



Learning styles– an introduction to the research literature

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1. Summary

This Becta introduction to the research literature on learning styles considers some definitions and the elements of learning style – information processing, instructional preferences and learning strategies. The article also includes a selective bibliography for further reading and research, as well as an appendix which summarises a number of models of learning styles.

Despite the many opinions on learning styles there are few generally agreed facts. Some theories are more influential than others, but no model of learning styles is universally accepted, for in this complex area reliable studies are lacking.

Although it is difficult to draw together such a diverse and complex area of theory and research, the following seem to be relatively consistent messages.

- There is no secure evidential base to support any one theory of learning styles – it is important to be aware of the limitations of any learning styles model and indeed of the field as a whole.
- Any theory or model of learning styles is necessarily a simplification of the complexity of how students learn.
- Learning styles are at best one of a range of factors determining how learners react to learning opportunities – environment, culture (of both learner and institution), teaching methods and curriculum requirements are all part of a complex pattern of interactions.
- Representing knowledge in multiple formats does appear to result in learning gains – however, it is at least as effective to match the presentation of content to the nature of the subject matter as it is to match it to individual learning styles.
- There is a danger inherent in learning styles of labelling students as particular kinds of learners – given the lack of robust evidence in the field, labelling strategies seems safer than labelling learners.
- An awareness of learning styles theories may help to develop metacognition and the ability to learn how to learn.
- At least some aspects of learning styles and strategies can be taught, regardless of natural inclination.

2. Defining learning styles

The term 'learning styles' has no one definition – in much of the literature it is used loosely and often interchangeably with terms such as 'thinking styles', 'cognitive styles' and 'learning modalities'. Research in the field of learning styles is conflicting and often methodologically flawed. The literature draws on the fields of pedagogy, psychology and neuroscience, but generally fails to engage fully with any of them.

There are numerous theories and opinions on learning styles, but few generally agreed facts. Some researchers emphasise the importance of working memory or sensory pathways in determining how students learn, while others subscribe to the idea of multiple intelligences. A lack of academic clarity and the competing commercial interests in the field have led to a confused and confusing array of concepts, models and tools. Some are more influential than others, but no model of learning styles is universally accepted.

However, a number of researchers (for example Cassidy 2004) have attempted to break down the concepts and processes which underlie the term 'learning styles'. Although there is a danger of oversimplifying a complex subject, learning styles may be said to consist of three inter-related elements:

- information processing – habitual modes of perceiving, storing and organising information (for example pictorially or verbally)
- instructional preferences – predispositions towards learning in a certain way (such as collaboratively or independently) or in a certain setting (environment or time of day, for instance)
- learning strategies – adaptive responses to learning specific subject matter in a particular context.

One of the key differences between the various theories of learning styles is the extent to which they are thought to be stable, or 'hard wired' into learners' minds. Some theorists believe that learning styles are rooted in fixed genetic traits, while others emphasise the influence on how students learn of experience, the environment and curriculum design.

Although the simplicity of assuming that everyone has a permanent, in-built learning style is appealing, there is little evidence to support this. The lack of longitudinal studies makes it impossible to be certain how stable learning styles are. There is the further problem of the reliability of the instruments used to test learning styles – even if learning styles are stable, many of the instruments cannot be relied on to give consistent results from one test to the next.

3. Brain-based theories – modalities and cognitive styles

Much of the learning styles theory in this area seems to be based on concepts from popular psychology which are taken at face value despite the lack of supporting evidence. The belief, for example, that creativity resides in the right hemisphere of the brain while logic is located in the left is at best an over-simplification of messages coming out of the complex, and still emerging, field of neurobiological research. While many theorists link learning styles with a preference for right- or left-brain processing, there is little empirical evidence for this.

Equally, it is not clear how fixed the characteristics of an individual's brain are. Even if there is a neurobiological basis to an individual's learning preferences, it may be that the brain's inherent adaptability will allow those preferences to change over time.

3.1 Learning modalities

One of the most widely known and used concepts in learning styles is that of learning modalities (a combination of perception and memory). This is the theory that all learners have a preference for receiving and storing information through one or more of the sensory modalities: visual, auditory, and kinaesthetic (some theorists also include a tactile modality). Visual learners learn best from either pictures or written text, auditory learners prefer the spoken word, and kinaesthetic learners think in terms of actions and bodily movement. While there has been considerable research to support the existence of these modalities, particularly relating to students with learning difficulties, the implications for pedagogy and content design are far from clear.

