aspects can be scrutinised in detail and explored for further analysis. Therefore the visual tool provides a platform for dialogue and development. It is proposed by the authors that visual tools can be used in increasingly complex levels of cognitive and analytical processing. We suggest the development of the tools can be divided into three progressive stages, these being 'Generate', 'Systematise' and 'Evaluate'. Sutherland and Katz (2005, p267) suggest visual tools (in their case concept maps) help to provide accessible information from a specific orientation which emphasises systematic acquisition, storage, access and use of knowledge, which parallels the cognitive system and schemas of individuals. They conclude that concept mapping encourages individuals to actively participate in the 'social activity of meaning making'.

This aspect of making meaning via visual tools is also suggested by Dimopoulos et al (2003) who state that although messages and meanings reside in language, a visual illustration is a relatively transparent and unproblematic window to reality. They argue that visual illustrations are autonomous systems of communication that produce images of reality bound up in the interests of social institutions. This suggests concepts can be taught and information represented via visual tools. They express understanding from the individual level to the organisational level. Visual images can therefore be assessed in an independent way from written text. According to Caviglioli and Harris (2004) visual tools transform the normally invisible, abstract act of thought into a concrete and public media. They enable teachers to reveal to the student how their thoughts are structured and vice versa. Buzan (1995) states that, traditionally, education has been built on the structural patterns of speech, which are in the main linear in nature. However he argues that the human

brain does not simply think in a linear fashion. What is not accounted for is the multi-modal nature of the human 'holographic' brain. Vision is a symbolic process and as images are inputted into the brain, any number of individual representations of it can be formed.

Shen-Hsieh and Schindler (2002) suggest that visual approaches are also very useful in order to create visual metaphors, such as milestones, and pipelines to explain the organisation of concepts (such as time, and identifying barriers). They are useful to visualise time and model scenarios. Visual pictures can provide deep understanding of data of individual and organisational decision processes helping to generate new insights and assist in decision making. The tools allow accessibility, interactivity and exposure to models, visible at many levels. In this way accurate data visualisation can occur. The tools should be designed and utilised with expectations of functionality in relation to goals.

The main way to use visual tools is to understand that there are simple tools that can be used at the beginning of a development/learning process. Then, as the need for understanding develops in complexity, from surface to deep learning, so the tools themselves become more complex and sophisticated in order to reflect this. Hyerle's (2004) system of thinking maps includes a process of applying eight maps (which he describes as primitives) which are sequentially used from the beginning of learning/developing of a concept. Each of these primitives can be expanded and each one shows more complexity than the previous. However it is recognised that this is one system only. We suggest that adult learners can widen their scope and explore the use of a wide range of visual tools and decide which ones work best in their systematic approaches to understanding. The notion however of using more sophisticated tools hierarchically as the student progresses through the learning taxonomy in relation to a given concept is a favourable one.

To summarise, visual tools can be used within a systematic learning or developmental process. The authors propose that there are three stages to this, generate, systematise and evaluate. This process is similar to that of Sutherland and Katz (2005), firstly ideas are generated, with descriptions and relationships which are then organised and rated. Generating information is related to developing basic descriptions of the characteristics or components of a concept and developing initial ideas in novel situations. At this initial stage the student is encouraged to identify all the characteristics of the concept, process or phenomena under discussion. This is otherwise known as ideas generation, brainstorming or thought showers.

The systematise stage follows the 'Generate' stage and involves some order being introduced to the visual tool. The diagram is developed a stage further to represent groups and subgroups, providing structure and hierarchy. Links between groups and subgroups are used to represent the relationships between the concept and their component parts (Heinze-Fry and Novak, 1990).

Evaluation is the final stage in some educational taxonomies such as Bloom, (1956). It is the stage where information is critically analysed and checked for its value. Visual tools can be utilised efficiently for this purpose. Various diagrams are used to examine components, relationships and prioritise to draw conclusions. Some visual

tools are used to compare and contrast, identify similarities and differences including strengths, weaknesses of concepts or ideas. It is essential that visual tools are applied effectively to the identified concept or problem under study. In other words the appropriate tool should be selected to reflect the stage of the process. Each stage is more sophisticated than the next and each tool can show the level of sophistication necessary. Examples of some of these tools are demonstrated throughout this package.

Principles

There are many principles related to the development of the range of visual tools. As outlined previously, these should develop in complexity resulting in a sophisticated diagram that explains relationships involved with the concept. A good rule of thumb is that complex relations should be seen in a single diagram. This therefore requires some principles in order to meet this. If not there can be tensions between the effectiveness of the graphical part of the diagram (expression/representation) and its linguistic (cognitive/hierarchical) properties. Girill (1992) states that graphical excellence occurs when a diagram gives the viewer the greatest number of ideas in the shortest time, with the least ink in the smallest space.

In a similar vein Johnson and Shneiderman (1991) stated that design should have effective space utilisation, interactivity, comprehension (able to provide rapid extraction of information with low perceptual and cognitive effort) and consider aesthetics. Therefore clear lines and shapes with space should be used and consideration being made to contrast aspects such as colours and dark/light backgrounds and foregrounds are vitally important. A fishbone diagram for example (see page 35) provides clear linear information whilst demonstrating increasing priorities and relationships of concepts.

When producing a diagrammatic representation or visual tool Girill (1992) suggests that visually cued text should have heightened boundaries, edges and division compared to straightforward prose. In visual text levels of subordination are indicated graphically and not just semantically. Visual cueing makes possible the selective use of text by varied audiences for varied purposes. A poster for example usually aims at some kind of promotion so is designed to attract and direct attention from a distance by means of display and ornamentations with colour and pictures. They present few data; hence poster design provides little counsel for making diagrams that are read more intensively. Alternatively, maps aim at detailed communication. They assume audience attention to detail so they are richer in data and repay more intense scrutiny.

By far the biggest factor is that the creator of the diagram chooses the right visual tool which suits them, the purpose and the level of understanding needed. If this is to then be communicated to others, care has to be taken to ensure that the representational aspects of the diagram or map can be interpreted correctly by the audience selected to share the information.

Overall visual tools can be seen as a method to assist individuals to learn and develop their understanding of particular concepts. This can then also be

transmitted to others so that they can share the same understanding of the material. They are simple and effective as long as the diagram maintains expressive clarity and linguistic/cognitive hierarchical principles that show the complexity of relationships and the conclusions made about the process. Visual tools are useful for generating ideas, insights, knowledge and understanding of concepts; systematising these by creating order, structure and highlighting relationships. Finally, they are useful for evaluating the material by analysing, comparing and contrasting and assigning rating and value to specific elements in the construction or de-construction of concepts. This package demonstrates some tools and some of these factors. As visual tools are wide and varied in range it is impossible to cover all of the types available.

In summary:
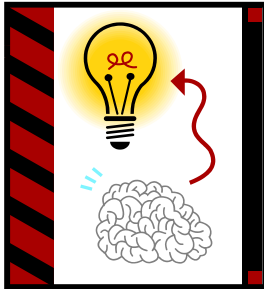
80 –90% of information absorbed by the brain is visual in nature (Jenson, 2000).

Vision is the sense that human beings rely on the most! (Enns, 2004)
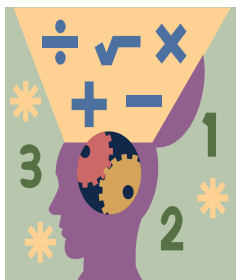
Garnett (2005) suggests that understanding and insight appears to be heavily dependent on creating images.

Visual tools transform the normally invisible, abstract art of thought into a concrete and public media. They enable teachers to reveal to the student how their thoughts are structured and vice versa. (Caviglioli and Harris, 2004).
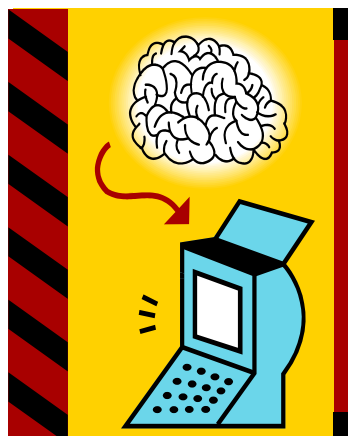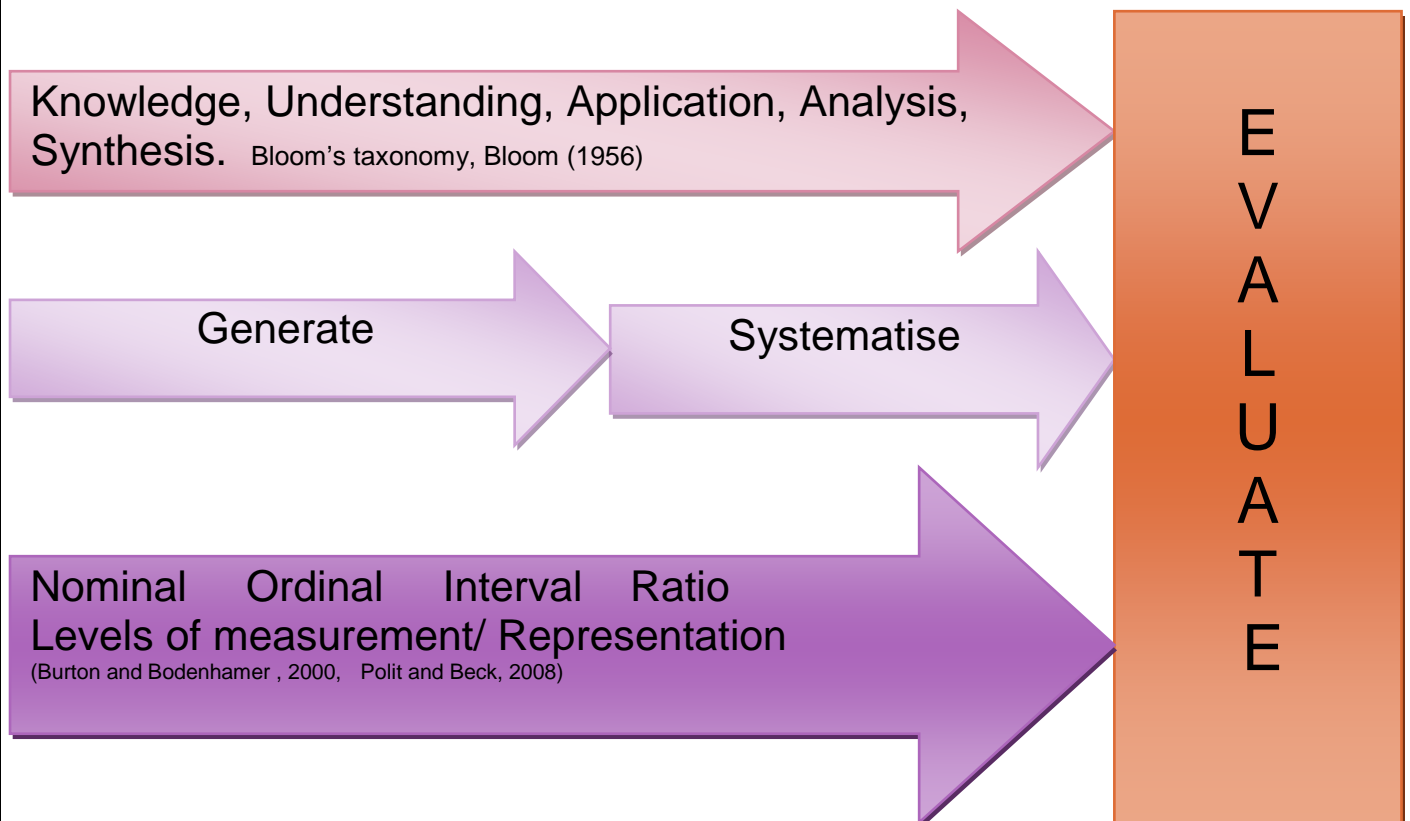
Creating Diagrams

The ability to create diagrams equips the student or lecturer to present information from simple to complex levels to represent their thoughts for themselves and others.

