# Cognitive style and learning strategies: some implications for training design

## Richard J. Riding and Eugene Sadler-Smith

*In designing learning materials there is often the assumption that all trainees will learn in a similar manner. This approach ignores the important issue of individual differences in cognitive style. Cognitive style may be defined as an individual's consistent approach to organising and processing information during thinking. Style does not appear to be related to intelligence and reflects qualitative rather than quantitative differences between individuals in their thinking processes. Here the authors argue that conventional training design methodologies (whilst acknowledging learning style) appear to lack the theoretical and empirical bases to acknowledge the important role played by cognitive style in determining learning performance. The aim of the article is to consider the relationship between learning performance, learning strategies and cognitive style and to suggest ways in which human resource development practitioners may accommodate individual differences in style in order that the effectiveness of training and development interventions may be improved.*

In designing learning materials there is often the assumption that all trainees will learn in a similar manner. Riding argued that this approach ignores the important issue of individual differences in learning style and cognitive style[1]. Streufert and Nogami, and Hayes and Allinson, suggested that one of the causes of the perplexing differences in performance of individuals across a variety of organisational settings is the effect of cognitive style[2].

In the UK the *Training and Development Lead Body (TDLB)* in its occupational standards for trainers made reference to the issue of 'learning styles'. In Unit A21 '*Identify Individual's Learning Aims, Needs and Styles*', the performance criteria include, 'Information on individual's preferred learning style is collected using appropriate processes' (A211e). They are not explicit about the definition of the term learning style nor about the processes which should be used for its identification. However, in their related Unit B21, '*Design Learning Programme to Meet Learner's Requirements*', no direct reference is made to,

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or advice given on, the accommodation of learning styles in the design process[3].

The present authors argue that conventional training design methodologies, whilst acknowledging the notion of learning style, appear to lack the theoretical and empirical bases to accommodate the important role played by cognitive style in determining learning performance. It is the aim of this article to,

1. distinguish between cognitive style and learning style/strategy,
2. consider the relationship between learning performance and cognitive style,
3. suggest ways in which designers of training may accommodate style and encourage strategy development in order to improve the effectiveness of training.

A distinction will be made between cognitive style, which is probably an in-built core characteristic of an individual, and learning styles, which are seen as strategies which are capable of being learned and are ways of adapting the material or its method of presentation to enable the individual to deal with it as effectively as possible.

## Cognitive style

Cognitive style is frequently included under the umbrella term 'learning style'[4], but as a construct it is much more pervasive, stable and deep seated than learning style. Cognitive style may be defined as an individual's consistent approach to organising and processing information during learning[5]. Since style does not appear to be related to intelligence, it may be argued that cognitive style differs from cognitive ability[6]. Both style and ability may affect performance on a given learning task, but style differs from ability in that performance on all types of task will normally improve as ability improves[7]. However, the effect of style on performance will be either positive or negative depending on the nature of the given task, some styles will be better suited to some tasks than others and vice versa. Hence, style reflects qualitative rather than quantitative differences between individuals in their thinking processes.

Unfortunately, the field of cognitive style has been made difficult to interpret from a human resource development perspective because of the wide variety of definitions of the term used by different authors (eg. serial-ist-holist, leveller-sharpener, field-dependent-independent, verbaliser-visualiser, etc). Hayes and Allinson identified twenty-two different labels of style in the literature and commented that the field is consequently 'complex and confusing'[8].

It has been suggested in extensive reviews of the style research literature that learners differ in terms of two fundamental and independent dimensions of cognitive style[9]; the Wholist-Analytic dimension and the Verbaliser-Imager dimension—see Figure 1. It is argued that these encompass related constructs such as the serialist and holist styles identified by Pask or are "likely to be correlates of the same single cognitive style"[10]. Allinson and Hayes have identified an intuitive-analytic dimension of cognitive style which is probably related to the Wholist-Analytic family of styles[11].

