LEARNING STYLES AND

TECHNOLOGY-BASED TRAINING

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CONTENTS

TERMINOLOGICAL NOTE

In the booklet, the term *Learning Style* will be used to denote a fixed characteristic of an individual, and the expression *Learning Strategy* will indicate an approach that can be learned, developed or changed.

Further, the term *Learning Style* has the same meaning as *Cognitive Style* used in connection with the *Cognitive Styles Analysis*.

CHAPTER ONE: INTRODUCTION

If you are reading this then the chances are that you are either:

- responsible for planning the provision of training,

- involved in the design and production of training materials, or

- a deliverer of training.

Whichever you are, this booklet contains information important to you. You will be asking yourself the sorts of questions it addresses.

WHY CONSIDER LEARNING STYLES AND TECHNOLOGY-BASED TRAINING (TBT)?

Both TBT and Style represent significant developments which have the potential to dramatically change both training methods and learning performance.

Taking TBT first, there are several attributes of Personal Computers (PCs) and the Information Superhighway that can be utilised to facilitate learning. These include the following:

- Attractive multi-media presentation capable of controlling such things as mode of delivery (visual/verbal), and the presentation rate of, for example, speech.

- Mechanisms for controlling the order of presentation, choice of learning activities, and pace of instruction.

- The ability to monitor learning performance, store responses and undertake assessments.

- The facility to simulate situations and environments (virtual reality) providing learning/training experiences in a risk-free and low cost manner for a range of topics such as medical diagnosis, piloting a plane, managing a company, and designing a building.

- The possibility of linking via the Superhighway the learner to an external tutor for support, or to other students/trainees/experts to form a collaborative learning group which can communicate with one another (including the exchange of data).

- Access via the Superhighway to information and learning resources, and assessment materials.

In considering the use of information technology in training, it is imperative that the organisation of learning design and the use of technology should include instructional

considerations. It is vitally important that trainers are not dazzled by new technology and lose sight of its place in the work of training and learning. For a learning system to be successful, it must comprise both good electronic technology and effective instructional technology. Attractive electronic technology, by itself, is insufficient to produce effective learning, and here the contribution of recent advances in the psychology of learning is also required. It is important that both are taken together if their full capability is to be exploited.

DO LEARNING STYLES AFFECT TRAINING PERFORMANCE?

In designing and delivering training there is often the assumption that all trainees learn in a similar manner. This approach ignores the important issue of learning style differences. An individual's learning style significantly affects the manner in which information is habitually processed during learning and thinking, and this can have a large effect on the efficiency and effectiveness of training.

In practice there is a considerable range of learning style which affects the ways in which an individual finds it easiest to learn. This booklet considers the nature of two fundamental learning style dimensions and their relationship to training performance and the implications for the planning, design and delivery of training.

ARE STYLES ONLY RELEVANT TO TRAINING?

While styles affect training, because they are part of how the brain organises the ways in which individuals represent and perceive the world they live in, they also influence social relationships, job performance, management approaches, and team building.

WHAT ARE LEARNING STYLES?

Learning styles reflect the fundamental make-up of a person, and have a physical basis. However, a person will not really be very conscious of their style since they will have experienced no other.

Learning styles control the ways in which events and ideas are viewed. They therefore affect how an individual responds to, and thinks about, events in their life and makes decisions. They also influence the attitudes an individual has to other people, and the ways of relating to them.

A person's style is the automatic way they respond to information and situations. It is constant for them and not something that appears to change. An individual cannot

switch it on and off since it represents the way they are. However, when a person is aware of their style they can develop strategies to utilise their strengths more effectively. They can also limit the effect of their weaknesses.

WHAT ARE THE TWO FUNDAMENTAL DIMENSIONS?

An extensive survey of learning styles[1] indicates that there are two style dimensions. People differ in two basic ways:

(a) Whether they take a whole view or see things in parts – the Wholist-Analytic dimension.

(b) Whether they are outgoing and verbal, or more inward and often think in mental pictures or images – the Verbal-Imagery dimension.

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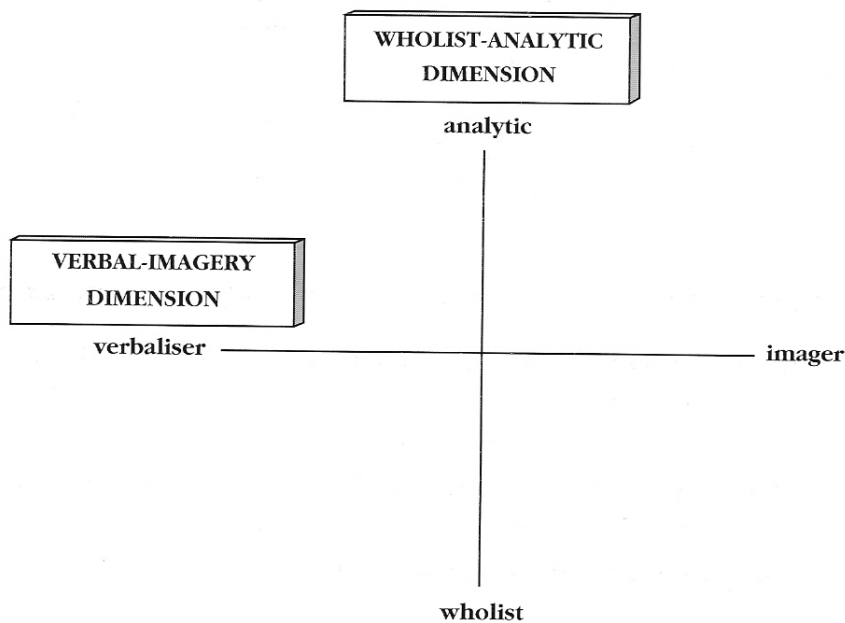
[1]See, Riding, RJ and Cheema I (1991) Cognitive Styles – an overview and integration. *Educational Psychology*, 11, 193-215.

These two dimensions are independent of one another. A person's position on one dimension of learning style does not affect their position on the other. However the way they behave will be the result of the joint influence of both dimensions. The two dimensions are shown at right angles to one another to form a style map.
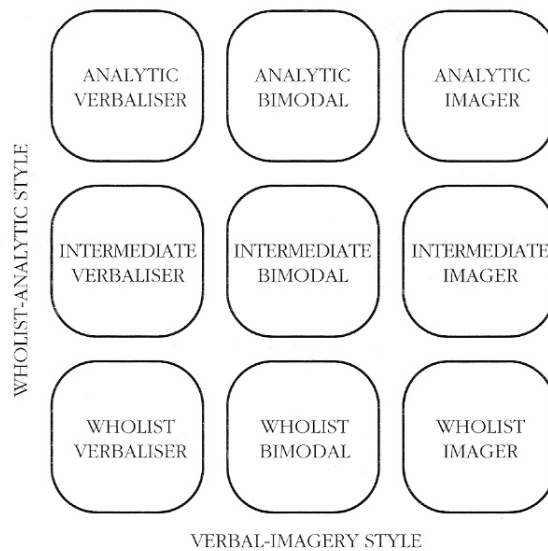
HOW CAN LEARNING STYLES BE ASSESSED?

A convenient way of finding out a person's style is to use the computer-presented Cognitive Styles Analysis (CSA)[2].

The CSA assesses a person's position on each dimension and this allows their position on a style map to be obtained. It is simple to use, only takes ten minutes to complete, is self-scoring, and does not ask any personal questions[3].

Its computer-presented format was developed with TBT in mind, so that it can be easily used in conjunction with TBT to determine the characteristics of trainees.

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[2]Riding, RJ (1991) *Cognitive Styles Analysis* (Birmingham: Learning and Training Technology).

[3]The CSA is available from the Publisher, Learning and Training Technology, 17 Porters Croft, Harborne, Birmingham, B17 8RU UK. Telephone 0121-429 7026.

WHAT DIFFERENCES DO STYLES MAKE?

Consider the style characteristics of four trainers:

John is an ANALYTIC-VERBALISER

Socially he is outgoing and friendly but restrained and moderately formal. He is organised and can get on with things himself rather than needing help from others. He is consistent, but the negative side of this will be an inclination to rigidity and stubbornness.

He is structured in his approach to learning, and likes to set ideas out in a structured form, with clear headings and paragraphs. He has a good verbal memory, and is able to retain facts readily, particularly when presented in verbal form.

In relationships with trainees he is moderately formal, and prefers to keep some distance between himself and them. His training tends to be structured, with him in control of the trainees' learning. His primary mode of delivery is words rather than illustrations although he may use tables.