❑ A wide range of tools are available which can represent processes, relationships and analytical representation of characteristics.

❑ These in turn can then be aligned with various recognised learning taxonomies.

Learning Taxonomies

A variety of diagrams can be created throughout the various key stages of the learning process and they may be used to represent the hierarchical level of learning, for example generating, systematising and evaluating concepts

Knowledge, Understanding, Application, Analysis, Synthesis. Bloom's taxonomy, Bloom (1956)

Generate

Systematise

Nominal   Ordinal   Interval   Ratio
Levels of measurement/ Representation
(Burton and Bodenhamer , 2000,   Polit and Beck, 2008)

EVALUATE

Blooms Taxonomy (1956)

|	
Knowledge	Simple knowledge of facts, terms theories etc.
Comprehension	An understanding of the meaning of knowledge.
Application	The ability to apply this knowledge and comprehension in new and concrete situations.
Analysis	The ability to break down material into its constituent parts and to see relationships between them.
Synthesis	The ability to re-assemble these parts into a new and meaningful relationship, thus forming a new whole.
Evaluation	The ability to judge the value of material using explicit and coherent criteria, either of one's own devising or derived from the work of others.

Generate

Systematise

Evaluate
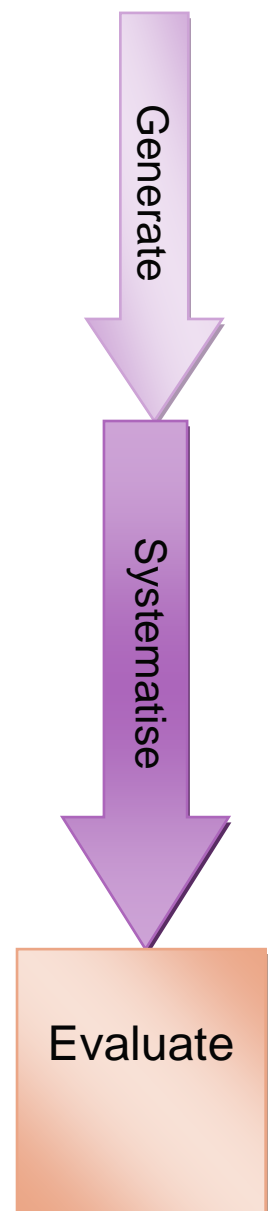
Visual tools complement progression through the taxonomy. They are diagrammatic representations that can be used at each stage in order to represent an individual's thoughts about the concept/development/proposal. Tools can be used more selectively at each stage in the process and within each stage of the hierarchy.

Symbolic/ Representations as Visual Tools

A basic use of a visual tool is the utility of icons or symbols to represent concepts. Some of these are quite concrete in that they mimic properties contained in the original aspect they are representing. However, others are more abstract, in that the diagram does not necessarily contain the same properties of the concepts being conveyed.

Some common signs/symbols
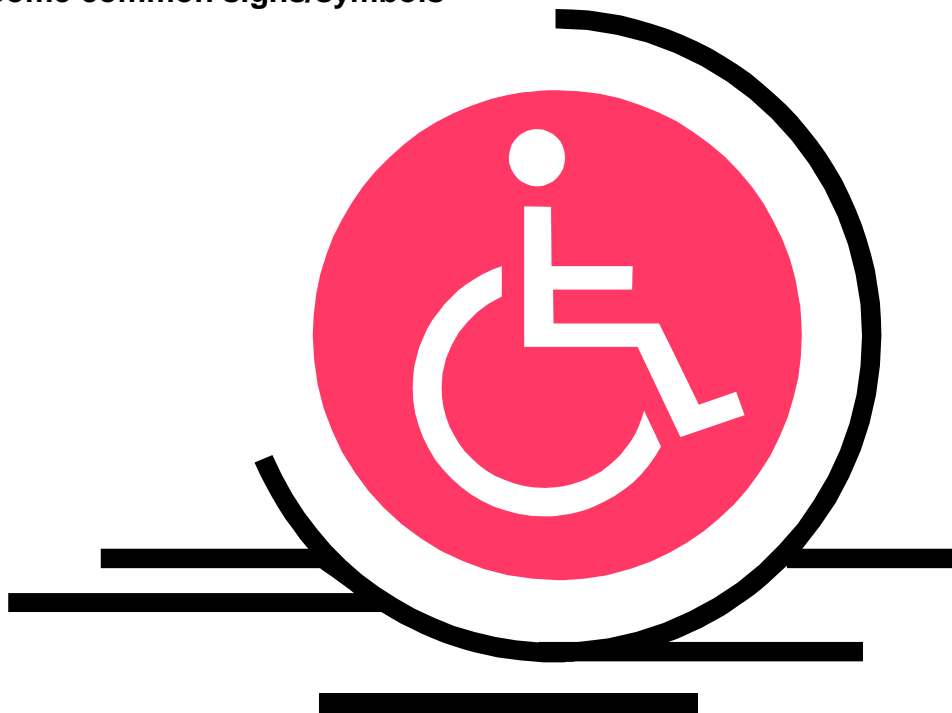
Key steps in the Process:
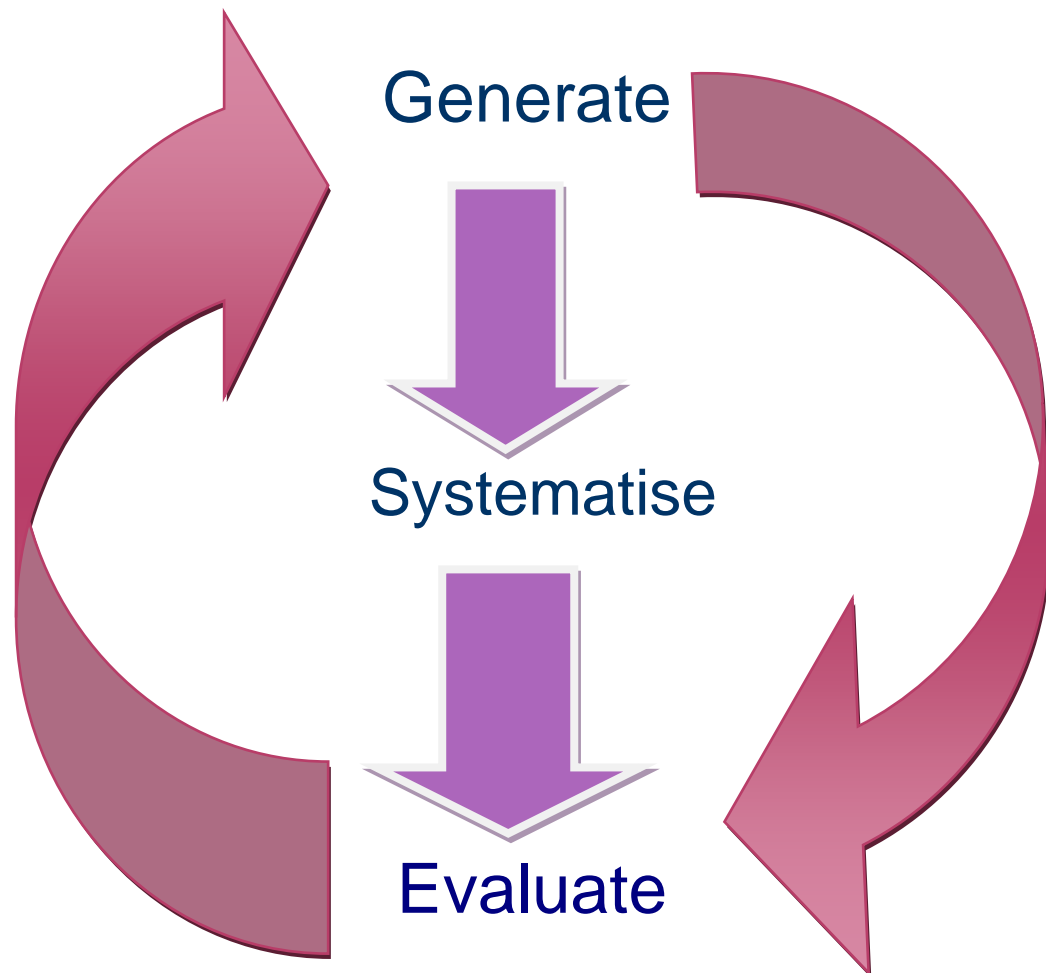
Visual Tools can be used at each stage of the process outlined here. Utilising and incorporating the information into more complex tools as progress is made can develop learning from one stage to another.

Step 1: Generate

This is the first stage of the process, it is otherwise known as brainstorming, ideas generation and it is a tool that is used to collect, gather or create information.

❑ Develops basic descriptions of the characteristics or components of a concept.

❑ Identifies all the characteristics of the concept, process or phenomena under discussion.

Below are some examples of visual tools which can be used to generate information related to concepts.
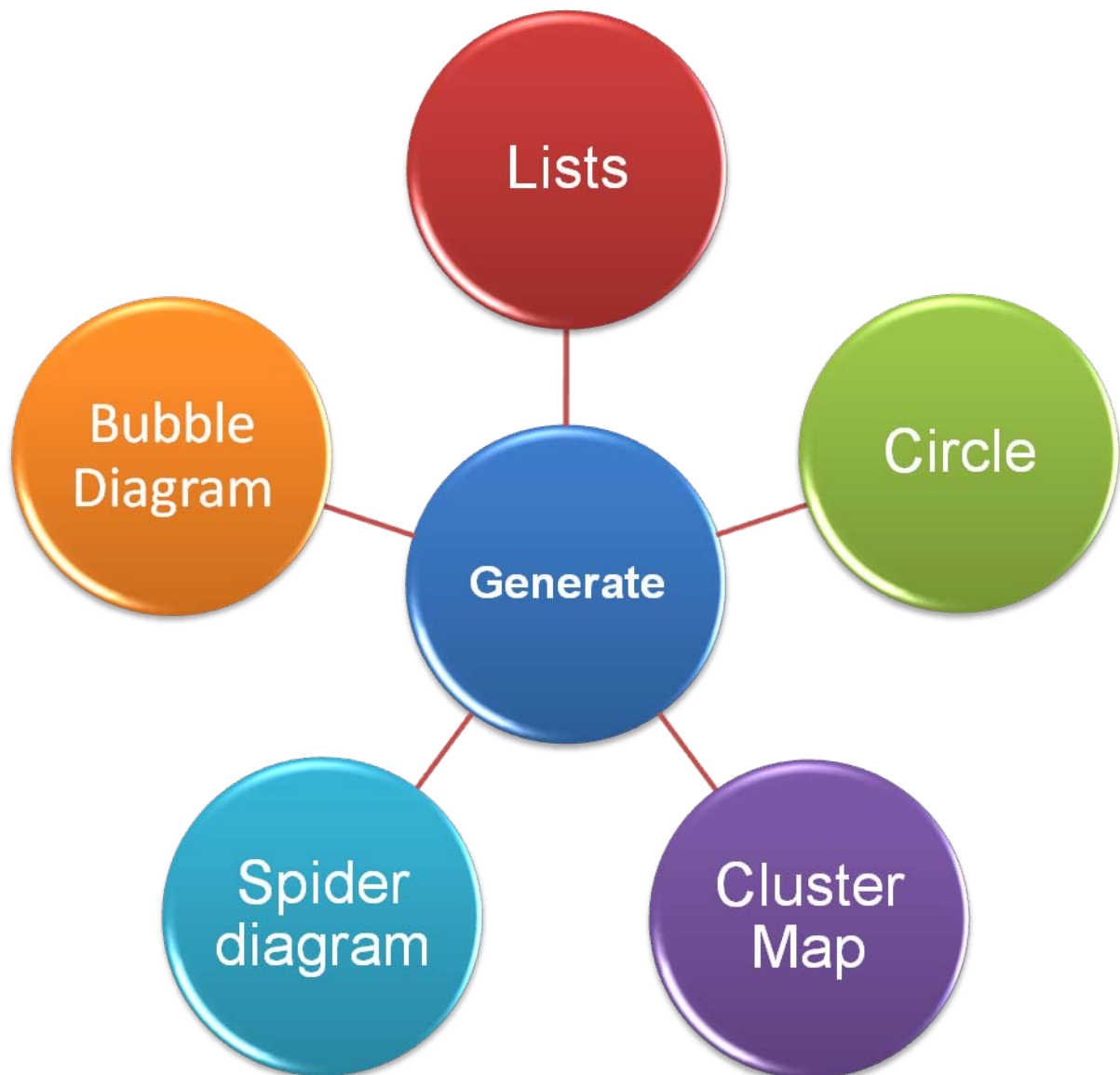
Tools Used to Generate Information