**Wholist-Analytic dimension of cognitive style**. The Wholist-Analytic dimension of cognitive style describes the habitual way in which an individual organises and structures information: some individuals will deconstruct information to its component parts (described as Analytics); others will retain a global or overall view of information (described as Wholists). For Wholists there is the danger that the distinction between the parts of a topic may become blurred. For Analytics, the separation of the whole into its parts may mean that one aspect of the whole may be focused on at the expense of the others and hence its overall importance exaggerated.

**Verbal-Imagery Dimension of Cognitive Style**. The Verbal-Imagery dimension of cognitive style reflects an individual's habitual
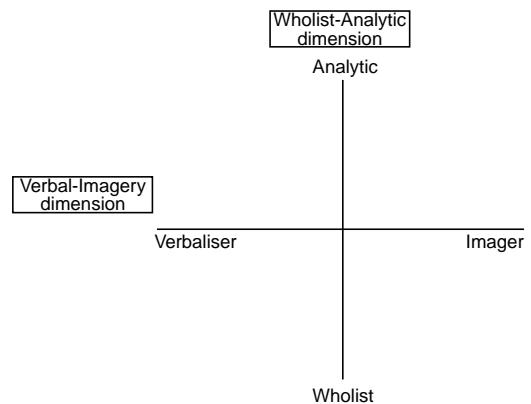


*Figure 1: The two dimensions of cognitive style*

mode of representation of information in memory during thinking. Verbalisers "consider the information they read, see or listen to, in words or verbal associations"; Imagers on the other hand, when they read, listen to or consider information, experience "fluent spontaneous and frequent pictorial mental pictures"[12].

**The Assessment of Cognitive Style**. A number of self-report tools are available for the assessment of cognitive style[13]. An individual's cognitive style may be assessed quickly, easily and probably more directly, using the computer-presented *Cognitive Styles Analysis (CSA)*[14]. This instrument assesses both dimensions of style by means of a direct, rather than self-report, assessment of an individual's habitual method of processing information. The *CSA* is a computer-administered test which presents information processing tasks and assesses both ends of the Wholist-Analytic and Verbaliser-Imager style dimensions. The computer records an individual's responses and computes his or her Wholist-Analytic ratio (low ratio corresponds to a Wholist style, a high ratio an Analytic style) and a Verbaliser-Imager ratio (low ratio represents a Verbaliser style, a high ratio an Imager style). The test is objective in that it is scored by the computer and the method of assessment is not obvious to assessees and hence difficult for them to contrive their results.

## Cognitive style and learning performance

It appears that the two fundamental dimensions of style affect learning performance in two separate ways: (i) the Wholist-Analytic dimension of cognitive style interacts with the structure and organisation of the contents of instruction (eg. simultaneous versus sequential; wholes versus parts), (ii) the Verbal-Imagery dimension of cognitive style interacts with mode of presentation of information (eg. textual versus pictorial).

*Structure of Presentation*: A number of studies suggest that for the Wholist-Analytic dimension of style, neither Wholist nor Analytic styles are ideal in the sense that neither leads necessarily to the optimum organisation of the contents of memory, ie., an integrated version of the whole of a new piece of information, with meaningful links to the learner's existing knowledge[15].

To help the trainee to form an appropriate internal structure of the material a 'map' of the content may be provided as an aid. A 'content map' may be in the form of either an *overview* or an *organiser*. Overviews can be designed to provide a whole view of the information which is more abstract and inclusive than the new material to be learned. Organisers can indicate the structure of the material and therefore give learners a means of organising the new material and relating it to what they already know. Overviews and organisers help learners to build a cognitive structure to which new learning may be linked in a meaningful way.

The effect on learning performance of overviews and organisers in a computer based learning package has been investigated[16]. This study suggested that Wholists may benefit from an organiser which performs an Analytic function, ie., presents the divisions of the content into topics and sub-topics. Analytics, on the other hand, may benefit from an overview which performs a Wholist function, ie., gives a global (non-hierarchical) view of the content. It is likely that Analytics will need to have all the information laid out before them in order to get a picture of the whole, otherwise they are likely to focus in on one part at the expense of others. Wholists by contrast will be inclined to see the overall view but need help in deconstructing information so as to see the organisation of material to be learned[17]. Sadler-Smith suggested that Wholists may benefit from a hierarchical 'tree'-type organiser (showing super- and sub-ordinate relationships), whereas Analytics may benefit from a global 'web'-type organiser (showing interrelationships and horizontal linkages)[18].