Christine is an ANALYTIC-IMAGER

Socially she is restrained and formal. At times she is socially unaware, and often shows a rather stern exterior, which does not reflect how she really feels. She is organised and self reliant, and tends to get on with things herself rather than seeking help from others.

Her approach to learning is structured. She learns best from diagrams and pictures rather than text. She is concise in writing and speech. In speaking, sometimes she can be hesitant, since words do not always come naturally, and she is not always fluent.

Her relationship with trainees is formal, and she prefers to keep them at a distance. Her training is structured, and she controls trainees' learning. Her training manner is typically interactive and she likes feedback. Her mode of delivery is typically in terms of illustrations rather than words.

Graham is a WHOLIST-VERBALISER

Socially he is informal, extraverted, and lively. He prefers to be with people and enjoys group activity. He is warm and open, and is easy to get on with. He has a lot of go, although he can be changeable and may be unreliable. He can be too dependent on others for help.

He has a good verbal memory and is able to retain facts readily, particularly when presented in verbal form. He does not find diagrams and illustrations helpful. Also he is less good spatially and does not have a strong sense of geographical direction. He is articulate and rarely lost for words, although this is sometimes a little overwhelming.

In relationships with trainees he is informal. His training does not tend to be highly structured, and he is happy for trainees to control their own learning. His training manner tends to be outgoing and lively. His primary mode of delivery tends to be words rather than illustrations.

Debbie is a WHOLIST-IMAGER

Socially she is informal and relaxed. She is fairly easy to get on with. She is usually diplomatic, socially aware and polite. Socially she tends to be reasonably outgoing. She is social, spontaneous, and warm in relationships although she is socially restrained and polite.

She benefits from having the learning material structured for her. She learns best from diagrams and pictures, rather than text. In speaking, she can sometimes be hesitant since words do not always come naturally and she is not always fluent.

In relationships with trainees she is moderately formal. Her training does not tend to be highly structured, and is generally happy for trainees to control their own learning. Her mode of delivery is when possible in terms of illustrations rather than words.

Do you see yourself in any of the above?[+] Having had a snapshot of the difference style can make the obvious next step is to enquire into the ways in which style operates.

CHAPTER TWO: HOW DO STYLES WORK?

WHY DO PEOPLE BEHAVE AS THEY DO?

We will now look at each style dimension in turn and consider its effects on behaviour.[5]

Wholist-Analytic Dimension. This dimension affects the way in which people think about, view and are able to respond to information and situations. This could affect the approach they have to their jobs, and their relationships with colleagues and friends.

Wholists, tend to see a situation as a whole, and are able to have an overall perspective, and to appreciate its total context. By contrast, Analytics will see a situation as a collection of parts and will often focus on one or two aspects of the situation at a time to the exclusion of the others. Intermediates will be able to have a view between the extremes which should allow some of the advantages of both.
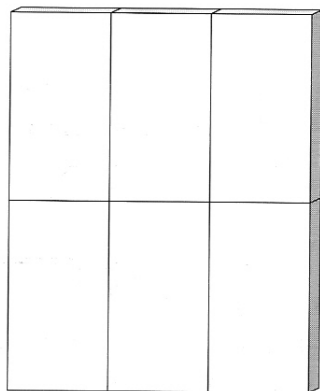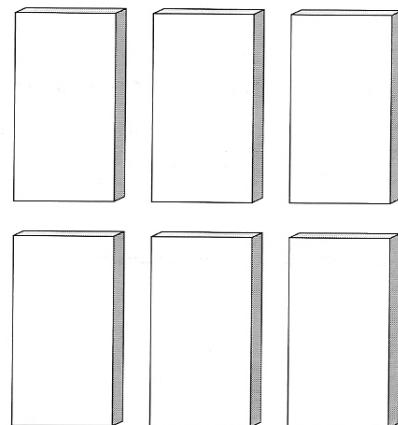
WHOLIST VIEW   **ANALYTIC VIEW**

The diagram[6] shows in a schematic way how a situation or information might be perceived by Wholists and Analytics. The former view tends to be unitary, and the latter more separated into parts.

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[5]For a full consideration of research into style, see Riding RJ (1996). On the nature of cognitive style. *Educational Psychology* 16, part 4.

[6]The diagrams in this Chapter are adapted with permission from Riding RJ (1994) *Personal Style Awareness and Personal Development* (Birmingham: Learning and Training Technology).

The positive strength of the Wholists is that when considering information or a situation they see the whole 'picture'. Consequently they can have a balanced view, and can see situations in their overall context. This will make it less likely that they will have extreme views or attitudes. The negative aspect of the style is that they find difficulty in separating out a situation into its parts.

For the Analytics, their positive ability is that they can analyse a situation into the parts, and this allows them to come quickly to the heart of any problem. They are good at seeing similarities and detecting differences. However, their negative aspect is that they may not be able to get a balanced view of the whole, and they may focus on one aspect of a situation to the exclusion of the others and enlarge it out of its proper proportion. Intermediates are likely to be between the two.

For Wholists not only are the parts not separated, but there is possibly the danger that the distinction between them is blurred so that it is very difficult to distinguish the issues that make up the whole of a situation.

By contrast, the Analytic will tend to focus on just one aspect of the whole at a time and this may have the effect of distorting or exaggerating it, or making it more prominent, with respect to the rest, and so there is the possibility of getting it out of proportion to the total situation.
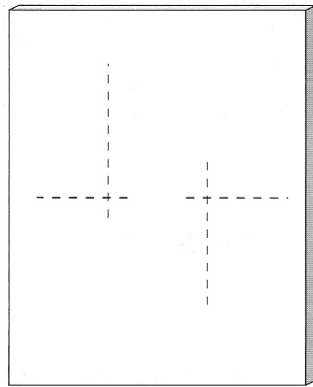
BLURRED WHOLIST VIEW   **DISTORTED ANALYTIC VIEW**
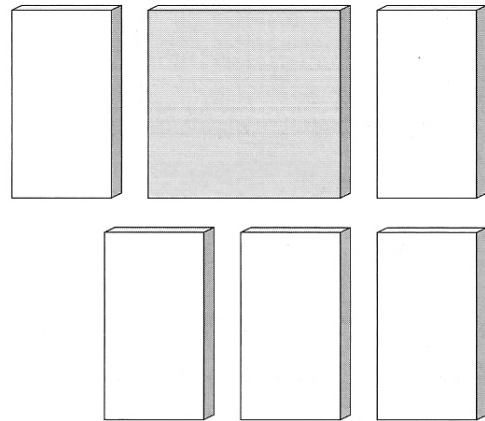
Verbal-Imagery Dimension. This dimension has two fundamental effects that have implications for behaviour, job performance, and relationships; the way information is represented, and the external/internal focus of attention.

(a) Representation. It affects the characteristic mode in which people represent information during thinking; verbally or in images.

If a person reads a novel, for instance, they can represent the actions, happenings and scenes in terms of word associations or by constructing a mental picture of what they read. Just as we can set down our thoughts on paper in two possible ways, in words or in sketches, so we can also represent them in our minds in those two modes. We can think in words, or we can think in terms of mental pictures or images.
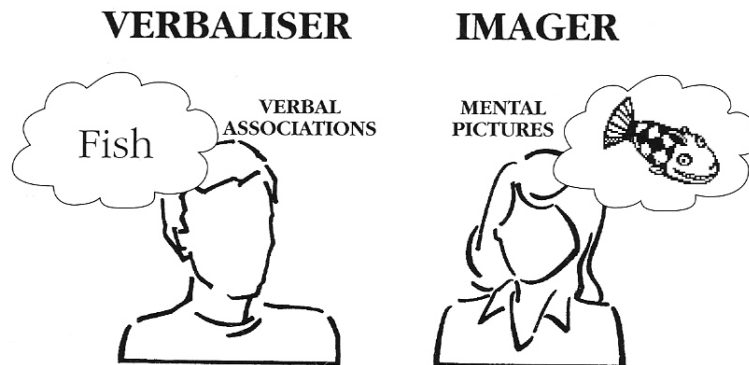
On this dimension people may be categorised as being of three types; verbalisers, bimodals or imagers:

> **Verbalisers** consider the information they read, see, or listen to, predominately in words or verbal associations.

> **Bimodals**, in the middle, tend to use either mode of representation.

> When **Imagers** read, listen to, or consider information, they experience fluent, spontaneous and frequent mental pictures either of representations of the information itself or of associations with it.

All groups can use either mode of representation if they make the conscious choice, i.e., verbalisers can form images if they try, but it is not their normal, habitual mode.

The dimension of style thus affects the processing of information and the mode of representation and presentation that individuals will adopt, and this will affect the types of task they will find easy or difficult.

A practical implication is that Verbalisers will often learn better by reading text, and Imagers by looking at pictures.