This circle is an example of Generation tool which has been developed in relation to the subject of Health

Lifestyle

Exercise

Diet

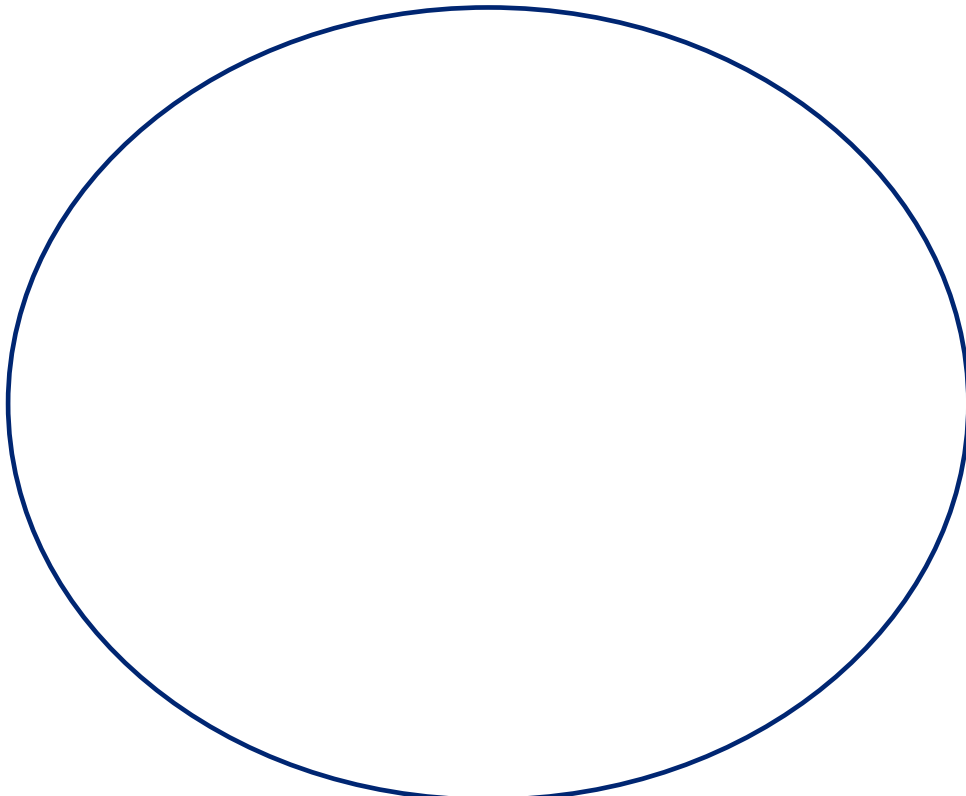Disease

Environment

Sexuality

Social Class

Age
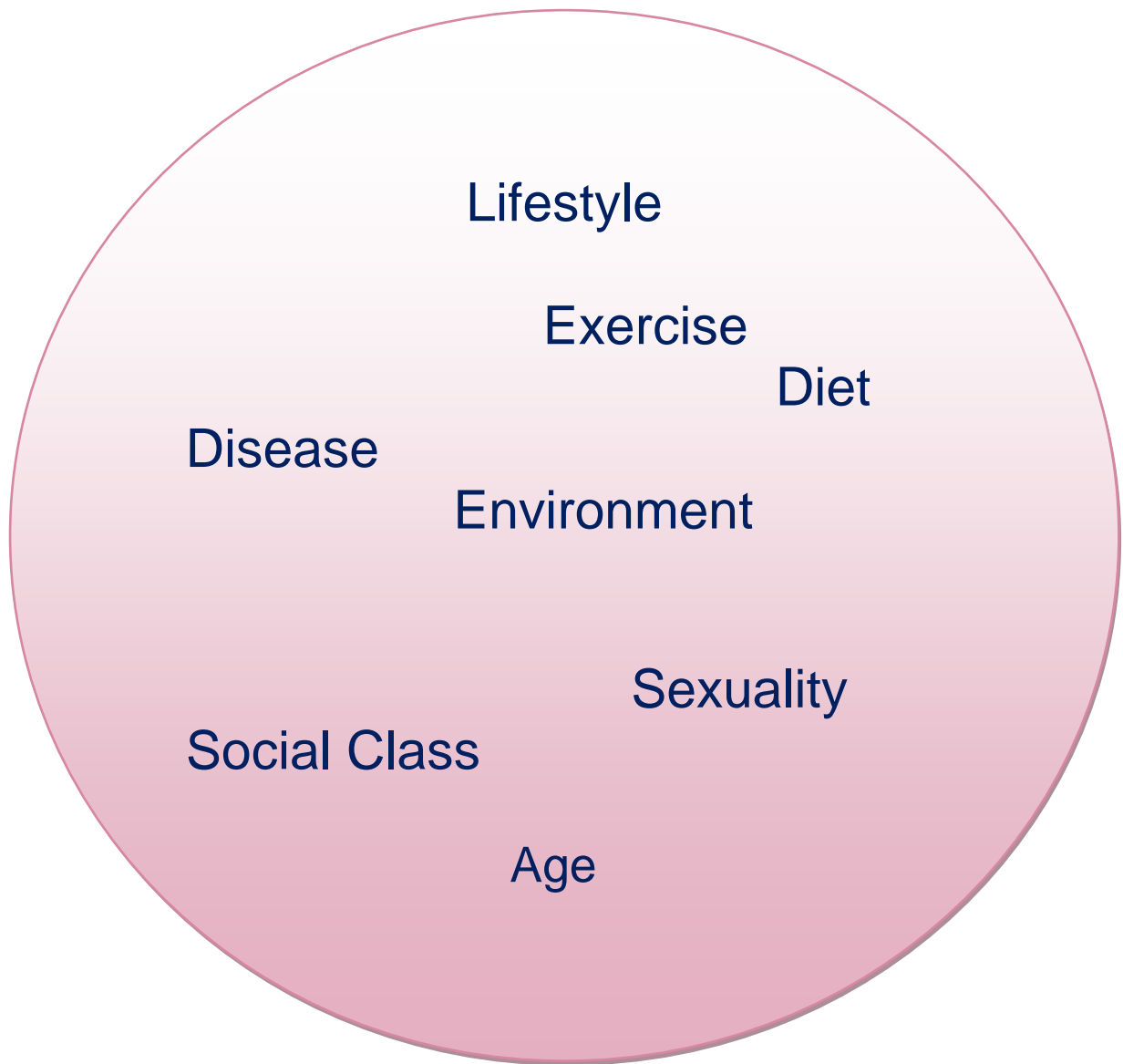
Activity 1

It is now your turn!
Study picture 1 and write down the things you can see in the picture within the circle below. Once you have completed this do the same for picture 2 in the new circle.
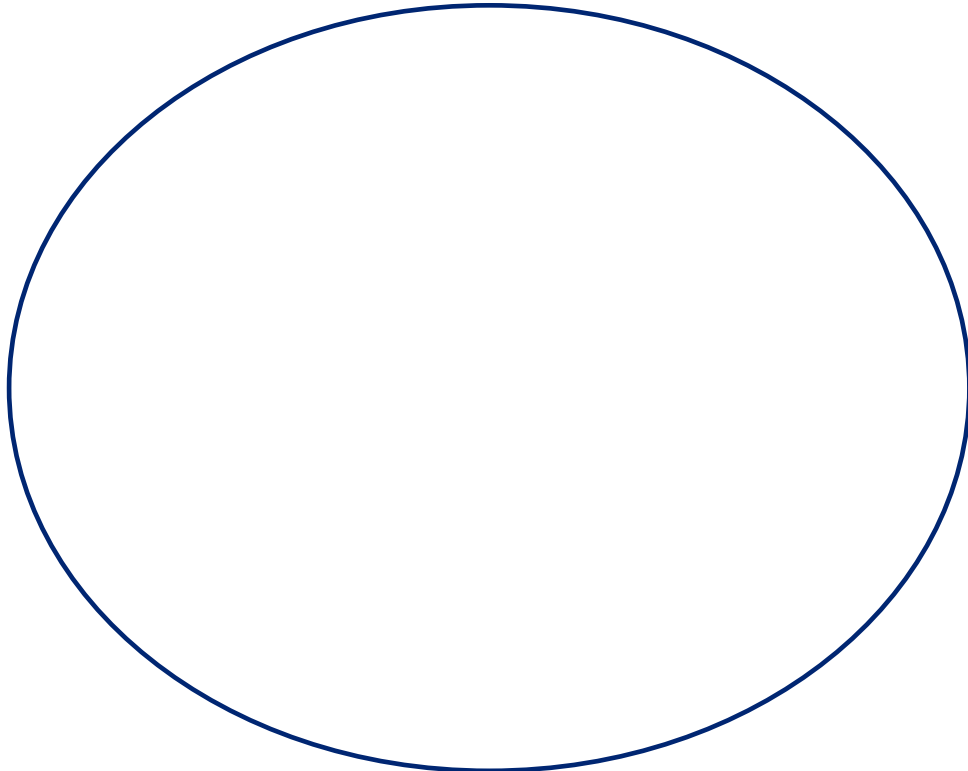

Picture 1

Picture 2

Activity 2
Now follow the same action as you did in Activity 1, this time based on a subject of your choice.