*Mode of Presentation*: A number of studies suggest a model for the interaction of cognitive style, learning performance and mode of presentation: Imagers may be expected to benefit more than Verbalisers from the presentation of information in a diagrammatic or pictorial form; Verbalisers may be expected to benefit more than Imagers from a textual presentation[19].

When trainees receive information that is not congruent with their style then learning performance is likely to be impaired.

## Cognitive style and training design

Hayes and Allinson argued that cognitive style may be an important factor in determining how individuals operate at each stage of

the learning cycle[20]. They suggest three types of interventions to facilitate learning: (i) improving job-individual fit; (ii) improving the effectiveness of training interventions; (iii) managing group composition. Hayes and Allinson reviewed nineteen studies (albeit in an educational setting) and found support in twelve of them for the hypothesis that accommodating individual differences in cognitive style has a beneficial effect on learning performance[21].

There are important questions for those involved in the design and development of learning, with respect to the organisation and presentation of material.

a. *Organisation of the training content*. How may the Wholist-Analytic dimension of style be accommodated (eg., should learners be encouraged to process information sequentially or simultaneously; should an Analytic view (organiser) or a more global overview, or both be presented in advance of new information?

b. *Mode of presentation of training*. How may the Verbal-Imagery dimension of style be accommodated (eg. should information be presented predominantly as words or 'pictures' or an equal balance of both)?

It is possible to suggest a variety of ways of designing training which (i) matches the mode of presentation of information to each aspect of the Verbaliser-Imager dimension or provide a balanced mode of presentation, and (ii) compensates for the deficiencies of each aspect of the Wholist-Analytic dimension. A framework for designing training which takes account of cognitive style is described below and shown in Table 1. General considerations for each style group include the following.

*Wholist-Verbalisers*: trainees of this style are likely to find difficulty in analysing new information into its component parts, but are able to retain an overall perspective. The verbal aspect of their style may confer upon them some element of Analytic ability. The latter may be pressed into service as an alternative strategy rather than a style *per se*. It may be necessary to provide an organiser which performs an analytic function, preferably in a verbal mode, since as Verbalisers they may benefit in general from a verbal presentation of information. As a result of their Wholist abilities they are likely to be proficient in gaining an overall view.

*Wholist-Imagers*: trainees of this style are likely to be unable to analyse a topic into its component parts since they have neither analytic nor verbal aspects to their style. For this reason it may be necessary to provide them with an analytic-type content organiser, preferably in a pictorial/diagrammatic form, since as Imagers they are likely to benefit in general from pictorial or diagrammatic presentation of information.

*Analytic-Verbalisers*: trainees of this style are likely to be proficient in breaking down new information into its component parts and relating these to existing knowledge. They are likely to be the least proficient in perceiving globally since they have no imagery capability which they can fall back on to use as a Wholist strategy. To compensate for this it may be necessary to provide this group with an overview-type organiser, preferably in a verbal form, since they may benefit in general from a verbal presentation of information.

*Analytic-Imagers*: trainees of this style, by virtue of the analytic aspect of their style, are likely to be unable to view new information globally. They are, however, able to analyse information into its component parts and the imagery aspect of their style may confer upon them some Wholist facility. It may be necessary to provide an Overview, perhaps in a pictorial and diagrammatic form, since as

*Table 1. Framework for accommodating cognitive styles*

| Adaptive technique | | Wholist Verbalisers | Wholist Imagers | Analytic Verbalisers | Analytic Imagers |
|---|---|---|---|---|---|
| Mode | Text | ■ | | ■ | |
| | Picture/diagram | | ■ | | ■ |
| Content map | Overview ('web') | | | ■ | ■ |
| | Analytic ('tree') | ■ | ■ | | |

Imagers they are likely to benefit in general from this presentation mode.

In addition, trainers need to be aware that their own cognitive style will affect their natural training style, which is unlikely to be the same as the style of most trainees.