(b) External/Internal Focus. The second effect is that it influences the focus and type of an individual's activity, – externally and stimulating in the case of Verbalisers, and internally and more passive in terms of Imagers.

VERBALISER

IMAGER

INDIVIDUAL

INDIVIDUAL

SOCIAL GROUP

SOCIAL GROUP

EXTERNAL
FOCUS

INTERNAL
FOCUS
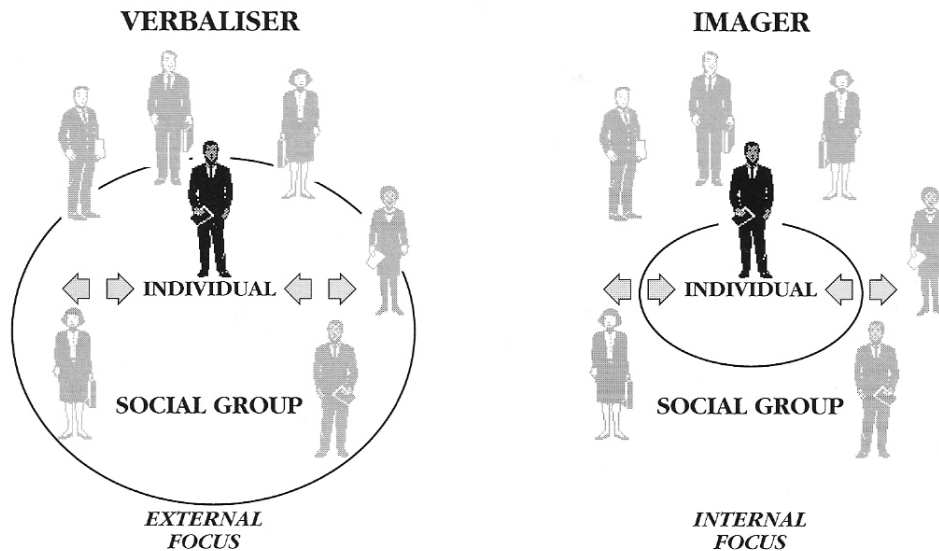
This has implications for social relationships, also for the type of work and environment people will be content in.

For Verbalisers the focus will be outward to others and they will prefer a stimulating environment. They will see the social group as an extension of themselves and be socially aware. For Imagers, the focus will be more inward, and they will be more passive and content with a more static environment. They will view the social group as more distant from themselves, and may be less socially aware.

WHAT IS THE DIFFERENCE BETWEEN LEARNING STYLES AND LEARNING STRATEGIES?

It is useful to distinguish between styles and strategies. Styles are probably inbuilt features that people are born with. By contrast, strategies are ways of processing information that may be learned. They may be developed to cope with situations and tasks which individuals naturally find difficult. They are methods of utilising styles to make the best of situations for which they are not ideally suited.

STYLES	STRATEGIES
Fixed, and unlikely to change.	Can be developed to cope more effectively with tasks that do not match the individual's style.
E.g., An Imager learns readily from pictorial information.	E.g., An Imager could 'translate' a textual description into a diagram or picture.

In the training context, 'Learning Style' needs to be distinguished from 'Learning Strategy'. A style is considered to be a fixed characteristic of an individual, while strategies are the ways that may be used to cope with situations and tasks. Strategies may vary from time to time and may be learned and developed. Styles, by contrast, are constant and are in-built features of the individual.

WHERE DOES STYLE COME FROM?

A style probably emerges from a difference between two complementary abilities. In order to illustrate this, let us deliberately over-simplify how the brain works. Suppose that within the brain there is one processor for verbal information and another for pictorial. If, in an individual, these two processors have unequal speed and processing capacity, then the individual will tend to use the one in preference to the other whenever possible, and this will lead to the establishment of a style, or habitual preference for one over the other.

For a style to exist as a dimension, the two processors must represent opposites in some sense. In the case of the Verbal-Imagery dimension, words and pictures are two different ways of representing information. This has the physical basis in terms of a shift of dominance from one hemisphere of the brain to another. For the Wholist-Analytic style dimension, it is possible to see a progression from the whole to the parts. The whole is in this sense, the opposite of the parts; the wood comprises the individual trees. In neurological terms, Wholists are relatively more active towards the front of the brain and Analytics towards the back.

HOW DOES STYLE DIFFER FROM INTELLIGENCE?

The basic distinction between them is that performance on most tasks will improve as intelligence increases, whereas the effect of style on performance for an individual will either be positive or negative depending on the nature of the task. It follows from this

that for an individual at one end of a style dimension, a task of a type they find difficult will be found easier by someone at the other end of the dimension, and *vice versa*. For instance, if the dimension were Verbal-Imagery, then Verbalisers would find pictorial tasks more difficult than would Imagers, but would find highly verbal tasks easier than would Imagers. In other words, in terms of style a person is both good *and* poor at tasks depending on the nature of the task, while for intelligence, they are *either* good *or* poor.

Style is independent of intelligence.[7] Intelligence, as measured by the sub-tests of the British Abilities Scale, has been shown not to be related to learning styles. Both Style and Intelligence will affect performance on a given task.

An important implication for training is that where the trainees are of lower ability, or the training material is difficult, then for reasonable performance it is vital to match the presentation mode of the training to that of the style of the trainee.

The next Chapter will consider the application of style to Training.

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[7] See Riding RJ & Pearson F (1994) The relationship between cognitive style and intelligence. *Educational Psychology* 14, 413-425.

CHAPTER THREE: LEARNING STYLES AND TRAINING STYLES

Effective training involves the use of training strategies that will appeal to a range of trainee learning styles. How effectively a person learns will be affected by the extent to which the instructional material, and the way it is presented, matches their Learning Style. This Chapter will show you how to develop your training strategies to suit a broad range of trainee learning style.

INTRODUCTION

Whatever your current experience of training, there is always some room for improvement. It is also useful to reflect on how you train, because it may be that in doing so you may come upon some simple way of making your training more effective and also more efficient.

This Chapter will consider the components of training and how you might modify your 'natural' training style by developing other training strategies. It will be useful whether you design and/or deliver training. Some of your approaches to training may be personal preferences that have little effect on trainee performance, while others could have quite a dramatic effect on the attainments of many trainees.

STYLE AND TRAINING EFFECTIVENESS

In order to consider styles of training it will be useful to remind ourselves of the basic steps necessary for effective learning within the context of individual differences in style.

In making decisions about these steps in the past, you may have been influenced by your own learning style, since you will have assumed that the ways in which material is structured that you find easy to learn will also have applied to your trainees. Similarly, you will have tended to think that the mode of presentation that you find best will have been shared by your trainees. Furthermore, you will have been inclined to consider that learning activities that you have found useful will be those that appealed to and helped your trainees.

At one level these were reasonable assumptions since you had only your own introspective experience to go on, although you may have been frustrated on occasions to find that however many times you explained things to some trainees, in a manner that seemed exceedingly plain and obvious to you, they still did not appear to understand. The descriptions about learning styles and the way they work should have shed some light on this experience.

Consider two trainees,[8] Jane and Jill.

Jane   Jane is a Wholist and requires material to be clearly structured by the trainer.

She learns best when verbal descriptions are given, she is a Verbaliser.

Jill   Jill is more Analytic and can impose her own organisation on material.

She prefers the visual presentation of material in diagrams and pictures, she is an Imager.

How will these two trainees approach learning? How will your training style relate to their learning styles?

As has been pointed out, an individual's learning style affects the manner in which information is habitually processed during learning and thinking. Consequently learning styles affect the ways in which an individual finds it easiest to learn. Trainees taught with materials and methods which do not match their learning style will therefore find difficulty in learning.

Your trainees will have a range of styles and only a few of them will have the same style as yourself. Consequently your 'natural' training style will often not match the learning style of the majority of your trainees, and this is likely to make their learning less efficient.

Matching training style to the learning style of the trainee is particularly important for trainees of lower ability, or where the material is relatively difficult for the trainee. This is because, in these cases, there is more pressure on the trainee's learning system, and consequently less spare processing capacity.