Generate

Below is an example of a 'Cluster Map', otherwise known as a 'Spider Diagram' or 'bubble map', another visual tool which can be used to generate initial thoughts, ideas and concepts. Again this cluster map demonstrates how it could be used in relation to the concept of health. The cluster map demonstrates slightly more structure than a circle diagram but contains the same information. This format is now useful as it can be extended.
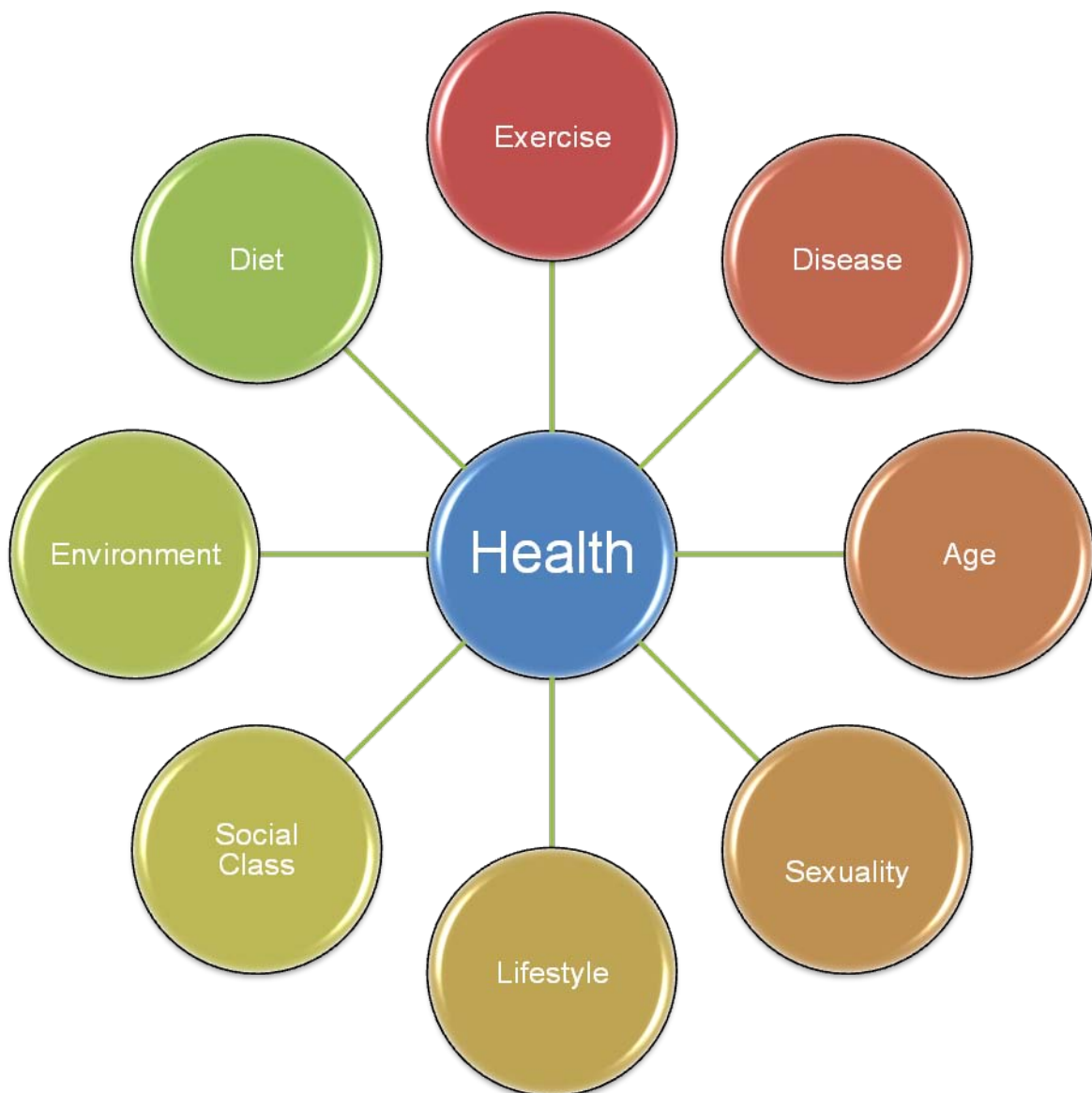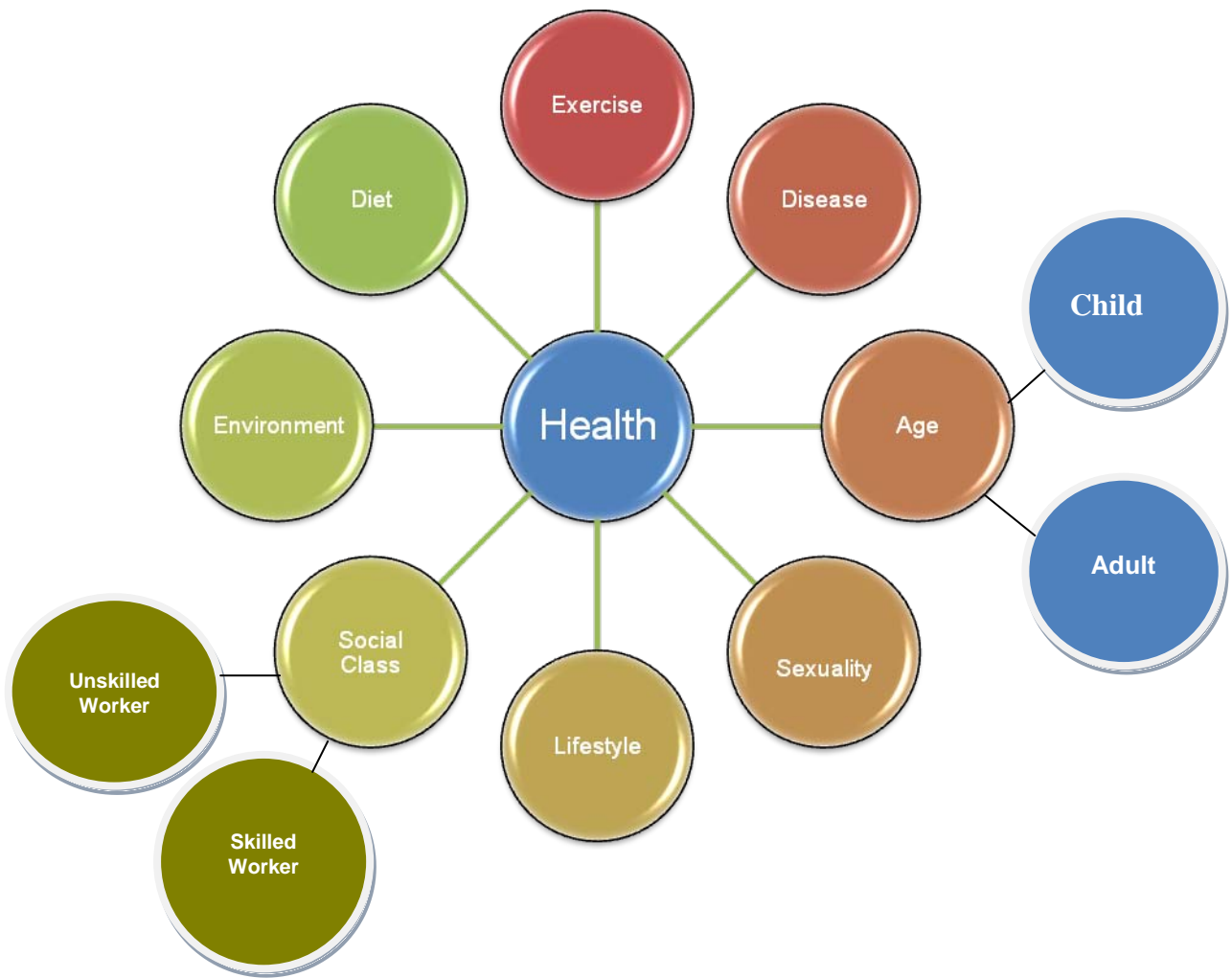
The tool above is the same tool as the previous cluster map but it has been extended to include subcategories, a further stage of generation. This can be completed for all of the elements in the map. This further development demonstrates a deeper understanding of the subject and it forms the basis for the next stage of the process which is systematisation.

Activity 3
Create a cluster map and an extended cluster map for your subject of choice from Activity 2.

Step 2: Systematise

- This stage follows the initial 'Generate' stage and involves some order being introduced to the visual tool.

- The diagram is developed into further stages to represent groups and subgroups, providing structure and hierarchy.

- Links between groups and subgroups are used to represent the relationships between the concept and their component parts (Heinze-Fry and Novak, 1990).

Tools used to systematise information

- Various tools may be used to 'Systematise' the information following on from the initial 'Generate' stage.

- These tools are sometimes known as Structural or Comparative Visual Tools.

- This group includes Tree Diagrams, Target Maps, Flow charts, Venn Diagrams amongst others (Caviglioli 2002).
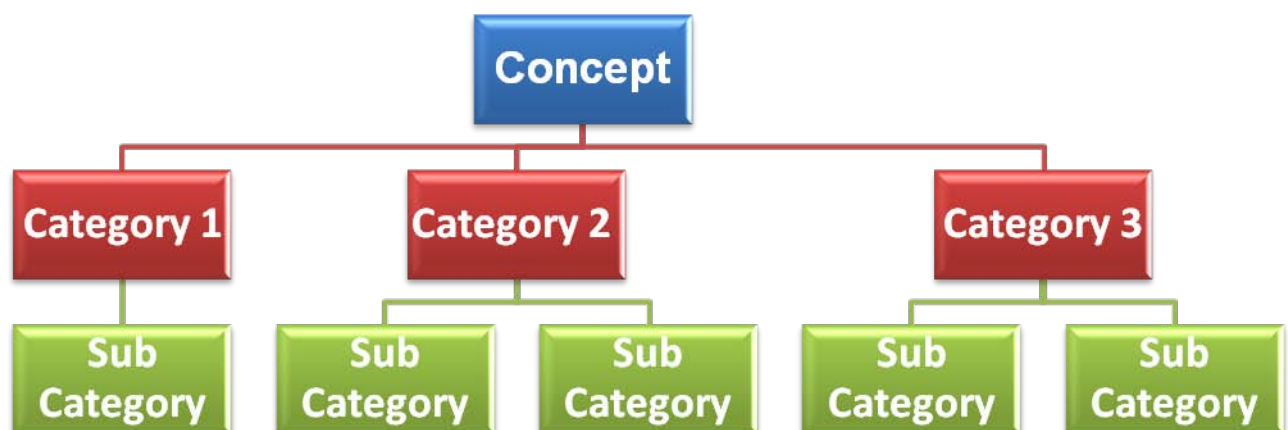
Tree Diagram
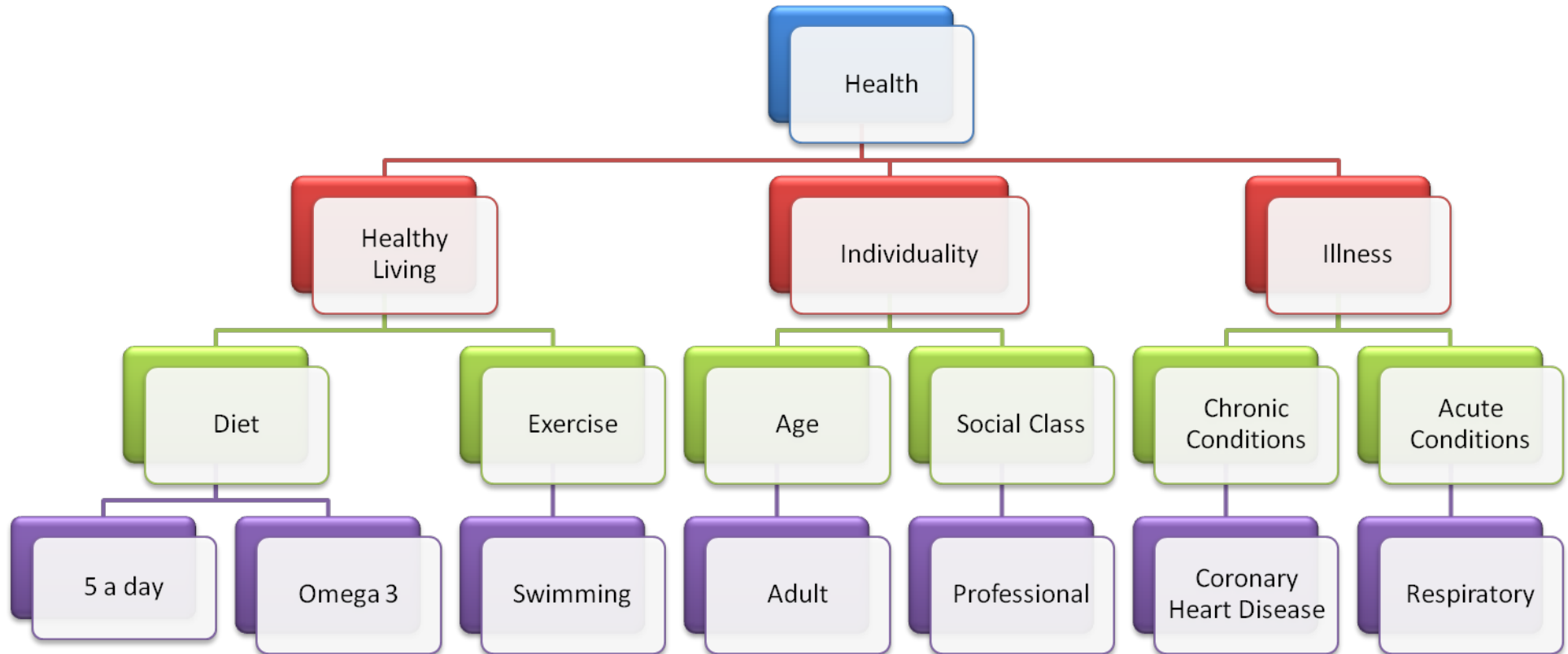
This tree diagram represents the concept of health with its subcategories and some of their component parts

Activity 4:
On a sheet of paper begin to develop categories based on your original ideas based on Picture 1 from Activity 1. Place all of the original items from your circle within the categories. You may include as many categories as you wish, an example of this is shown below.