### Accommodation of cognitive styles into training design

The individual differences in cognitive style detailed above may be accommodated into training by means of three approaches.

1. An *adaptive* approach which matches the cognitive style of the individual trainee (eg. presents Verbalisers with information in a textual mode and Imagers with information in a pictorial / diagrammatic mode).
2. A *balanced* approach which provides a balanced design to accommodate as many aspects of cognitive style as may be found in a group of trainees (eg. present all learners with a dual mode of textual and pictorial/diagrammatic presentation of information). Clearly, for the majority of trainers this is likely to be the most practical alternative.
3. A *strategy* approach which encourages trainees to develop strategies to make learning tasks easier by using the strengths of their styles.

(1) and (2) represent alternatives, but (3) may be used alone or in conjunction with either (1) or (2).

1. **Adaptive training designs**. These may be used to present information in a manner which matches each aspect of the learner's style: (i) Verbal-Imagery dimension: using appropriate combinations of text, still and animated diagrams, still and moving photographic images, speech and sound to match the mode of presentation to the learner's style; (ii) Wholist-Analytic dimension: adapt the structure of the content and provide a suitable content map to compensate for the deficiencies of the learner's style.

Such adaptive systems would, ideally, be presented via a computer-based medium using digital storage (eg. compact disc) to accommodate the large volumes of alternative forms of information required (text files, photographic images, animations, etc.). The use of a computer-based system would have the added advantage that the cognitive style of the learner could be identified quickly and easily using the computer-based *Cognitive Styles Analysis*. Style data may then be used to form the basis of a user model upon which decisions within the programme regarding the mode and structure of the presentation may be based. Theoretically, the system could also have a generative capacity in the sense that the user model and hence the training design could be modified in the light of learner performance (the adaptive system, in a sense, would be 'intelligent'). The aim here is to provide a single training package to be used by all the trainees that has within it sufficient variety to allow the trainees to attend to what suits their style.

2. **Balanced training designs**. These may be used to provide a balance of text, pictures and diagrams along with a flexibility in the structure of the design which allows learners opportunities to explore new information in their own idiosyncratic ways with the aid of alternative forms of overviews and organisers[22].

3. **Learning strategy development**. The possibility of strategy development will be considered in the section that follows.

## Learning strategies

While cognitive styles appear to be fairly fixed characteristics of individual trainees, it is possible for trainees to develop learning strategies (broadly equivalent to Kirton's 'coping behaviours') to enable them to make the most efficient use of the strengths and limitations of their particular cognitive style. Work in this area has been relatively limited and has been influenced by the experiential learning approach. However, this approach, while widely used in training circles, is not strong on empirical evidence of its psychometric validity or effectiveness in improving training[23]. Mention will be made of the approach, but an alternative, based on strategy development will be proposed.

### The experiential learning model

The term 'learning style' has been frequently associated with the work of Kolb and Honey and Mumford[24]. The latter developed the *Learning Styles Questionnaire (LSQ)* which is widely used in management training and

development. Hardingham, using the experiential learning model suggested that "a preference for one or more styles indicates . . . at which point in the learning cycle he or she is most likely to enter[25]. The designer should keep these in mind when developing materials to ensure they are suitable for the person and the situation"[26]. Buckley and Caple noted that the identification of a trainee's learning style may help trainers to design programmes that fit in with the dominant style of the trainee[27], but they failed to go beyond the original suggestions of Honey and Mumford as to how this may be achieved[28]. DeCiantis and Kirton in a comparative study of Kolb's *LSI* and Honey and Mumford's *LSQ* suggest that the former has conflated three separate 'cognitive elements'; style, level or ability and process[29]. They argue that the experiential learning process is a 'map' (or more appropriately a 'route') which is unrelated to both style and level. Like Hayes and Allinson, they suggest that each stage can be accomplished by means of a variety of styles and that the degree of success at a particular stage is contingent upon it being undertaken "in an appropriate style and at an appropriate level *depending on the specific situation at hand*" (italics added)[30].