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[8]The illustrations in this Chapter are adapted with permission from Riding RJ & Rayner S (1995) *Personal Style and Effective Teaching* (Birmingham: Learning and Training Technology)

TRAINING STYLE

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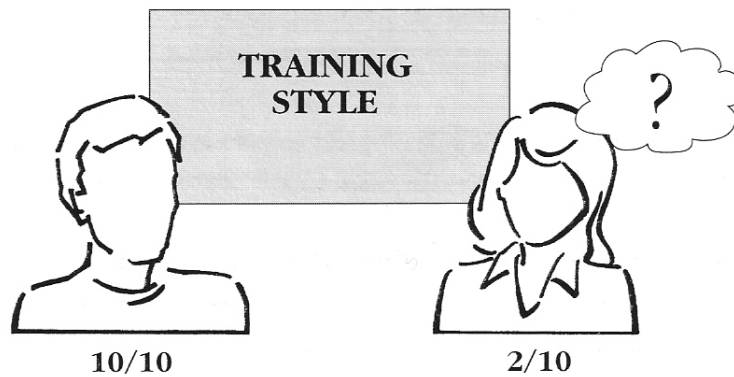
STYLE MATCH   STYLE MISMATCH

PLANNING TRAINING DESIGN AND DELIVERY

The planning of training may be seen as three steps.

(1) The selection of the training material and its starting point so that it fits in with what the trainees already know, to facilitate meaningful learning.

(2) The choice of the way in which it will be structured, and the mode of presentation of the material, to maximise ease of learning.

(3) The decision about the types of learning activities to be used, to consolidate the learning and to develop learning strategies.

These will be considered in turn.

(1) Training Content

KEY TRAINING PRINCIPLE ONE
The first basic principle of training is that what we see and hear is understood in terms of what we already know.

(a) *What makes learning meaningful?* For new learning to be meaningful it must be linked to what trainees already know. Difficulties in learning occur if trainees are presented with information that they cannot relate to existing concepts in their memory. If they learn it at all, they will learn by rote and the new material will be stored as an isolated unit, which is difficult to make use of in a range of contexts.

Since this is an important point let's try a couple of simple examples. What do you make of the following words, 'dog', 'quagga'?

Take 'dog' first. You found this word very meaningful because it is well organised in your memory. It readily brought many associations. It may have evoked a mental picture; it has associations with similar concepts like fox, wolf and, perhaps, cat; it has associations with instances of other examples of the same concept such as alsatian, poodle, collie; it has associations with more inclusive ideas like animal and mammal. Thus 'dog' readily produces many associations, and it is this variety of associations which makes the word meaningful for us. If we were to read a story with a dog in the plot we would experience no difficulty in understanding it.

By contrast, if the tale featured a quagga it is likely that things would be different, because for most readers the term lacks meaning. That is, when we read the word we get no associations and the word is nonsense, and so we cannot link new information to it.

What would make the term 'quagga' meaningful? Well, if you were told that a quagga was an animal related to the donkey and the zebra, and that quaggas are now extinct but once lived in southern Africa, then this would make the word mean something to you, because you would be able to relate, or link, it to concepts like 'donkey', 'zebra', and 'Africa', which are already familiar to you.

Instruction is like this. Trainees give new information meaning in terms of what they already know.

(b) *Foundations – The Trainee's Present Knowledge and Effective Learning.* Instruction, like making a building, needs a solid foundation on which to build. The foundation is what the trainee already knows that is relevant to the new topic, and which will give meaning to the new information.

The first step in planning instruction is to compare the content of what is to be taught, with what the trainee already knows that is relevant to the topic. This will give their knowledge readiness characteristics. This present knowledge will indicate the starting point for the new learning. There must be an awareness by the trainer of what the trainees already know about the topic that is necessary to the understanding of the new work. Successful learning is rather like building a wall – each new topic may only be added if the ones on which it depends for meaning are already in place.

While this sounds very obvious it is often undertaken far too infrequently and superficially by many trainers.

(c) *Building a Wall.* Instruction is like constructing a wall. Having laid the foundation, the new blocks of information are built upon it. As the wall progresses, each block must be capable of being built upon those already in place. Missing bricks are those not learned or forgotten.

Below is an example of a good wall. All the blocks are in place.
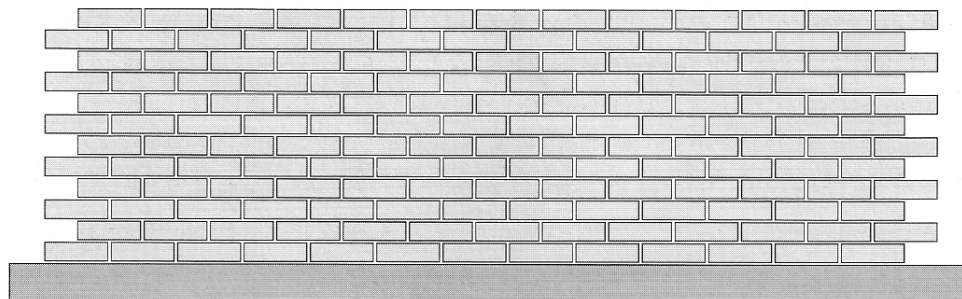
Now consider a poor wall. Many of the blocks are missing. Poor instruction is like this. The trainee has only understood and learned some of the information.
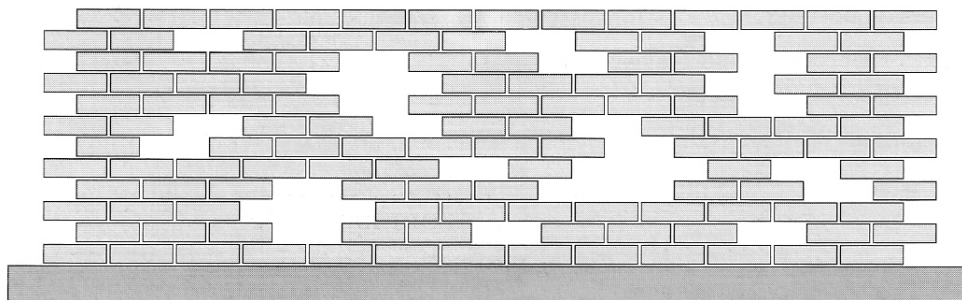
The wall that follows is impossible to build because many necessary bricks are missing.
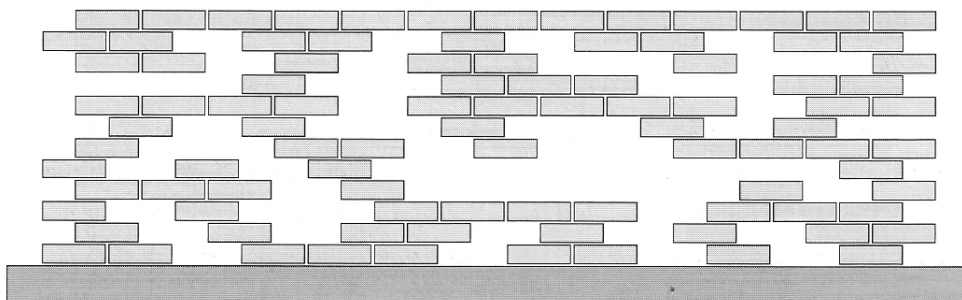
The new information will need to be accommodated and integrated into what the trainee already knows so that the relationship with other ideas and contexts are established. This will be done by means of the learning activities.

(2) Structure and Content Form

KEY TRAINING PRINCIPLE TWO
Trainees learn best when the material structure
and content suits their learning style.

Conceptual Structure and Wholist-Analytic Style. Having selected the material for training there is now the question of how it is to be sequenced and structured. An old preacher, when asked about his approach replied, 'Well, first I tell them what I am going to tell them, then I tell them, and then I tell them what I have told them'. The telling them about what they are to hear corresponds in training terms to giving an *Organiser*. The telling them what they have been told, will be termed an *Overview*.

We have already noted that Wholists can see the whole but have more difficulty seeing the parts, and that Analytics are good at seeing the parts, but have problems with integrating it into the whole. We need to be aware of the difference between trainees of different style.

It is necessary to insert in the training, opportunities for emphasising both the whole and the parts. Just how this will be done will depend upon the topic, but in general an *organiser* can be used to show the structure of the parts, and an *overview* to give the whole view.[9]

STYLE	TYPE OF SUPPORT REQUIRED
Wholist	An *Organiser* to indicate the parts and structure of the material
Analytic	An *Overview* to provide a picture of the whole of the material

Wholists will need help in seeing the structure and sections of learning material, and of dividing the whole into its parts. They will need an analytic organiser to show them the parts of the whole, and to enable them to analyse the material into sections. They will be inclined to see the overall view when it is recalled from memory, but will be able to distinguish the parts when the material is set out before them, with the sections very

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[9]For a further consideration see, Riding RJ & Sadler-Smith E (1992) Type of instructional material, cognitive style and learning performance. *Educational Studies* 18, 323-340

clearly marked. The approach would be to use an analytic organiser of the content of all topics emphasising the sections, or parts, and their divisions (e.g., hierarchical content map showing sub-divisions).