It is difficult to say how many learners will have a very strong preference for just one modality – and, as with learning style tests in general, there is the issue of the accuracy and reliability of measuring a learner's preferences. So it is perhaps not surprising that Coffield *et al* (2004) found no evidence that matching instruction to an individual's sensory or perceptual strengths and weaknesses is any more effective than designing content-appropriate forms of presentation and response. It may be, therefore, that matching presentation with the nature of the subject matter is both more important and more achievable than matching individual preferences. Similarly, Marzano (1998) found that graphic and tactile representations of information had marked effects on learning outcomes, regardless of any attempt to match them with individuals' modalities.

3.2 Cognitive styles

Cognitive styles are similar to modalities in as much as they are thought to be biologically based and therefore relatively stable. As in the field of learning styles in general, here too there are many competing and overlapping theories. Although different authors may use different terms to describe them, two of the more widely accepted types of cognitive style are the verbal-imagery dimension and the wholist-analytic dimension (Riding and Read 1996).

Verbalisers represent information in the form of words; imagers tend to think pictorially. Imagers therefore learn best from pictorial representations of information, while verbalisers learn best from words/text.

Wholists take a global, top-down view of information; analytics break information down into its component parts. For the wholist-analytical dimension, it is the organisation of information that is the key consideration. Wholists tend to prefer a 'breadth-first' structure which gives an overall view of a topic before introducing detail. Analytics on the other hand prefer a depth-first approach, where each topic is explored fully before moving onto the next one.

Again, there is strong evidence for the existence of these styles but what they mean for instructional design is less clear, particularly in terms of matching instruction to cognitive style. While there is some evidence (Ford and Chen 2001; Riding and Watts 1997) that matching learning materials to a student's cognitive style improves both performance and satisfaction, some authors argue that

mismatching materials and learning styles is beneficial as it helps students develop a more balanced approach. Constantinidou and Baker (2002) found that pictorial presentation was advantageous for all adults taking an item-recall test – indeed, it was especially so for those with a strong preference for verbal processing.

According to a study by Riding and Rayner (1998), it may be that matching is most beneficial for lower-ability students, particularly when presenting difficult material, while higher-ability students benefit more from mismatching as it allows them to develop new approaches to learning. The effects of matching and mismatching seem to be dependent on context and are certainly far from simple: outcomes differ according to the subject matter and intended learning outcomes (for instance conceptual knowledge versus practical performance). Other factors such as prior learning, computer experience and gender complicate the issue still further.

3.3 Accommodating modalities and cognitive styles

For content developers, in particular, it may be more appropriate to think in terms of accommodating, rather than matching, a range of modalities and styles. Offering learners a variety of ways of engaging with content does seem to be beneficial in terms of both outcome and motivation. Moreno and Mayer (1999) found that mixed modality (visual/auditory) presentations were the most effective, while Jaspers (1994) argues that designing instructional materials to cater for a dominant modality is both practically difficult and theoretically unsound. Gregorc (1984) also observed that learners prefer a variety of instructional approaches, though this may be for no more complex reason than to 'avoid boredom'.

Sadler-Smith and Smith (2004) offer the following recommendations for accommodating learners' cognitive styles:

- give a structured route through learning
- provide a global perspective of the content
- present information both visually and verbally (written or spoken)
- make the structure and scope of content, as well as its relationship to other topic areas, as explicit as possible.

4. Learning styles and learning strategies

A significant number of theorists and researchers (Kolb, Honey and Mumford, for instance) have argued that learning styles are not determined by inherited characteristics, but develop through experience. Styles are therefore not necessarily fixed, but can change over time, even from one situation to the next. Theorists such as Entwistle, on the other hand, are more interested in how students tackle a specific learning task (learning *strategy*) than any habitual preference (learning *style*). What these authors have in common is an emphasis not simply on the learner but on the interaction between the learner, the context and the nature of the task. Indeed, Bloomer and Hodkinson (2000) argue that learning styles are only a minor factor in determining how learners react to learning opportunities: the effects of contextual, cultural and relational issues are much greater.

If, therefore, learning styles are not fixed personality traits, the emphasis shifts from accommodating learning styles to encouraging a balanced approach to learning and – perhaps more importantly – an explicit awareness of the range of approaches available to the learner. Even among authors who question the validity of learning styles as a concept, most agree that there is a benefit in enabling learners to reflect on how they learn. Encouraging metacognition (being aware of one's own thought and learning processes) is therefore perhaps the most important advantage that can be claimed for applying learning styles theory to learning and teaching. According to Sadler-Smith (2001), it may be that a knowledge of learning styles makes students better able to adapt to different situations. Ramsden (1983) makes a similar claim regarding learning strategies: students who are aware of a range of strategies are more likely to select the correct one for a particular task.