## Cognitive style and the development of learning strategies

An alternative, or perhaps complement to the experiential learning approach is the active development of a repertoire of learning strategies. Cognitive styles appear to be relatively fixed[31]. Individuals therefore may not be able to change their styles but they can develop strategies to make themselves as effective as possible in a given learning situation (for example at a particular stage in the learning cycle or a given training event). It is proposed that there are three stages of learning strategy acquisition by an individual within the training context and these involve,

1. sensing and preferring,
2. selecting,
3. strategy development.

1. **Sensing and preferring**. When faced with a learning situation, individuals will sense inwardly the extent to which they feel comfortable with the situation. They may not be very aware of this in a conscious sense of saying to themselves that they feel unhappy, but with respect to certain aspects of training they will have a sense of the extent to which the learning task is easy or more difficult. This awareness by the trainee will be with respect to at least three aspects of the training situation, (a) the mode of presentation of the training task, (b) the structuring of the task, and (c) the social context of the learning.

*a. Ease of use of the mode of presentation.* Riding and Staley gave a questionnaire to university business studies students which assessed their preferences about the content and presentation of their courses, and this was compared with the actual performance by students on the course modules. Basically, where the mode of presentation and course content matched the Verbal-Imagery style of the student, then the students underestimated their performance. In cases where the Verbal-Imagery style did not match, they overestimated their performance. This was interpreted as suggesting that while the performance of students is affected by the extent to which the mode of presentation matches their Verbal-Imagery style, they are not very consciously aware of the match or mismatch, during actual learning[32].

However, where students are given an actual choice of mode of presentation, they will choose the one that suits their style. Riding and Watts told secondary school students that three versions of a sheet giving information on study skills had been prepared for them, and that each sheet contained the same information but that the formats were different. They were then invited to come one at a time to take one of the versions which were laid out on a table. The versions were Unstructured-Verbal (paragraphs, without headings), Structured-Verbal (paragraphs, each with a clear heading), and Structured-Pictorial (paragraphs, each with a clear heading, and a pictorial icon depicting the activity placed in the left margin). No students chose the Unstructured-Verbal version. With the two structured versions the majority of the Verbalisers selected the Verbal version and most of the Imagers the Pictorial. Students were obviously attracted to, and preferred to select, materials that appeared to them to suit their own style[33].

It appears, then, that trainees are likely to sense which format of training material or presentation they prefer, even if they do not actually feel less comfortable when learning from some inappropriate presentations.

*b. Appropriateness of the structure.* In the study

by Riding and Staley, described above, where there was a match between the structural requirements of the subject matter and the Wholist-Analytic style of the students, then the students did less well than they expected, but better than they expected when there was a mismatch. This was interpreted as indicating that the students were sensitive to how easy it was to understand a subject, and were consciously aware of the style of structure preferred, and expectation was commensurately higher or lower[34].

Trainees will be aware of the extent to which they are understanding the training they are receiving.

*c. Suitability of the social situation.* Riding and Read individually questioned secondary school pupils about their preferences about learning and working in social contexts. The preferences for group and individual working were that work in groups was particularly liked by Wholists, while individual work was least disliked by Analytics[35]. Sadler-Smith and Riding in a study of the effect of cognitive style on the learning preferences of undergraduates found further support for this[36].

The first step to strategy attainment is the awareness that particular formats or situations are more helpful to, and more comfortable for, the individual. This then forms the basis for the next stage.

2. **Selecting**. As individuals become increasingly aware of what suits them in the training they begin to select the most appropriate mode or structure, where possible or when a choice is provided. For example, an Imager may prefer to focus on a picture in a training manual rather than on the text. Riding and Read asked secondary school pupils about their preferences as to mode of working. Imagers reported that they used less writing and more pictures than Verbalisers, especially where the subject allowed, as in science. The tendency by Imagers to use pictures, and Verbalisers writing, increased with ability. There was evidence that lower ability pupils were more constrained by the usual format of the subject than were those of higher ability[37].