By contrast, Analytics are helped by an overview to provide an overall picture, to enable them to integrate the sections into a whole. It is probable that they will need to have all the material, facts or information, laid out before them in order to get a picture of the whole, so that it does not depend on memory. When recalling information, because their memory will tend to focus on only one part at a time, they may not be able to get a whole view. Consequently, they will require a general overview of the whole content emphasising the structure and links, to enable them to appreciate it as a unified whole (e.g., integrated concept map showing links).

Verbal-Imagery Style and the Type of Content. With respect to type of content, generally, Verbalisers are likely to be superior on the understanding and recall of information which contains unfamiliar and acoustically difficult terminology,[10] a situation frequently met when a new technical subject is first encountered. They are also better on details dealing with actions, time and abstractions. The style of the verbaliser would appear to be more appropriate to coping successfully with learning from text and definitions, than that of the imager.

Imagers do best on material which can be visualised in mental pictures, and which does not contain many acoustically complex and unfamiliar terms. They are superior to verbalisers on spatial and directional information.

STYLE	TYPE OF SUPPORT REQUIRED
Verbaliser	Provide verbal versions of pictorial and diagrammatic material
Imager	Convert verbal material into pictorial form Choose concrete analogies of abstract ideas

The basic principle that applies is that information is likely to be successfully understood and learned if trainees can readily code it using their natural styles. Further, when the

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[10]See Riding RJ & Calvey I (1981) The assessment of verbal-imagery learning styles and their effect on the recall of concrete and abstract prose passages by 11 year-old children. *British Journal of Psychology* 78, 59-64.

content of the material does not coincide with the learning style, then learning performance will be reduced, particularly if the trainee is unable to find ways of representing the information in a form that corresponds to their style.

Layout of Information and Wholist-Analytic Style. With respect to the way in which information is presented, Analytics will find tables and tree diagrams helpful in structuring the information, but Wholists will not. Since Wholists find the extraction of information from densely embedded displays difficult, these should be avoided as the only means of conveying the information.

(3) Mode of Presentation

<div style="border:1px solid black; padding:10px; text-align:center">

KEY TRAINING PRINCIPLE THREE

Learning is easier for trainees when the mode
of presentation matches their style.

</div>

Choice of Mode of Presentation and Verbal-Imagery Style. In terms of the mode of presentation of material, generally Imagers learn better from pictorial presentation and Verbalisers from written material.[11]

SCHEMATIC GRAPH OF THE EFFECT OF PRESENTATION MODE ON LEARNING

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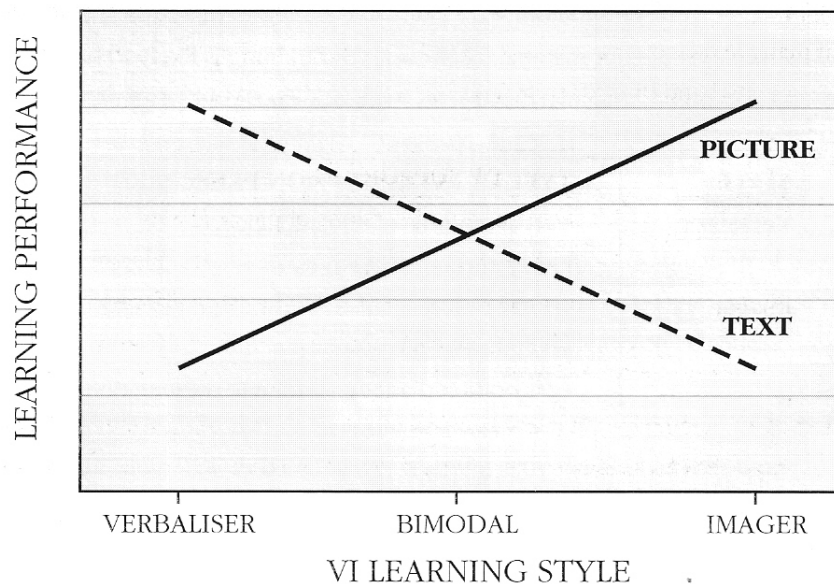
[11]Riding RJ & Douglas G (1993) The effect of cognitive style and mode of presentation on learning performance. *British Journal of Educational Psychology* 63, 297-307.

When trainees receive information whose presentation does not match their learning style then performance in learning is likely to be impaired particularly when the material is more difficult for the trainee or more complex in nature.

The mode of presentation should be as appropriate as possible to the styles of the trainees. It is important to note that many types of information can be presented in several ways. A wide range of media are available for instruction and consideration should be given to how these can be most effectively used to provide a wide range of modes to suit a variety of styles. Printed material can contain both text and illustrations. Live presentation by a trainer can use both speech and pictures or objects. Video or multimedia technology will provide both modes.

Social Preferences. Verbalisers, particularly Wholist Verbalisers, will benefit from a more stimulating presentation than Imagers. They will prefer variety and will be less willing than Imagers to plod through material they find boring. They are also happy to learn in a social group, while Imagers are often happy to work alone.

If you are a Verbaliser then you are likely to use speech and textual material to the exclusion of pictorial material. You need to make more effort to accommodate the needs of the Imagers in your training sessions.

If you are an Imager, your presentations are likely to emphasise the visual and you may neglect textual versions of your material. However, your training is likely to be interactive, and you prefer, and are sensitive to, feedback from your trainees.

STYLE	TYPE OF PRESENTATION PREFERRED
Verbaliser	Verbal in terms of text and speech
	Lively and outgoing in manner of delivery
Imager	Use of pictures, illustrations, diagrams, charts and graphs
	Less bothered about a dynamic presentation

(4) Learning Activities

Learning activities should have three purposes:

- to encourage active rather than passive learning so that the new material is integrated into what is already known,

- to aid the memory of the material, and

- to facilitate strategy development so that trainees will find ways of coping with material that is not ideally suited to their styles.

For learning to be meaningful, it must be actively learned and linked to what the trainee already knows. This is in contrast to passive, rote learning, where the trainee may internalise information without linking it into the structure of what they already know.

Trainees can sit and listen to a trainer, but this does not mean that they are actually learning. Learning activities should be chosen to ensure active learning and integration of the new information and skills into what is already known. Every effort should be made to ensure that the trainees have the opportunity to accommodate new learning as fully as possible into what they already know.

Wholists may be inclined to undertake passive learning more easily and may require appropriate activities that encourage integration of the new material into what they already know.

The basic principle is that successful learning results from a combination of the input of information in a structure and mode that trainees find it easy to assimilate, and the active accommodation of it by the output of responses to it via learning activities.

Activities should require people to apply or express what they have in their memories. It is important to note that, to be effective, learning activities should encourage trainees to consider links between the new material and what they already know.

PURPOSE	EXAMPLES OF SPECIFIC ACTIVITIES
(1) Active Learning	(a) working out problems (b) expressing material in the trainee's own words (paraphrasing, summarising, etc.) (c) applying the instruction to real situations
(2) Memory Consolidation	(a) inserted questions (self-test, quizzes, etc.) (b) acting out events
(3) Strategy Development	(a) writing a brief Overview to obtain a whole view (b) constructing a one-page Organiser of a section of a topic to see the parts (c) representing material in their preferred mode (e.g., an Imager producing a picture from a verbal description)

Learning Strategies. Since learning styles are inbuilt and appear to be fairly fixed, individuals are either blessed or lumbered with them depending on the type of tasks they are undertaking. They cannot change their styles but they can develop strategies to make them as effective as possible for a particular learning situation. People need to be encouraged to develop learning strategies which enable them to cope with situations which do not naturally suit their style.

An important first step towards a strategy is for individuals to be aware of their own style and of its strengths and limitations, and then to recognise that the tasks they find difficult are often because of a mismatch between the task demands and their style.

This is important in freeing them from the sense of inadequacy that often accompanies finding something difficult or failing at it. If a person acknowledges that they are likely to find certain types of task difficult and that they will never be brilliant at them because of their style combination then they will cease to feel so inadequate. They may realise that however much they try they will never shine at some tasks, and accept themselves as they are, then they may be able to smile at their inabilities, rather than feeling condemned by them.

The next step is to see how individuals can develop learning strategies to make tasks easier by using the strengths and features of their styles to help them.

The following methods may be used to help individuals accommodate situations and learning to their style:

(a) *By changing the mode of presentation* to match the position on the Verbal-Imagery dimension. For instance, a Verbaliser could change the pictorial information into words, and the Imagers could change words to illustrations or diagrams.

(b) *By making the subject-matter fit the representation.* This is not always possible, but often subject matter may be represented in an alternative mode to convey a similar meaning. For instance, the mathematical concept of an equation can be represented visually by a picture of a balance with the equals sign at the fulcrum or pivot, and this may aid Imagers.