This is where the fundamental difference lies between those who believe in fixed learning styles and those who believe in flexible learning strategies: instead of adapting teaching and content to the learner, the learner needs to choose the approach which is most appropriate to the requirements of the task at hand. Here the issue becomes as much one of study skills as learning styles or strategies. For the content developer, then, the challenge is to provide metacognitive support for learners, enabling them to reflect not just on what they learn but also how and why.

5. Bibliography

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Appendix: Learning styles models

The following is a brief summary of the key points of 13 of the most popular and influential models of learning styles (adapted from Coffield *et al* 2004).

Gregorc – Mind Styles Delineator

- Two dimensions: concrete-abstract and sequential-random
- Most learners prefer a variety of instructional approaches
- Issues of validity and reliability
- No empirical evidence that using Gregorc's model brings any learning benefits

Dunn and Dunn – Learning Styles Questionnaire/Inventory

- Four styles: environmental, sociological, emotional, physical
- Aims to help teachers identify individual instructional preferences and adapt pedagogy and the learning environment accordingly
- Widely used internationally
- Lack of independent research to support this model

Riding – Cognitive Styles Analysis

- Two dimensions: wholist-analytic, verbaliser-imager
- Evidence of links between cognitive styles and instructional preferences
- Need to take working memory into account as well as cognitive styles
- Although the model has potential value, Riding's instrument for measuring cognitive style is not reliable

Myers-Briggs – Myers-Briggs Type Indicator

- Based on Jung's theory of personality – four bipolar scales (perceiving/judging, sensing/intuition, thinking/feeling, extraversion/introversion) producing 16 personality types
- Conceived as a tool to categorise personality, not just approaches to learning
- Limited evidence that matching teacher and learner types may increase performance

Apter – Motivational Style Profile

- Based on motivational 'states', not fixed types, in four domains: means–ends, rules, transactions, relationships
- Theory of personality, not learning style
- Although not widely researched, the theory's emphasis on motivation may have considerable relevance for education

Jackson – Learning Styles Profiler

- Four types: initiator, reasoner, analyst, implementer
- Mostly used in business
- Emphasises the importance of personal development through building up multiple strengths

Kolb – Learning Styles Inventory

- Four styles: active, reflective, abstract, concrete
- Learning styles are not fixed personality traits, but relatively stable patterns of behaviour

- Students should gain competence in all four learning styles to become balanced, integrated learners

Honey and Mumford – Learning Styles Questionnaire

- Four types: activists, reflectors, theorists, pragmatists
- Learning style is defined as ‘a description of the attitudes and behaviour which determine an individual’s preferred way of learning’
- Most people exhibit more than one trait

Herrmann – Brain Dominance Instrument

- Four types: theorists, organisers, innovators, humanitarians
- Most people have two or more strong preferences
- Originally based on brain research, but social, cultural and experiential factors are more important in determining learning preferences
- Learners should develop the flexibility to respond to particular learning situations, regardless of their natural preferences
- Well established in business but not widely used in education

Allinson and Hayes – Cognitive Styles Index

- One bipolar dimension: intuition-analysis
- Relatively high level of validity and reliability
- Intended for use in business rather than education

Entwistle – Approaches and Study Skills Inventory for Students (ASSIST)

- Three approaches: deep, surface, strategic
- Deep learning is seen as the most effective and beneficial
- Intended to characterise approaches, not individuals
- Widely used in UK higher education
- Offers recommendations for designing instruction to promote deep learning

Vermunt – Inventory of Learning Styles

- Four approaches: meaning-directed, application-directed, reproduction-directed, undirected
- Each learning style affects five dimensions: cognitive processing, learning orientation (motivation), affective processes (feelings about learning), mental model of learning, regulation of learning
- Used mainly in higher education
- Combines cognitive and emotional aspects
- Emphasis on the teaching-learning environment rather than individual differences

Sternberg – Thinking Styles

- Thirteen thinking styles divided into three functions, four forms, two levels, two scopes and two leanings
- Distinguishes between styles and abilities – a style is ‘a preferred way of using the abilities one has’
- Learners have a profile of styles, not just one single style
- Profiles of styles may differ according to gender and cultural background

- Styles are teachable and should fit the context, so a variety of teaching and assessment methods is desirable.