Picture1
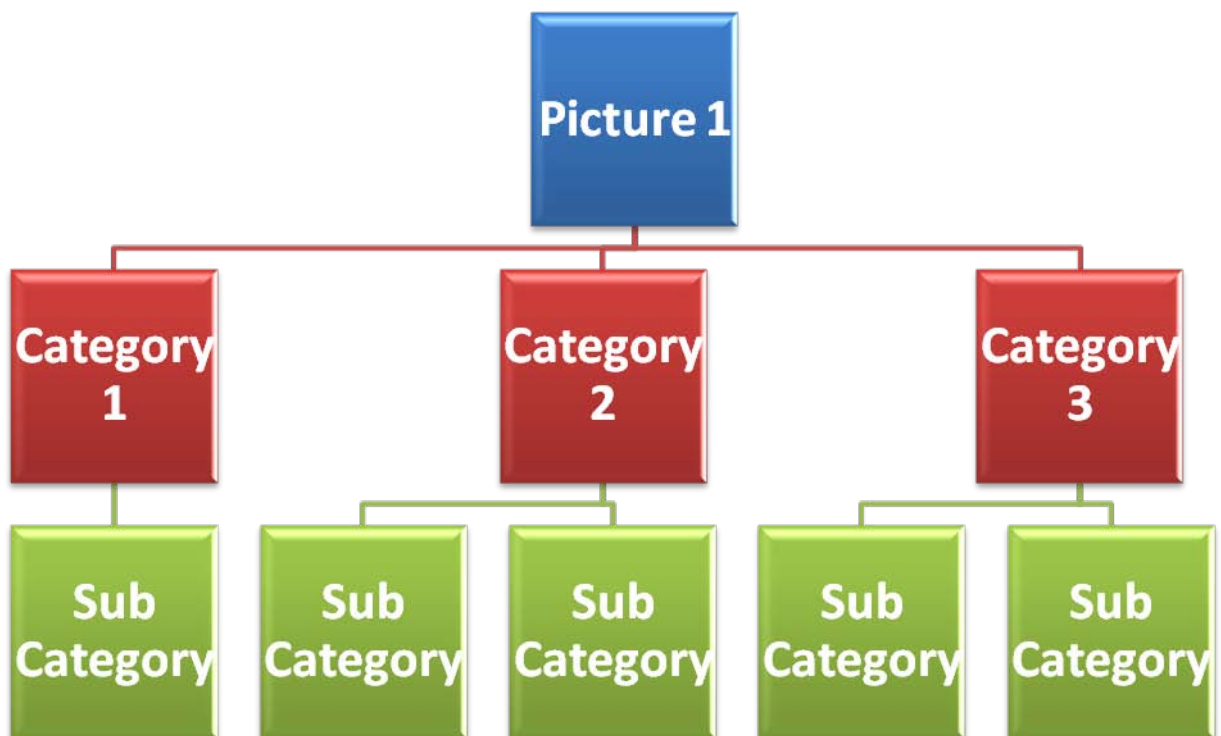
On a sheet of paper repeat the actions of Activity 4 but instead base your categories on your original ideas related to Picture 2 in Activity 1. Place all of the original items from your circle within the categories. Once again, you may include as many categories as you wish. Once you have completed this, repeat this action for the subject of your choice.

Picture 2
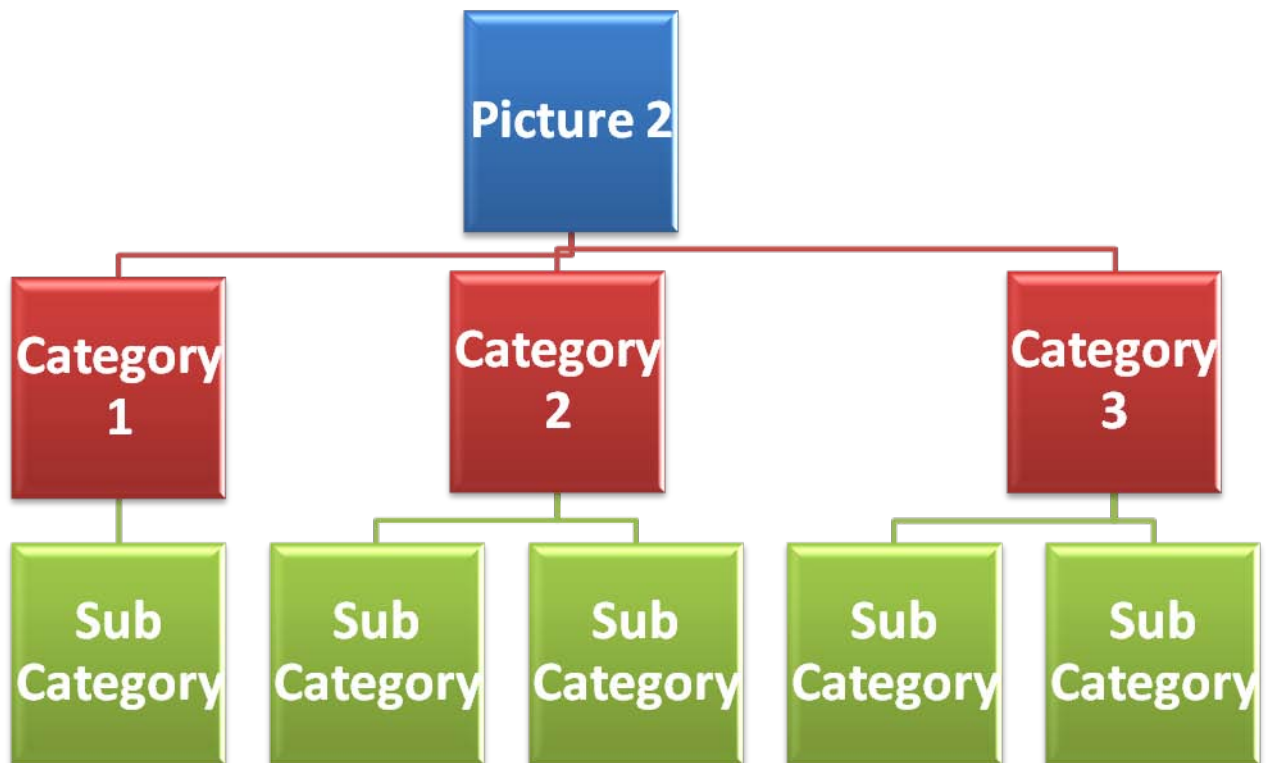
Systematise by Time/events/processes

Visual tools representing time in terms of sequences of events or processes are described as Temporal Visual Tools. They are useful for reviewing events or planning future developments.

Flow diagram
The use of arrows can demonstrate the sequence of a particular process
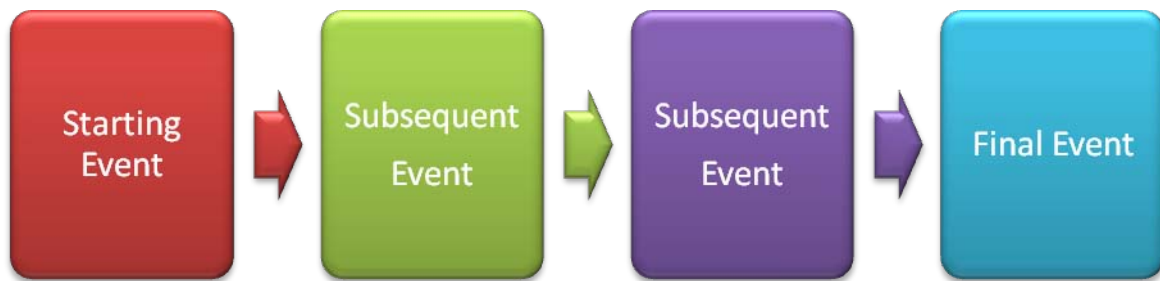
Gantt chart
Represents the sequence and where aspects occur simultaneously.

Gantt charts are often used in the work place for project planning.
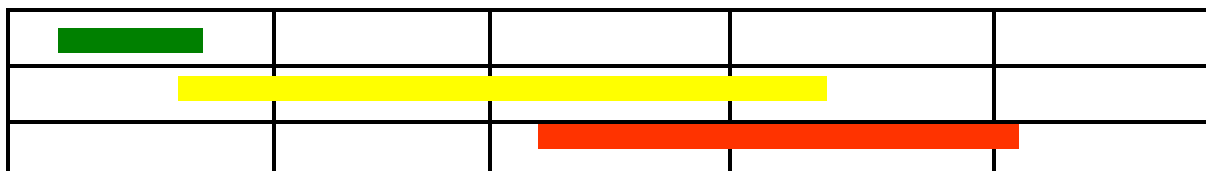
Time lines

Used to demonstrate the sequence and timing of events

Activity 6:
Think of a process or skill that you are aware of, use a timeline diagram to show the sequence of steps taken in completing the skill.

Picture/Story boards

Show not only the sequence of events but may also provide detail.
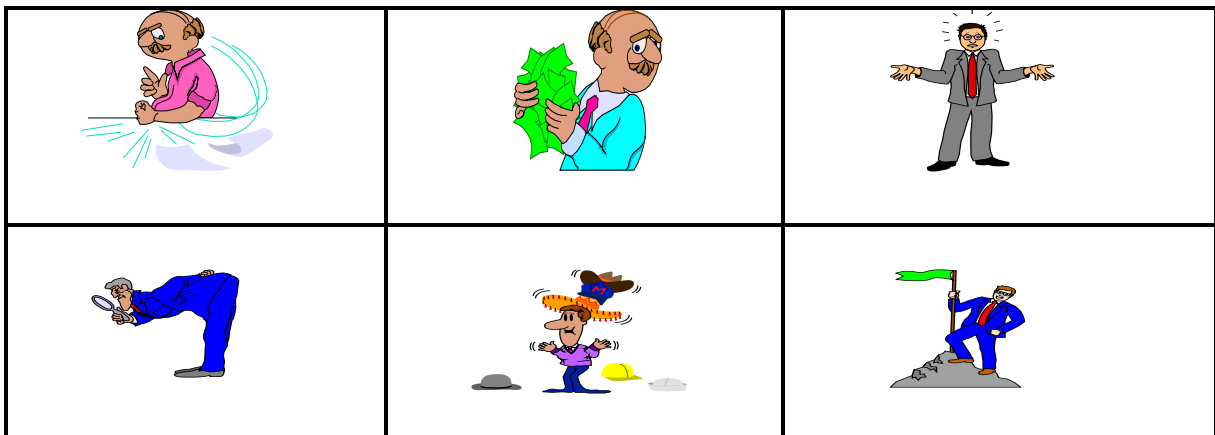
Activity 7:
Now use a Story Board to outline the same process from activity 6.

Systematise - Compare & Contrast

Some tools may be developed to demonstrate the strengths, weaknesses or similarities and differences related to subjects. The diagram below shows the Strengths, Weaknesses, Opportunities and Threats related to a subject or problem. This tool is otherwise known as a SWOT analysis.