(c) *By integrating or separating the parts.* Analytics may be helped by setting information out on a sheet in parts and re-ordering it into a whole structure. If a person is an Analytic then they will have difficulty in seeing the whole of some task or situation. They can be encouraged to develop the strategy of mapping it out on a sheet of paper so that they can lay out the whole which will allow them to see all parts at once rather than concentrating on the separate aspects. Wholists can be encouraged to cut up general concepts into specific points.

Interaction between the Styles. The verbal-imagery representational style can often be pressed into service to help with an individual's limitation in the wholist-analytic dimension. For instance, an Analytic who is also an Imager, may use the overall view that a mental image allows to provide a more whole view of a topic. Similarly, a Wholist who is also a Verbaliser, may use the aspect of verbalisation which divides concepts into discrete units, as an analyser to help to determine the parts of the material.

Planning a Topic and its Delivery – A Summary

The aim is to provide a style-friendly approach to learning! It is not only the content of training that is important, but how the training is designed and delivered. The concern of the training designer is how to plan a topic to maximise the effectiveness of the learning, and how to help particular trainees who are likely to have difficulties with the subject.

The planning will comprise the following stages:

- Initially the trainer must be clear about what the trainees already know.

- The Topic should be ordered starting from what is known, and in such a way that the ideas are introduced progressively like building a wall.

- The **structure** should suit the Learning Style of the trainee. For Wholists, it should enable the parts to be identified, and for the Analytics, that a whole view be obtained.

- Some adaptation of the **content** may be necessary to help trainees whose style finds it difficult to represent the material.

- Both verbal and pictorial **presentation** should be used so that both the Verbalisers and the Imagers are catered for, or there should be a selection to suit the style of the trainee.

- Learning activities should be chosen to:

  - integrate learning into existing knowledge,

  - consolidate it in memory, and

  - help the development of learning strategies that allow styles to cope with difficult situations.

Are some Trainees finding the Topic Difficult because of their Styles?
Knowledge of the styles of the trainees also permits a consideration of whether their difficulty with the topic is because of their style. Obviously there can be several reasons why a trainee is not succeeding with a subject.

The causes, acting singly or together, can include:

- a learning style not ideally suited to the subject matter,

- low ability – it should be remembered that style is different from intelligence,

- essential aspects of the subject not being learnt,

- difficulty in concentrating because of emotional problems caused by, for example, trouble at home.

If material is meaningful to the trainee and easy to learn because its structure and presentation is adjusted to match the trainee's style, then there is likely to be success at learning and nothing succeeds like Success!

A happy trainee is a successful trainee! Success enhances self-confidence and makes further learning attractive.

Having set out the principles that come from a consideration of learning styles and training, these will now be applied to a consideration of TBT.

CHAPTER FOUR: LEARNING STYLES AND TECHNOLOGY-BASED TRAINING

HOW FLEXIBLE IS TBT?

TBT has considerable flexibility in the ways in which it can be configured. There are three main dimensions of choice and these represent the extent to which:

(1) the system is stand-alone or networked,

(2) the manner in which it accommodates individual style differences, by being either (a) broadly based, or (b) adaptive and,

(3) the training is directed or open.

(1) Stand-alone versus Networking. In Stand-alone mode a Personal Computer (PC) works by itself without any connection to another computer. In training the trainee would either load the instructional package onto the computer by means of floppy disks or CD-ROM, or it may already be installed on the hard disk.

In the Networked situation the PC is also connected to a Server with which it can communicate to both receive and transmit information. Within networking three modes of operation relevant to instruction are possible:

(a) Linking to Record Performance. In this situation, the learning material is made available to the PC by ordinary mail transmission, for example by sending a CD-ROM disk to the trainee. When this is installed on the PC, there can be linking to the server briefly to receive any additional instructions, or for the central system to advise on suitable modules for the particular trainee, and then again on-line at the end of a module to record performance centrally.

(b) Downloading. Here the PC is on-line to the server only for sufficient time to download the necessary module for the instruction which is then stored on the disk in the PC, and to send information such as performance measures from the PC to the server at the end of the module.

(c) Continuously Interactive. In the continuously interactive system, the information is transmitted to the receiving PC and the responses continually monitored by a central network server. While this is currently possible, it is demanding of the transmission system, and can be expensive over a public system, requiring the system to be constantly on-line.

(2) Broad-based versus Adaptive Accommodation of Style Differences. Three approaches can be used to adapt the instructional materials to the individual style of the trainee:

(a) *Group Assessment and Balanced Design.* The *Cognitive Styles Analysis* may be used to assess the styles of the target group of trainees, or a sample of them, prior to the design of the training package so that it can incorporate features that will make it acceptable to as wide a range of style as possible. Generally in this approach, a balance of presentational and structural features will be built into the package so that the trainees may choose to concentrate on those that suit their style.

(b) *Style Linked Versions.* Two or more versions of the package are made, emphasising a particular feature to suit a learning style group. For instance, predominantly textual and illustrated/pictorial versions of a package could be made to suit Verbalisers and Imagers, respectively. The trainees would be given the CSA and the Verbalisers would use the version designed for them and the Imagers the more visual version.

(c) *Intelligent Tutor System.* A final possibility is to use TBT with computer control in which the system determines the learning style characteristics of the trainee, and then for the system to act in the role of an intelligent tutor and select the modes of presentation of the material that are most appropriate for the individual. If a package is to adapt to the cognitive style of a particular trainee, then the package must contain a means of assessing the cognitive styles quickly and easily. This may be done by adding the **CSA** to the introductory section of a training package. There must also be a control program within the package, which selects the mode of presentation to match the material to the trainee's cognitive style, and so optimise learning performance.

Of the three approaches, the first is the simplest and is relatively efficient. The second represents an intermediate position, while the third is an ideal situation which is becoming more feasible as technology improves. Further, advances in the understanding of learning styles provide a framework for the development of an intelligent control system to facilitate individualised learning, and the possibility of this development of an Integrated Learning System will be discussed later in this Chapter.

(3) Directed versus Open Training. It is useful to distinguish between 'directed' and 'open' learning. 'Directed' training is where the learning objectives are clearly stated and usually externally controlled. This would apply to many training situations. For instance, a bank might have a set of new procedures that they wish employees to follow and these

need to be learned. 'Open' learning, by contrast, is when the choice of material, method and objectives are more in the control of the learner. This is a situation which will increasingly apply to life-time learning and the need for career flexibility in which an individual may need to obtain new knowledge and skills at intervals throughout their career to facilitate job changes and technological advances. 'Open' learning is more complex and so initially 'directed' learning will be considered.

THE IMPLICATIONS OF STYLE FOR TECHNOLOGY-BASED TRAINING

Three examples of configurations will be considered in order to illustrate the possibilities and to explore the ways in which style can be accommodated:

(A) a stand-alone broad-based system,

(B) a stand-alone adaptive system, and

(C) a networked adaptive open learning system.

(A) Stand-alone Broad-based System for 'Directed' Learning

For this example, imagine a training designer preparing a topic for a target group of trainees. The training will be presented on stand-alone PCs with CD-ROMs. This system of technology-based delivery of training offers several advantages:

- it is much easier to use it to assess the trainee's present knowledge,

- the structure and order of the presentation is easier to control,

- there are several possible modes of presentation available using a multi-media approach, e.g., verbal, written, spoken, pictorial, diagrams, and video, and

- there is the ready possibility of interactive learning activities.

In addition to the technological possibilities, the designer will also be aware of the advances in the instructional technology which can be applied to training design to facilitate efficient learning and understanding. The designer will need to make a number of decisions about the training content and format. These will be considered in some detail since it will help to clarify the application of developments in the understanding of learning styles to practical TBT design and delivery. Further, it will provide a framework for the design of the control systems necessary for the adaptive systems that follow the current example.

(1) Knowledge Readiness of the Trainees – are the Supporting Blocks in Place?

> **DESIGN POINT.** Training must start from what the trainee already knows.

What is the Conceptual Content of the New Topic? In designing training for a new theme or topic, the concepts that are necessary to make the topic meaningful to the target trainees must be identified. The training designer can do this by listing the main ideas/information that the new topic assumes will be known.