This development of a strategy of selecting the mode or structure which, for the individual suits their style can then lead on to more effective and conscious strategy development. An important feature here is that there is no 'right' way to learn that applies equally to all individuals, ie. the styles represent *qualitatively* different types of thinking. Trainers need, therefore, to avoid the notion of 'this is the way' to learn. After all, a particular trainer's natural training style will be a reflection of their own cognitive style. The trainees need to be encouraged to use whatever means seems to be right for them as individuals. This can be quite a liberating experience for trainees!

3. **Strategy development**. There are at least three types of strategy that can be developed to make learning easier for a given style. These are: (a) translation, (b) adaptation, and (c) reduction of processing load.

*a. Translation.* Translation involves recasting the information which as presented may be in a form that does not suit an individual's style, into a mode that makes it easier to process and understand. Examples of such translations include the following.

- An Imager may 'translate' a page of text into a diagram which represents the same information in visual form.
- A Verbaliser may describe a picture with words.
- An Analytic may map out the elements of a topic on a sheet of paper to obtain a 'whole' view.
- A Wholist may go through a chapter of a book and list the headings to give an indication of its structure.

All these are attempts to represent the information in a form that is more appropriate to the style of the learner.

*b. Adaptation.* This is where a style dimension is pressed into service because a feature is not available on the other dimension of an individual's style. For instance, an Analytic-Imager obviously does not have the same facility as a Wholist to obtain an overview of situations or information. However, it is often possible to obtain a whole view by generating an image of the whole. Similarly, a Wholist-Verbaliser lacks an analysing facility, but the analytic nature of verbal representation may to some extent be used as a substitute. Some possible adaptations are shown in Table 2.

*c. Reduction of processing load.* Here the approach is to minimise the information processing load by using a strategy that economises on processing. Although we are not usually consciously aware of it, any information we see or hear we have to analyse and pro-

*Table 2. Available styles and strategies for the four groups*

| Cognitive style | Styles and strategies available |
|---|---|
| Wholist Verbalisers | Wholist and Analytic |
| Analytic Imagers | Analytic and Wholist |
| Analytic Verbalisers | Analytic only |
| Wholist Imagers | Wholist only |

cess in order to give it meaning. This analysis takes processing capacity within the brain. If the information is in the preferred mode then the information processing load is less than if it is not. For an individual, additional processing load will, at the least, result in a longer time being required to learn the information. At worst, the load may exceed capacity, and the information may not be learned at all[38]. Some examples of strategies to reduce the load are as follows.

- An Imager who finds that verbal processing imposes a high load can selectively scan text and extract only the most important sections to save reading the whole.
- A Wholist could underline words in text to produce 'headings' to clarify the structure.

**Facilitating strategy development**. Over time and with experience, an individual will discover for themselves some of the strategies that will help them to deal with information or learning situations that do not ideally suit their cognitive style. However, this process may be facilitated and accelerated by training and development practitioners in the following ways: (a) by the use of the *Cognitive Styles Analysis* to give style awareness to an individual; (b) by providing a repertoire of ready-made strategies suited to an individual's particular style and which are applicable to the training requirements of the learning tasks.

*a. Personal style awareness.* An important first step towards the development of a strategy is the recognition of one's own style by using, for instance, the *Personal Styles Awareness* package and the recognition of the features of a learning situation which may match or mis-match one's own preferred way of learning[39].

*b. The provision of ready-made strategies.* To do this a trainer would need to identify the types of tasks that are necessary for the successful completion of training. These might include the understanding of text in a training manual, the understanding of a talk or lecture in a training session, learning how to perform a practical skill to work on an assembly line and learning how to interact in a social setting via role play exercises.

Using the principles set out above, it is then possible to devise strategies that would be of help to individuals of particular styles to help them to undertake the training. Team learning may also be made more effective in this context by having a balance of styles within the group so that each may learn from others of contrasting styles to their own.

## Conclusion

The accommodation of cognitive style in the training design process has the potential to improve the efficiency and effectiveness of individual learning, and may also help in the identification of learning difficulties. A recognition of the strengths and weaknesses of one's own style naturally leads to the formation of strategies (coping behaviours). Human resource development practitioners have a crucial role to play in the facilitation of individual learning strategy development and hence in making trainees more aware of their own learning processes and hence help them to become more effective as autonomous, self-directed, life-long learners.

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