Force Field Analysis

This force field analysis diagram below represents the factors which support or oppose a subject or concept; these may also be known as 'Driving' and 'Restraining' forces. This diagram is often used within the process of change management, to identify the factors for and against the change or to explore opposing sides of a debate.
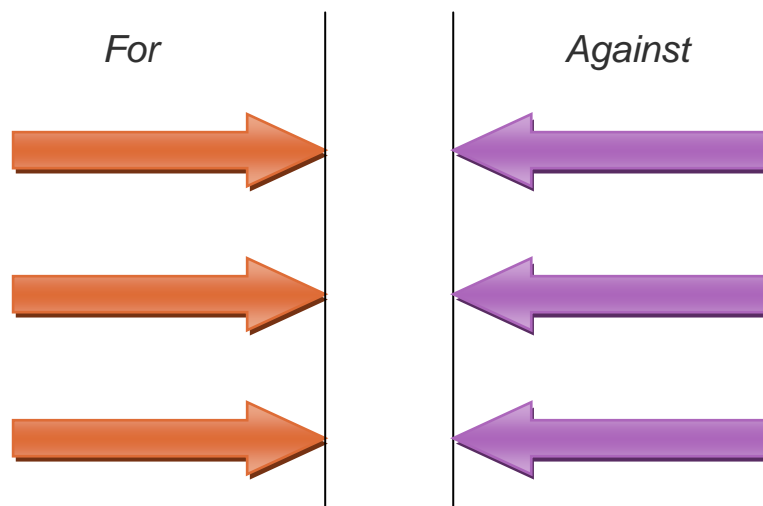
Venn-diagram

The Venn-diagram illustrates shared and individual components/characteristics of a subject.
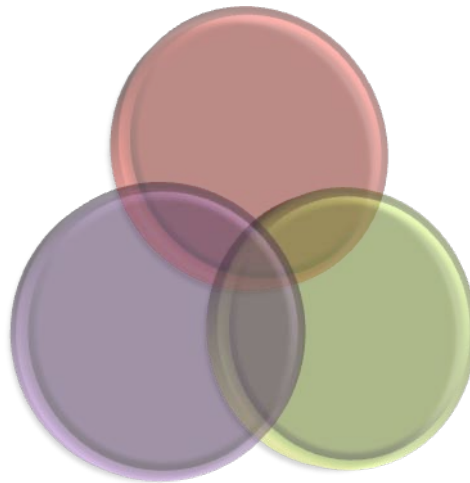
Affinity diagrams

A table/matrix represents cross referencing of all the components of each of the concepts of interest.

	1	2	3	4
A				
B				
C				

Systematise
Compare & Contrast
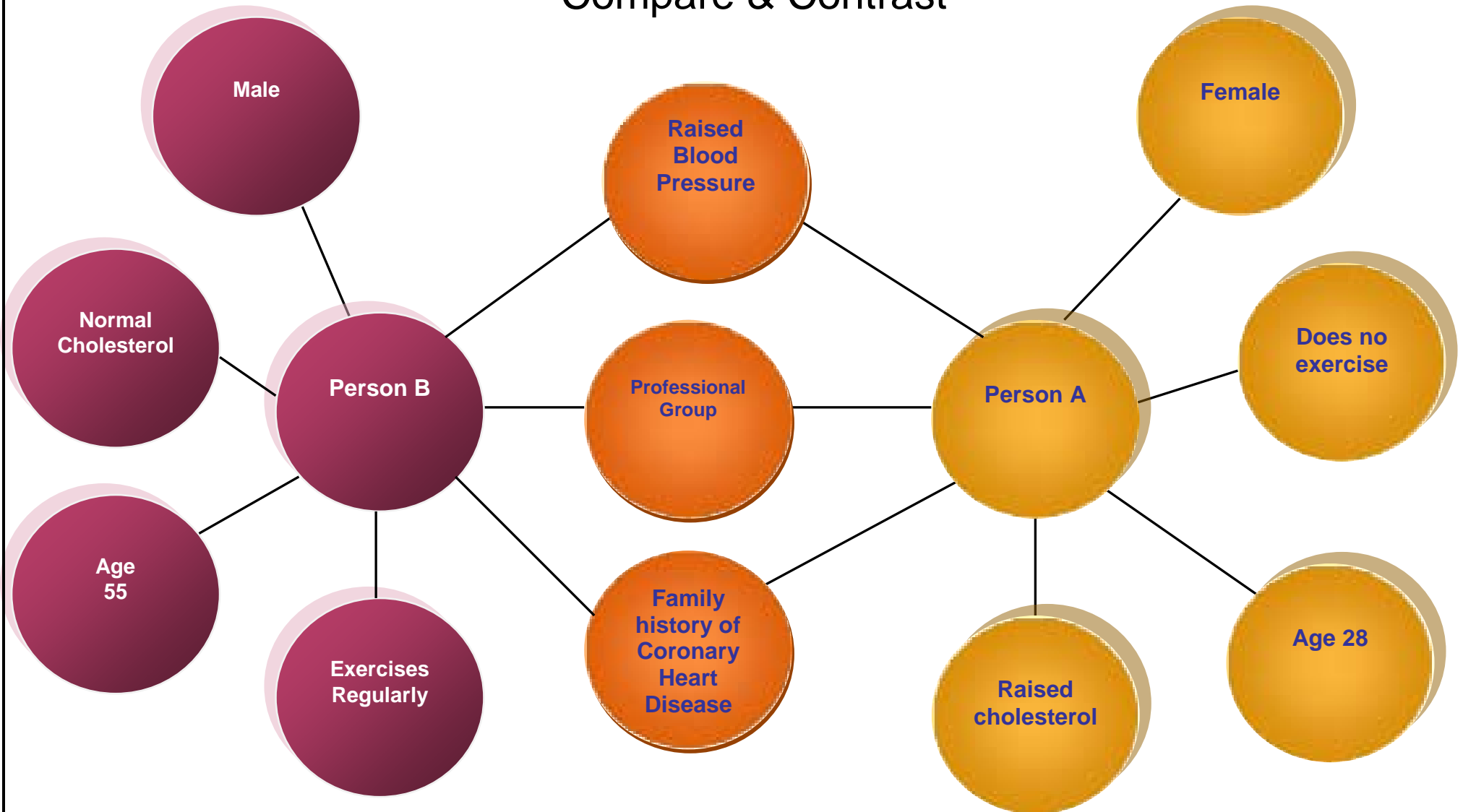
This double concept diagram shows individual and shared properties of a subject, it can be regarded as sharing similarities of a Venn Diagram.

On a clean sheet of paper begin to compare and contrast the two pictures using your original ideas showing the similarities and differences in the diagram.

Picture 1

Picture 2

The double concept tool can be used to review articles or theories, highlighting the similarities and differences, or the strengths and weaknesses inherent in a subject or concept.

Systematise for Priority/Importance

Target maps support the prioritising required for decision-making. Like any other ranking method 'Target maps' help to identify the characteristics which have the most or least significance in a given concept or problem. The characteristics identified in the centre are regarded to be the most important compared to those further away from the centre that are considered to be of less importance.

Lifestyle

Environment

Social Class
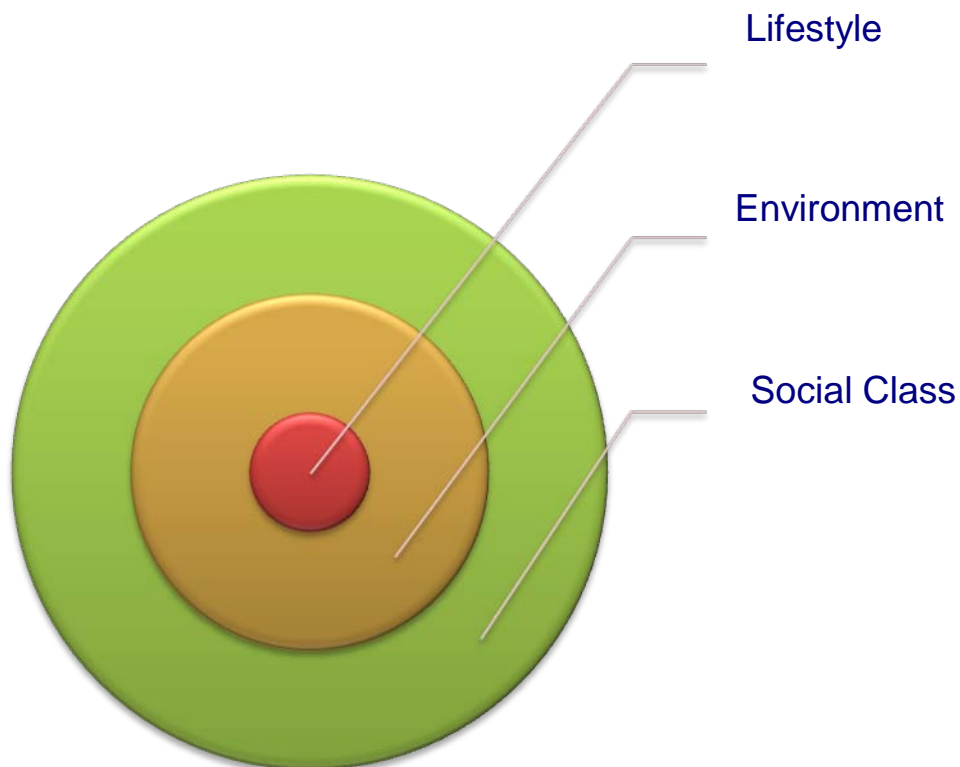
Activity 9:
Complete a target map demonstrating the most and least important factors related to your subject of choice in Activity 2.

Systematise by
Causal Links/ Relationships/ Protocols

❑ More complex visual representations are required to illustrate relationships.

❑ Many of these representations are familiar to students. It is the construction of these representations that are applicable to the concept or problem solution being represented.

Algorithm/Process Chart

Algorithms are often used to represent and support various decision-making processes in the form of a flow chart of options and steps. The example below demonstrates the decision making process and appropriate response in the case of a choking adult. Resuscitation Council, UK, (2007).

Adult choking treatment

```
                    ┌──────────────────┐
                    │  Assess severity  │
                    └──────────────────┘
              │                              │
              ▼                              ▼
    ┌──────────────────┐        ┌──────────────────┐
    │      Severe       │        │       Mild        │
    │ airway obstruction│        │ airway obstruction│
    │ (Ineffective cough)│       │ (Effective cough) │
    └──────────────────┘        └──────────────────┘
        │            │                      │
        ▼            ▼                      ▼
┌───────────┐ ┌───────────┐      ┌──────────────────┐
│Unconscious│ │ Conscious │      │ Encourage cough   │
│           │ │           │      │                   │
│ Start CPR │ │5 back blows│     │Continue to check  │
│           │ │           │      │for deterioration to│
│           │ │5 abdominal │     │ineffective cough  │
│           │ │  thrusts  │      │ or relief of      │
│           │ │           │      │   obstruction     │
└───────────┘ └───────────┘      └──────────────────┘
```
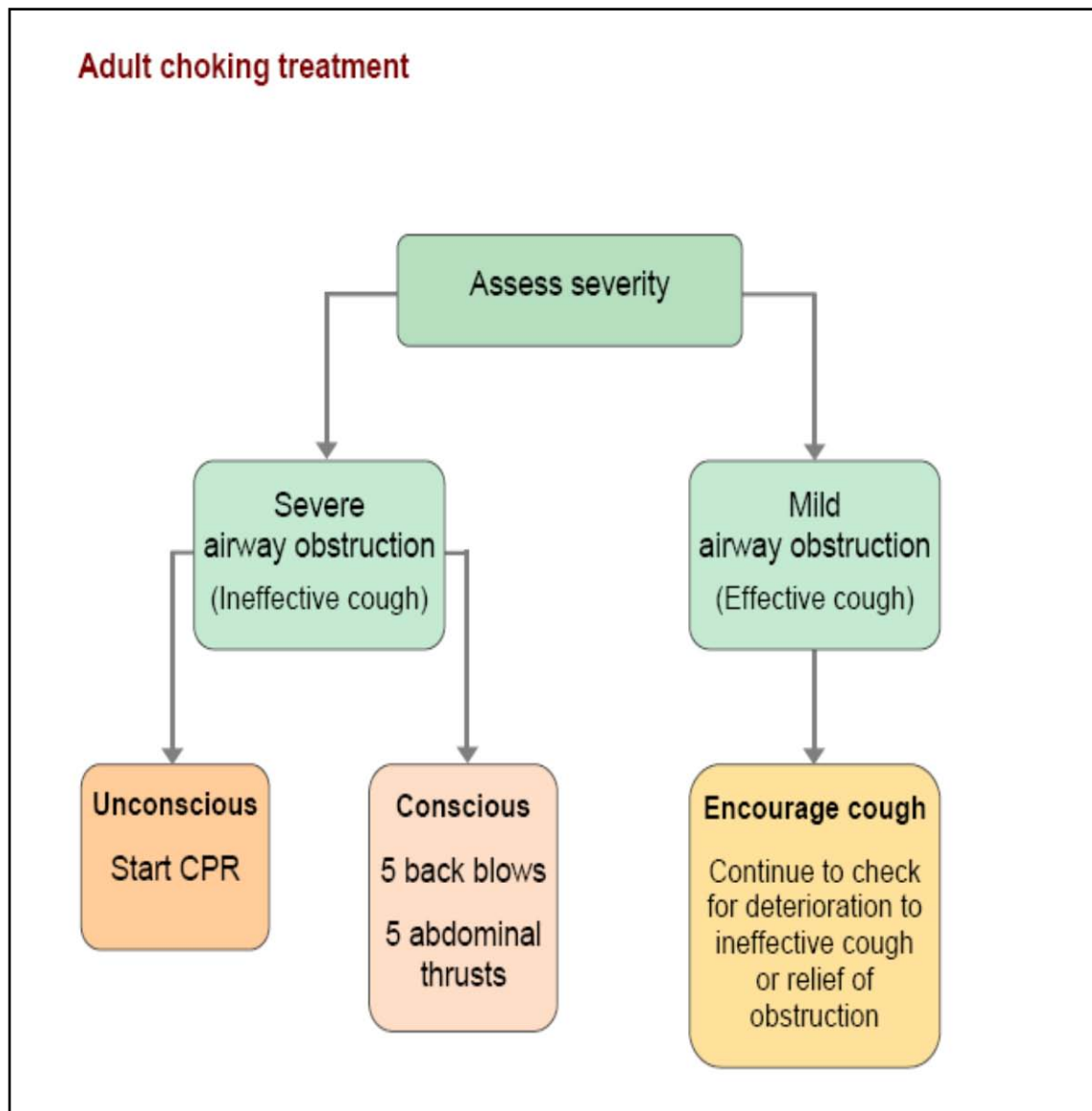
Relations Diagram