What is the Initial Trainee Knowledge? Consideration will be given to the typical group of trainees who are going to receive the new topic. To what extent are they familiar with these ideas? If they have not been covered previously, the starting point will need to be adjusted to include any missing concepts. Since for successful learning it is also important that the key concepts are capable of being readily recalled, any difference between what the new material requires to give it meaning, and what the trainee presently knows, is made up before commencing the new topic.
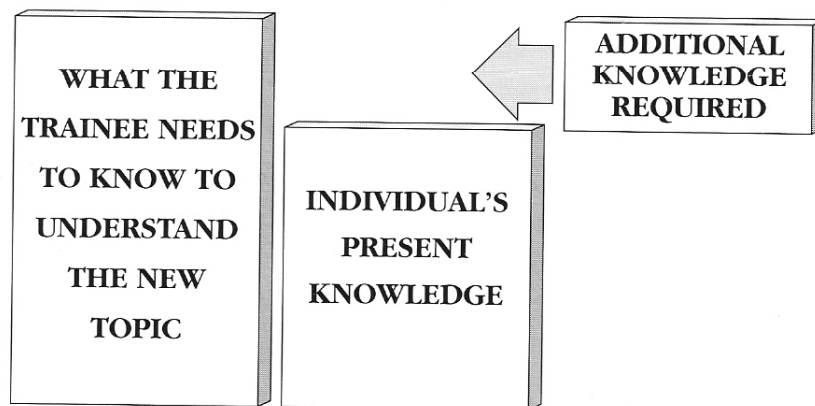
How Readily Available is that Knowledge? It is also important to bear in mind that even if they have been covered previously, this does not necessarily mean that they have been remembered. In view of this, the designer will need to consider whether the present knowledge that the trainees have relevant to the new topic is capable of being readily recalled. It is sensible to make the new topic overlap with the previous one to which it is related, in order to remind trainees of the necessary concepts.

(2) Controlling Presentation and Minimising Information Load

The training designer will need to remember that the way that he or she naturally tends to structure material will reflect his or her own style, and will need to make a conscious effort to have a broader approach.

(a) Conceptual Structure and Wholist-Analytic Style. Trainees will benefit from having a clear structure of the material.

> **DESIGN POINT**. In practice, an easy way to accommodate
> a range of styles is to provide both an *Overview* and an *Organiser*.

Is the Purpose of the Topic clear? The designer will need to make sure that he or she has a clear view of where the topic is leading and why it is being presented. If the intention is uncertain to the designer, then it is not likely to be clear to the trainees! The designer will need to consider the structure of the topic, and identify its principal parts, and how these fit together. This can be done by producing an analysis of the topic by listing the headings and sub-headings on an A4 sheet. This can then be used as the basis for an *Organiser* to show the overall structure of the parts and the sections. This will be particularly useful to give Wholists an indication of the parts of the topic.

Can an Overview be used to make the Purpose clear to the Trainees? At the start of the training session or sessions the trainees may have little idea of where the topic is going. If possible, an indication of the scope of the topic will need to be given to help, particularly Analytics, to see a whole view of the subject matter. It may help trainees to be provided with a brief *Overview* of the topic at this point.

STYLE	TYPE OF SUPPORT REQUIRED
Wholist	An *Organiser* to indicate the parts and structure of the material
Analytic	An *Overview* to provide a picture of the whole of the material

To appeal to a range of styles it is desirable to build into the training, opportunities for emphasising both the whole and the parts. An *organiser* is used to show the structure of the parts, and an *overview* to give the whole view.

(b) Verbal-Imagery Style and the Type of Content. Materials will differ in the nature of their content.

> **DESIGN POINT.** Where possible translate naturally verbal information into diagrams and vice versa.

Is the Topic likely to be Difficult for some Styles to Represent in their Natural Mode? With respect to type of content, Verbalisers are likely to be superior on the understanding and recall of verbal information and when it contains unfamiliar and acoustically difficult terminology. Imagers do best on the material which can be visualised in mental pictures, and which does not contain many acoustically complex and unfamiliar terms.

The designer will need to examine the content of the topic to see whether there are parts of it that, in their present form, are only in one mode, and to consider whether other forms of representing the information may be possible.

STYLE	TYPE OF SUPPORT REQUIRED
Verbaliser	Provide verbal versions of pictorial and diagrammatic material
Imager	Convert verbal material into pictorial form Choose concrete analogies of abstract ideas

(c) Choice of Mode of Presentation and Verbal-Imagery Style. Various presentation modes are available.

> **DESIGN POINT.** Try to present material in both verbal and pictorial forms where possible; aim at Dual Mode presentation!

What Modes of Presentation are going to be used? If the designer is a Verbaliser then his or her natural inclination will be to use speech and textual material to the exclusion of pictorial material. The designer will need to make more effort to accommodate the requirements of the Imagers in the group. On the other hand, if the designer were an Imager, the presentations would be likely to employ visual material and textual versions of the material may be omitted. In terms of the mode of presentation of material, generally Imagers learn better from the pictorial presentation and Verbalisers from the written material particularly for the Wholists.

What are the Possible Presentation Modes that could be used? It is important to note that many types of information can be presented in several ways. A wide range of media is available for instruction and consideration should be given to how these can be most effectively used to provide a wide range of modes to suit a variety of styles.

- Screens can contain both text and illustrations.

- Video clip presentations can use both speech, and pictures or objects.

- Multi-media technology will provide both speech, text and diagrams.

STYLE	TYPE OF PRESENTATION PREFERRED
Verbaliser	Verbal in terms of text and speech
Imager	Use of pictures, illustrations, diagrams, charts and graphs

(3) Motivation and Locus of Control. Presentations can either be dynamic or more restrained. Further the control of the learning can either be with the trainer or the trainee.

> **DESIGN POINT**. Have variety in the presentations.

Social Preferences. Verbalisers, being outward, will benefit from a more stimulating presentation than Imagers.

STYLE	TYPE OF PRESENTATION PREFERRED
Verbaliser	Lively and outgoing in manner of delivery
Imager	Less bothered about a dynamic presentation

Locus of Control. Analytics prefer to be in charge of their learning, rather than being organised by others. By contrast, Wholists have no particular preference as to whether they are self-directed or directed by others. The stand-alone broad-based system for directed learning cannot accommodate variation in approach to control, (but see the description of adaptive systems that follow). Incidentally, Analytic designers may be inclined to try to organise other people's learning!

(4) Choice of Learning Activities. Different types of learning activity have different uses.

> **DESIGN POINT**. The inclusion of interactive learning activities
> will be essential to real learning.

Effective training requires an appropriate choice of learning activities. Learning activities have several purposes including:

- to encourage active rather than passive learning so that the new material is integrated into what is already known,

- to aid memory of the material, and

- to encourage strategy development so that a trainee will find ways of coping with material that is not ideally suited to their style.

To some extent these purposes will overlap and an activity is likely to fulfil more than one of the above.

How should Learning Activities be Selected? The designer will select a range of activities for the topic that will cover all three purposes bearing in mind the requirements of trainees of different styles. Learning activities would be selected to ensure active learning and integration of the new information and skills into what is already known.

Effort would be made to ensure that the trainees have the opportunity to accommodate new learning as fully as possible into what they already know. Wholists may be inclined to undertake passive learning more readily and may require activities that encourage active integration of the new material into what they already know. This can be done through the use of the appropriate learning activities.

Activities should require people to apply or express what they have in their memories. It is important to note that, to be effective, the learning activity in a training programme must involve an interaction between memory and the new material. An activity should encourage the trainees to consider the links between the material and what they already know.

Having set out, in some detail, the application of learning styles to a stand-alone broad approach, consideration will now be given to the addition of an adaptive system within TBT.

(B) Stand-alone Adaptive System for 'Directed' Learning

The main difference between this and the previous system is the inclusion of adaptation to style. The system is shown below.
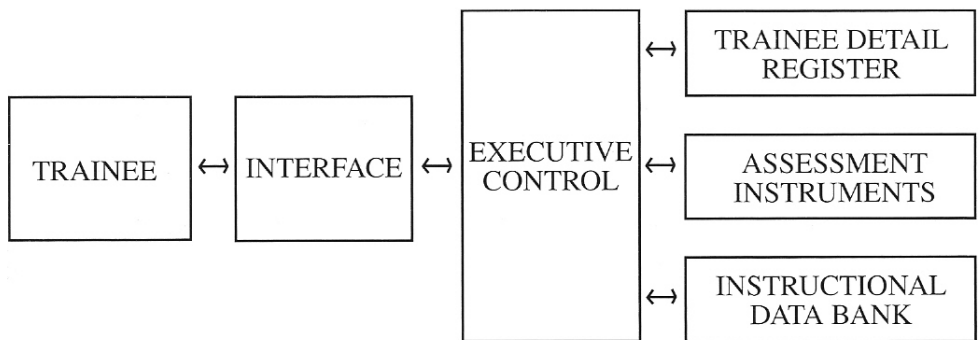
Interface
Comprises the TBT display and associated facilities

Executive
Controls the interaction with the trainee in an intelligent manner

Trainee Detail Register
This would contain biographical details of the individual including previous training performance, modules completed, etc.

Assessment Instruments
1) Determination of Learner Characteristics eg, Style and Intelligence.
2) Assessment for the specific training
a) Assessment of Present Relevant Knowledge
b) Tests of formative learning as the training is received, to check progress
c) Tests the summative learning at the end of the module or modules

Instructional Data Bank
The set of instructional materials from which are selected those appropriate for the trainee

The basic requirement for adaptation to the style of a particular trainee is that the system will assess the trainee's learning style and will also have available a range of presentations so that the trainee can receive the material in a form that most suits their style. This system will therefore require an interactive intelligent-tutor system to manage the adaptation to style.

The *Interface* should be simple to use and appropriate to a range of styles. In this respect it might be possible to provide the trainees with the option of customising the interface environment to suit their style and sophistication. This approach is already utilised at a simple level in a number of office packages such as those for word processing and spreadsheets, where the user can customise the method of operation and can opt for icons versus menus, or the use of a mouse versus key stokes.

At each training session the *Executive Control System* would identify the trainee by reference to the *Trainee Detail Register*. At the initial session it would determine the Trainee's Learning Style using the *Cognitive Styles Analysis*, and also the level of intelligence. At the start of each new training session the present knowledge relevant to the training to be given, would also be determined.

The Executive Control System would then select the appropriate training materials from the *Instructional Data Bank* and would govern the key aspects of instruction. It would:

- select the starting point of the content to fit what the individual trainee already knows,

- choose the way in which the content would be structured, and the mode of presentation of the material, to maximise ease of learning,

- make decisions about the types of learning activities to be used to consolidate the learning.

The System would then present the required instruction in a manner appropriate to the trainee. By the use of formative assessments available in the *Assessment Instruments*, it would monitor performance in terms of the responses by the trainee as the instruction progresses.

At the end of a training session, it would store in the *Trainee Detail Register* the details of the personal characteristics, the performance of the trainee, and the modules completed, together with any other information which might be necessary for accreditation.

To be feasible and practically useful an Integrated Learning System will require a framework for making decisions about the requirements of an individual trainee, and the material in the data bank must be capable of providing the necessary information to the control system. The Integrated Learning System could be constructed using the learning design principles set out in Chapter Three and applied to the previous example.

(C) Networked Adaptive 'Open' Learning System

So far only stand-alone and directed learning systems have been considered. In practice, in training there will be a variety of uses and users which range in sophistication from basic training with specific, fairly closed, objectives through to more open-ended trainee controlled learning. There will also be an increasingly wide range of materials available via the Information Superhighway.

The Nature of the Information Superhighway

Since the present emphasis is instructional rather than technological, the features of the Information Superhighway will be given in outline.[12] The Information Superhighway provides a world-wide network of information transfer links between personal computers by a variety of means; wire, fibre-optic cable, microwave and radio. This network is already capable of delivering audio and video information at a level useable for instruction, and this capability is likely to increase considerably in the future.

The network has inter-connections, or hubs, and an increasing number of these have the necessary architecture to control and facilitate the interactive transfer of information between deliverers and users. The standard PC usually now has the necessary power and facilities for two-way communication via the Superhighway network. It can receive, store, manipulate, and present information in a multi-media format. It can also log responses and control the presentation. It has the facility to transmit information to a network server and to other PCs. Developments in software should improve communication between users and access to information.

Taken overall, the Superhighway has considerable potential for the delivery of learning and instruction, with the following advantages.

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[12]More information about its technical background is given in, for instance, DFE (1995) Superhighways for Education, London: HMSO and DfEE (1996) *Superhighways for Training,* London: HMSO

FLEXIBILITY

- Greater flexibility in terms of both location and the time when the training can be undertaken. For instance, training could be at home at a time convenient to the trainee, or could be at work at an off-peak time when other demands are at a minimum.

- The facility to more easily update training materials to meet changing training needs or variations in work practice.

GUIDANCE AND SUPPORT

- The possibility of providing on-line interactive Training Needs Analysis to guide trainees to the most appropriate training.

- The possibility of linking via the Superhighway the learner to an external tutor for support, or to other students/trainees/experts to form a collaborative learning group which can communicate with one another (including the exchange of data).

- The ability to assess and monitor learning performance, and to store responses.
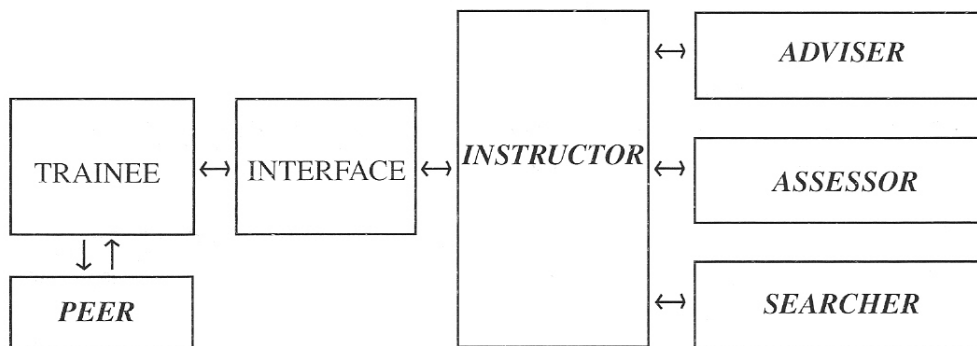
EFFECTIVE LEARNING

- Attractive multi-media presentation capable of controlling such things as mode of delivery (visual/verbal), and the presentation rate of, for example, speech.

- Mechanisms for controlling the order of presentation, choice of learning activities, and pace of instruction.

- The facility to provide simulations of environments (virtual reality) which provide learning/training experiences in a risk-free and low cost manner for a range of topics such as medical diagnosis, air traffic control, managing personnel, and designing a building.

- Access via the Superhighway to banks of information and learning resources, and to assessment materials.

The Integrated Learning System for 'Open' Learning

The development of the control system to cope with the 'open' situation offers more of a challenge than the 'directed' system. However, the 'open' learning design carries great potential for the future shape of training architecture.

The 'Open' Learning system is a development of the one for adaptive directed training. Since on the one hand, the learner is in control, and, on the other, there is so much knowledge that it is easy to drown in a sea of information, there is the need to build into the system a series of aids. This could be done by giving to the features of the 'directed' system a degree of 'intelligence' in their operation, and by adding additional features. The elements of the system could be seen as Agents or helpers of the learner which would perform a series of functions to facilitate learning.

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Within the wider 'open' learning context, the *Interface* will probably include one or more 'virtual learning' environments, such as a simulated training centre, through which the trainee can move in order to obtain advice, resources, assessments, and so on. Such environments will need to be style sensitive and have a balance of 'structure' for Wholists, and 'independence', for Analytics. They will need a similar range for the Verbal-Imagery dimension with both 'verbal' and 'pictorial' modes. This will allow a range of styles to be catered for, or for the trainees themselves by the adaptive system once the style of the trainee has been determined.

In the diagram, the Agents are shown in italics and have the following functions.

Adviser. Provides advice on appropriate and relevant 'courses', perhaps in conjunction with the Assessor. The Adviser would also manage the determination of goals and the scheduling of activity to meet them. In order to do this efficiently, the system would need to have established the level of sophistication of the user. Otherwise there is the danger of the user being overwhelmed or confused by too much or inappropriate input.

Instructor. Plans the appropriate modes of delivery and learning activities to suit the individual and to maximise efficient learning. This would employ the executive control principles outlined for the 'directed' learning system.

Assessor. Determines the individual's characteristics; present knowledge, learning styles and ability. Undertakes the learning needs analysis, in association with the Advisor.

Searcher. Searches for, and obtains, the appropriate information or courses for the learning. With the advent of banks of electronically stored information such as textbooks, encyclopedias, and journals, it would be possible for the control system to anticipate the material that will be needed by the user and to have searched and retrieved this in advance of its being required.

Peer. Links to others for collaborative learning or for mutual support, by, for instance, locating others studying the same topic or course. Style preferences will be relevant here since most people will probably benefit by linking with others. However, while Wholists have a particular preference for working in pairs or groups, Analytics are more content to work individually.[13]

The further development of these features will allow intelligent-tutoring systems to be much more versatile and effective.[14]

The style features that affect training that were applied in the first example will also be relevant here, but the question of locus of control becomes much more relevant, since individuals in effect are determining their own training needs.

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[13]Riding, R.J. & Read, G. (1996) Cognitive style and pupil learning preferences. *Educational Psychology*, 16, 81-106.

[14]See, Riding, R.J & Rayner, S. (1995) The information superhighway and individualised training. *Educational Psychology*, 15, 365-378. The illustrations in this Chapter were adapted with permission from the article.