Relations diagrams show how components and concepts are structured, how they interact and relate to one another.
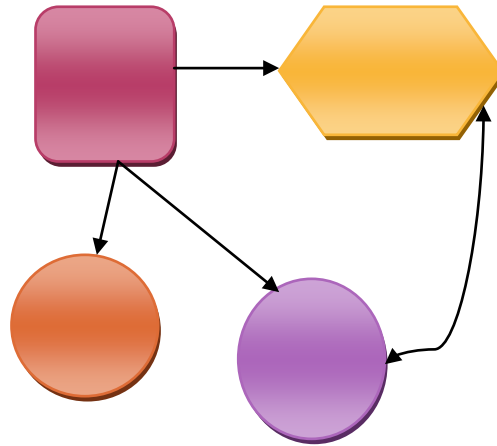
Lines can be thicker/thinner, nearer/further or dotted in order to show the strengths of relationships.

Cycle/process diagram

These diagrams are used to represent the sequences, stages, occurrences and processes within a concept/situation

Fishbone/Causal representation diagram (Ishikawa, 1990)

The fishbone diagram is very sophisticated as it can demonstrate a number of factors identified in the generate stage. It can also show the categories, sub categories and their importance identified in the systematise stage. The nearer the concept to the head and spine of the diagram the more important it is considered. This diagram demonstrates the key components to achieving optimum health; the closer the subject is to the mid line, the greater the influence/importance on the outcome.

Relaxation

Rest

Interests

Sleep

Shelter

Social Interaction

Warmth

Other

Healthy diet

Complex Carbohydrates

Fruit and Vegetables

Fibre

Protein

Water

Motivation

Aerobic

Stamina training

Exercise

Optimum Health

Activity 10:
Complete a fishbone diagram related to your topic of choice from Activity 2.

35
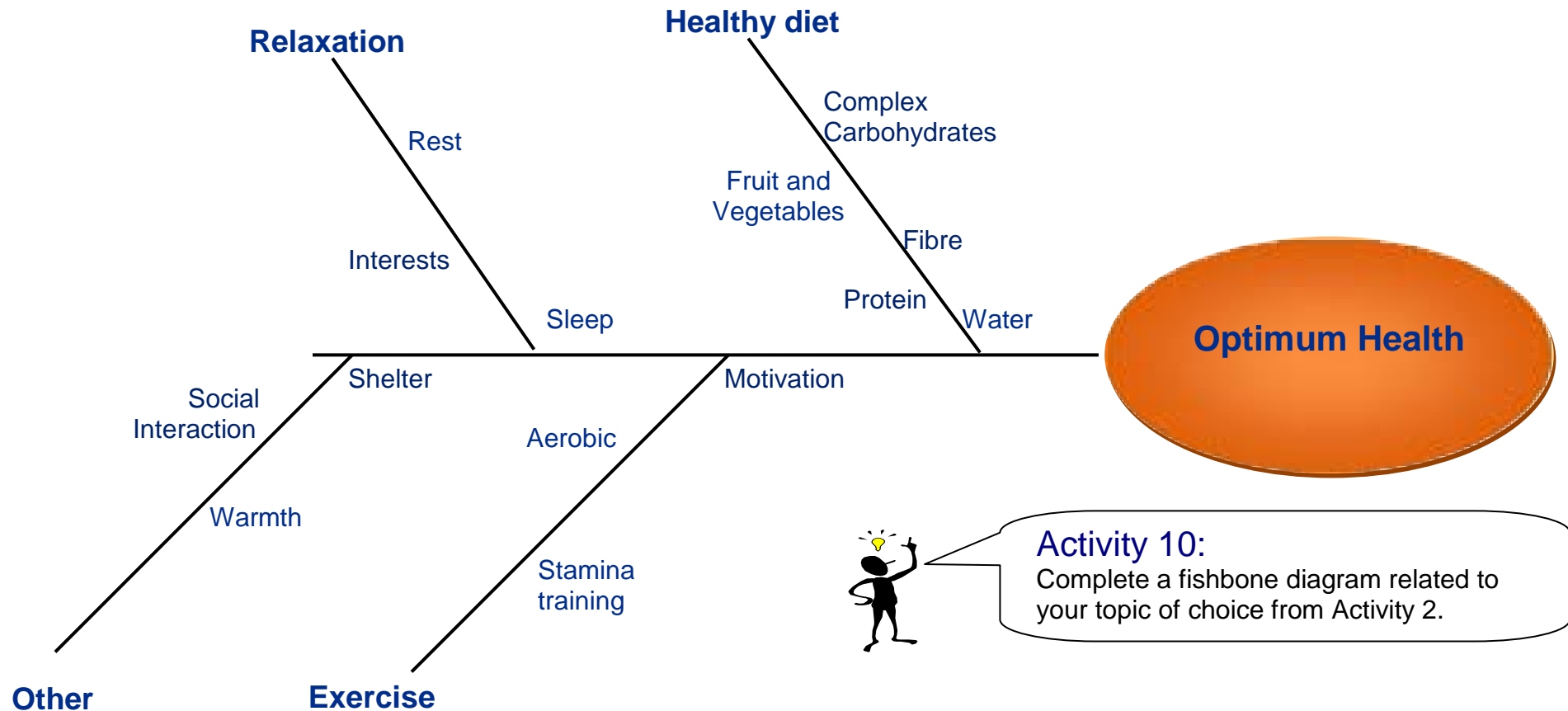
Step 3: Evaluate

❏ Evaluation is the final stage within many educational taxonomy frameworks.

❏ Various diagrams are used to examine components, relationships and prioritise to draw conclusions.

❏ Visual representations include those that compare and contrast, which identify similarities and differences including strengths and weaknesses.

❏ It is essential that these are applied effectively to the identified concept or problem under study.

Tools Used to Evaluate Information

This visual representation can be used to both consider the advantages and disadvantages of the subject matter.

It also highlights anything new or interesting that has come to light during analysis.
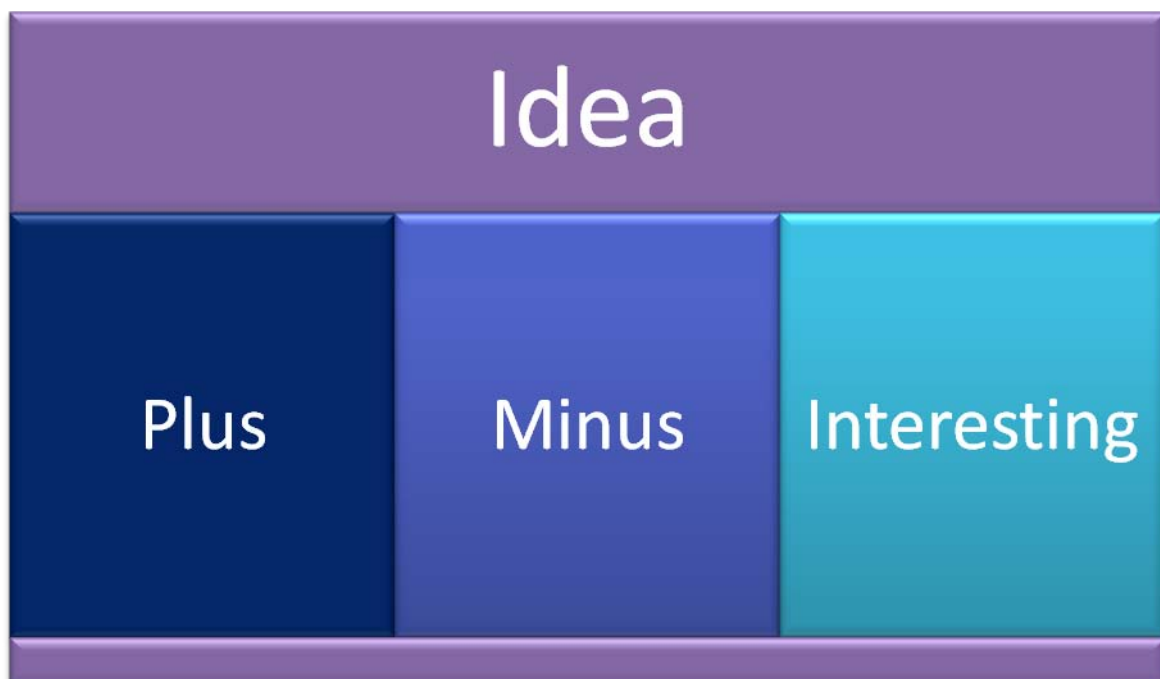
Plus Minus Interesting 'PMI' (De Bono, 1993)

The diagram on the next page shows how this tool can be utilised in evaluating the use of visual tools

Visual Tools in Adult Learning

Plus

Educational tools.

Promote meaningful learning.

Meet individual learning styles.

Supports students with dyslexia.

Promotes critical thinking.

Develops problem-solving skills.

Identifies gaps in knowledge.

Students control their learning.

Useful for:
Planning
Revision
Curriculum development
Assessment Strategy
Portfolio development

Minus

Time to become proficient.

Interpretation can be difficult initially.

Information technology software can be time consuming.

Teacher transition to facilitation of student centred learning.

Interesting

Use in the national curriculum within the UK and implications on HE.

Students with some forms of dyslexia have the opportunity to demonstrate their understanding and problem solving skills in alternative ways to written narrative (Farmer et al, 2002).

Mind Maps

Mind maps were initially developed by Tony Buzan in the popular book 'Use Your Head' originally published in 1974. Buzan (1995) suggested that 'laws of mapping' should be used in order to increase recall of topics as the central concept is clearly indicated and the relative importance of each idea is developed in relation to each other. This gives us a sense of prioritising and of order and subordination of concepts (Buzan, 1995). Caviglioli and Harris (2000) suggest a map produces models of the individuals' thoughts about concepts or ideas. Therefore it could be argued that it is a useful tool in all three aspects of the process that we have discussed, generate, systematise and evaluate. It could be considered a useful way to bridge the graphical and linguistic properties of a visual tool. As outlined in the literature review, maps provide detailed information related to concepts. Buzan (2004) suggests that mind maps help in solving problems and clarifying situations. Mind maps are useful for planning, generate creativity, organisation or analysis and are an effective communication tool.

The system is quite simple. Starting from a central point, branches of sub concepts or aspects are added. These themselves can be broken down into further branches so that concepts can be seen and developed. The advantage of a mind map is that it can be changed or re-organised as it develops or is evaluated. Relationships between branches and sub branches can be defined and highlighted. Shapes, icons and colours can be used to highlight similarities or differences, with lines and arrows been used to demonstrate interrelationships.

They can be systematised or generic. For example when prioritising if we imagined the most important aspects to be placed in the 12 O'clock position as if on a clock face and worked around in a clockwise direction we could develop our understanding of the relative importance of concepts and then communicate these clearly to others as long as they understood the systematic rules. However the main benefit of a mind map is that it represents information in a holographic way meaning that the whole can be seen at once. This brings to mind the Gestalt notion of the whole been greater than the sum of its parts. A mind map shows the whole and the parts. Therefore the mind map is useful and very flexible for a whole range of learning and planning as it can be used to create or review a subject or concept. Harris and Caviglioli (2003) suggest they mind maps are useful as they provide a basis for information processing (maintaining the linear aspect of information whilst adding a holographic nature), as a form of socialisation in that they can be used to communicate with other parties, they can be individualised and adapted to suit the individuals requirements and they provide behavioural feedback in as much as they can be utilised for self correction.

As discussed above, the mind map can encapsulate some of the linguistic properties of simple to complex visual tools. The central concept is broken down into it's component parts and links made between them. Each branch can be developed into a mind map of its own to develop the complexity and understanding of a topic. There are many opinions of the best practice for developing mind maps and there are many commercial products being used to produce them using computers.

However they can quite simply be drawn by the individual using them. There are however some general rules of thumb to apply. Margulies and Maal (2004) suggest that we start with a central image and concept. We then provide branching lines which can be curved (to make best use of space and increase graphical effectiveness). Words should be written on the line and not at the end of it and should be printed for clarity. Symbols shapes and colours should be used consistently to highlight issues and concepts and to freely associate between ideas and subtopics. Some floating icons or text can also be used to emphasise points and ideas. It can be useful to use the map at the generation stage to develop ideas and information, it can be used as part of the systematising process by creating order to information generated, or it can be used at the end of the process to evaluate once the prior processes have been completed, perhaps using a variety of visual tools with the mind map being used to summarise the learning or developmental ideas.

'Mind Mapping works for me!

The statement below is a testimony volunteered from a first year nursing student having attended the visual tools workshop and subsequently uses visual tools for different purposes to support their studies.

'..During the first year at University, I was experiencing difficulty with assignments and essays. I was struggling to put things down on paper and most importantly in the order that is expected at University. Such comments included ' lacking structure' and 'lacking flow'. I felt like I was out of my depth and began to doubt my capabilities. I was very upset with my grades as this was reinforcing my own thoughts of being inadequate. It was daunting that I had a further 2 assignment and 2 exams to pass.

Fortunately I attended an optional Visual Tools workshop, before attending the session I had absolutely no idea what to expect from it. However in relation to visual tools and mind mapping which was covered during the session, I now have a formula which I personally view as my 'key' to any given subject. I apply these tools to essays, assignments and exams in my own way. Through 'Mind Mapping' I now have a technique of clarifying, structuring, and revising relevant subjects. It helps to identify personal strengths and weaknesses, therefore I am able to guide myself in the right direction in search of the information and knowledge that I require.

I have received much higher grades then I previously ever thought possible, I feel reassured now that my goals are personally achievable. I have since received feedback comments on my work which included 'impressed' and 'exceptional'. I truly believe that this was facilitated by my attending the Visual Tools workshop as this assisted me in finding my own 'key' and made these results personally achievable.'

Student Nurse (Jan 08, Cohort)

Conclusion
Using Visual Tools for Analysis and Learning
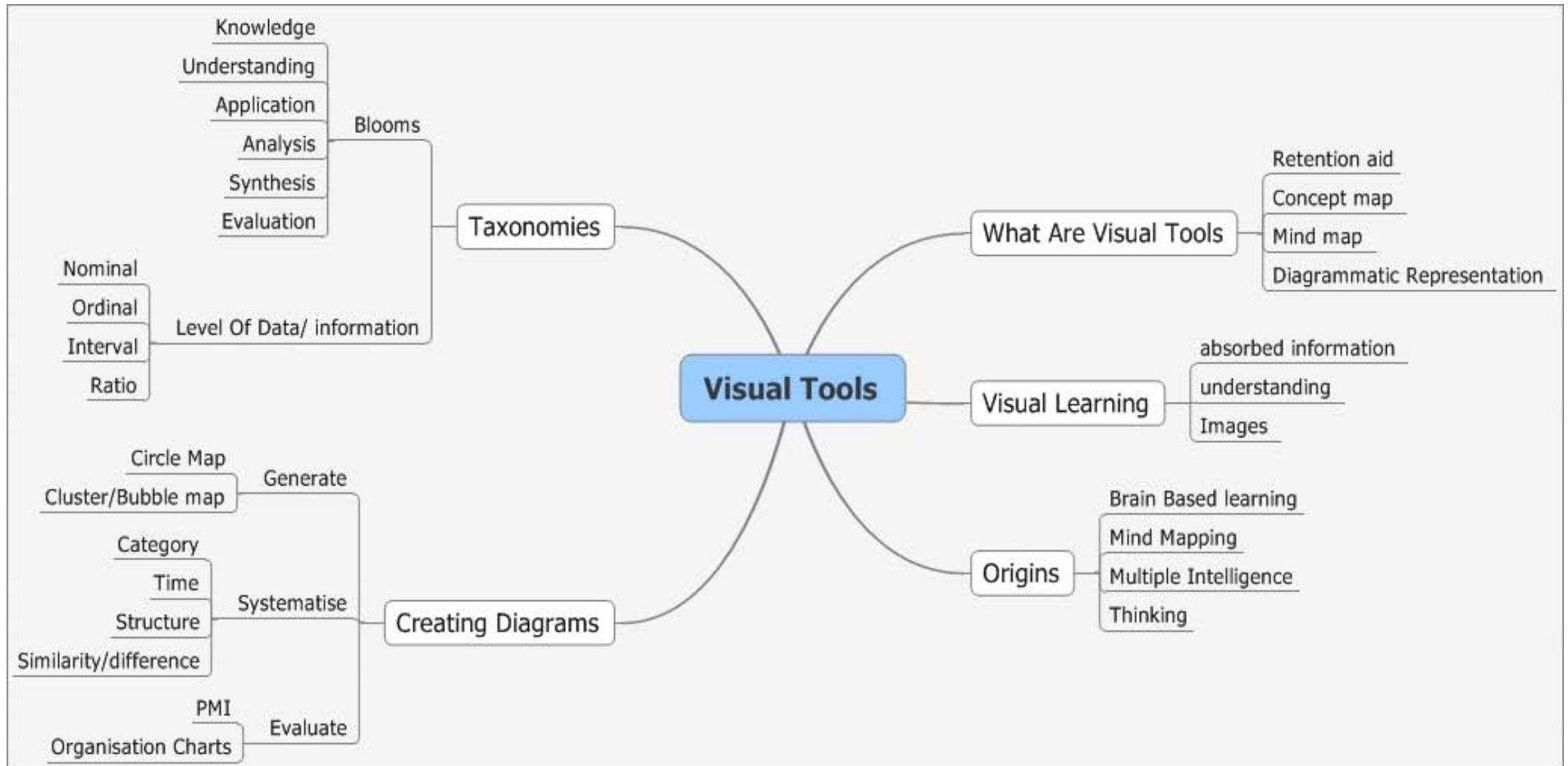
References

Blackwell, A. F. (2001) *Thinking With Diagrams,* Dordrecht Boston London, Kluwer Academic Publishers.

Bloom, B. S. (1956) *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain,* New York: , McKay.

Burton, J., Bodenhamer, B. G. (2000) *Hypnotic Language :its structure and use,* Wales, Crownhouse publishing.

Buzan, T. (1995) *Use Your Head,* London, BBC Books.

Buzan, T. (2004) *Mind Maps At Work: How To Be The Best At Your Job And Still Have Time To Play,* London, Thorsons.

Caviglioli, O., Harris, I. (2000) *Mapwise,* Stafford, Network Educational Press Ltd.

Caviglioli, O., Harris, I., Tindall, B. (2002) *Thinking Skills And Eye Q: Visual Tools For Raising Intelligence,* Stafford, Network Educational Press Ltd

De Bono, E. (1993) *Teach Your Child How to Think,* New York Penguin.

Dimopoulos, K., Koulaidis, V., Sklaventi, S. (2003) Towards An Analysis Of Visual images In School Science Textbooks and Press Articles About Science and Technology. *Research In Science Education,* 33**,** 189-216.

Enns, J. T. (2004) *The Thinking Eye, The Seeing Brain: Explorations in Visual Cognition,* New York ,London, W.W. Norton and Co.

Ewenstein, B., Whyte, J. K. (2007) Visual Representations as 'Artefacts Of Knowing'. *Building research & Information,* 35**,** 81-89.

Farmer, M, Riddick, B., Sterling, C, (2002) *Dyslexia and Inclusion: Assessment and Support In Higher Education.* London. Whurr Publishers.

Gardner, H. (1993) *Frames of Mind: The Theory of Multiple Intelligences. ,* New York, Basic Books.

Girill, T. R. (1992) The principles of visual rhetoric and the rhetoric of visual principles. *Asterisk Journal of Computer Documentation,* 16 17 - 26

Harris, I. & Caviglioli, O. (2003) *Think It - Map It,* Stafford, Network Educational Press LTD.

Heinze-Fry, J., Novak, J   (1990) Concept mapping brings long term movement toward meaningful learning. *Science Education.,* 74**,** 461-472

Hsu, L., Hsieh, S.I. (2005) Concept Maps as an Assessment Tool in a Nursing Course. *Journal Of Professional Nursing,* 21**,** 141-149.

Hyerle, D. (2004) *Student Successes With Thinking Maps: Results, and Models For Achievement Using Visual Tools,* Thousand Oaks, California, Corwin Press.

Ishikawa, K. (1990) *Introduction To Quality Control*, London, Chapman and Hall.

Jensen, E. (2000) *Brain Based Learning: The New Science Of Teaching and Training,* San Diego, The Brain Store.

Johnson, B. & Shneiderman, B. (1991) Tree-Maps: a space-filling approach to the visualization of hierarchical information structures. *Proceedings of the 2nd conference on Visualization '91.* San Diego, California, IEEE Computer Society Press.

Marguiles, N. & Maal, N. (2004) *Mapping Inner Space: Learning and Teaching Visual Mapping,* Carmarthen, Crown House Publishing.

Marguiles, N. & Valenza, C. (2005) *Visual Thinking: Tools For Mapping Your Ideas,* Norwalk USA, Crown House publishing Company LLC.

Marieb, E. N. (1991) *Human Anatomy and Physiology,* California, Benjamin Cummins.

Novak, J. D. (1990) Concept maps and Vee diagrams: two metacognitive tools to facilitate meaningful learning. *Instructional Science : ,* 19**,** 29-52.

Resuscitation Council (UK) (2007). Adult Choking Algorithm. http://www.resus.org.uk/pages/achkalgo.pdf date accessed June 3rd 2009

Rose, C. & Nichol, M. J. (1997) *Accelerated Learning For the 21st Century,* London, Piatkus.

Shen-Hsieh, A. & Schindl, M. (2002) Data visualization for strategic decision making. *Case studies of the CHI2002\&\#124;AIGA Experience Design FORUM.* Minneapolis, Minnesota, ACM.

Shimojima, A. (2001) The Graphic-Linguistic Distinction: Exploring Alternatives. *Artificial Intelligence Review,* 15**,** 5-27.

Sutherland, S. & Katz, S. (2005) Concept Mapping Methodology: A Catalyst For Organisational Learning. *Evaluation and Program Planning,* 28**,** 257-269.

Williams, M. (2004) Concept Mapping - A Strategy For Assessment. *Nursing Standard,* 19**,** 33-38.

Wolfe, P. (2004) in Hyerle, D. (2004) *Student Successes With Thinking Maps: Results, and Models For Achievement Using Visual Tools,* Thousand Oaks, California, Corwin Press.