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The relationship between learning style and cognitive style

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Abstract

One of the principal debates in the field of individual differences in 'learning style' (often used to include cognitive style) has centred around the proliferation of constructs and measures, many of which have been developed with little regard for extant theories and instruments. This study explored the construct validity of learning style as operationalised in the Learning Styles Inventory (LSI) and its relationship with cognitive style as measured using the Cognitive Styles Analysis (CSA). In addition the relationship between styles and learning preferences was examined. Correlational and principal components analyses suggested that: the Learning Style Inventory assesses two dimensions as theorised by Kolb (comprehension and transformation); learning style and cognitive style are independent and the relationship between style and preference is mediated by gender.

Keywords: Cognitive style; Learning preferences; Learning style

1. Introduction

The term 'learning style' is used widely in education and training to refer to a range of constructs from instructional preferences to cognitive style (Riding & Cheema, 1991). One of the most significant taxonomic developments in the field came with the work of Curry (1983). She placed learning style in between learning preferences and cognitive style in a layered 'onion' model of individual difference constructs. The 'core' of the onion is the central personality dimension; as one passes outwards from the centre, the constructs (cognitive style, learning style and learning preferences) become increasingly open to introspection, more context-dependent

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and less fixed. In spite of this theoretical advance individual researchers continue to design and develop their own instruments without sufficient regard for extant theory and measures, consequently there is the potential for real confusion amongst researchers and practitioners alike. As Furnham (1992) noted 'the proliferation of eponymous questionnaires that overlap considerably cannot be good for the development of the discipline'. If the field is to progress there is a need to delineate cognitive styles and learning styles as separate constructs (if indeed they are such). The LSI has been the subject of recent analyses by Willcoxson and Prosser (1996), Yahya (1998) and Loo (1999). Their findings gave some support to the LSI's two-dimensional structure, however they did not consider learning style in relation to other constructs. It is the aim of this study to assess the validity of a widely used measure of learning style — the Learning Styles Inventory (Kolb, 1985) and compare it with a measure of cognitive style (Cognitive Styles Analysis; Riding, 1991).

1.1. Cognitive style

Messick's (1984) definition of cognitive style as consistent individual differences in preferred ways of organising and processing information and experience has been cited widely. Sternberg and Grigorenko speculated that cognitive style may represent 'a bridge between what might seem to be two fairly distinct areas of psychological investigation: cognition and personality' (Sternberg & Grigorenko, 1997). Riding and Cheema (1991) argued that learners differ in terms of two fundamental and independent dimensions of cognitive style, the wholist-analytical (WA) dimension and the verbaliser-imager (VI) dimension (Riding, 1991). The wholist-analytical dimension of cognitive style describes the habitual way in which an individual processes and organises information: some individuals will process and organise information into its component parts (described as analytics); others will retain a global or overall view of information (described as wholists). Low correlations ($r = 0.05$) have been reported between the wholist-analytical dimension of cognitive style and intelligence as measured by the British Abilities Scale (Riding & Pearson, 1994). The verbal-imagery dimension of cognitive style describes an individual's habitual mode of representing information in memory during thinking. According to Riding (1994) 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'. As with the WA dimension, very low correlations ($r = 0.12$) have been reported between the VI dimension and intelligence (Riding & Pearson, 1994). Riding and Wigley (1997) observed very low correlations ($r < \pm 0.09$) between both cognitive style dimensions and the scales of the EPQ-R and IVE personality questionnaires (Eysenck & Eysenck, 1991).

1.2. Learning style

Kolb (1984) described learning as a four-stage process consisting of concrete experience, observation and reflection, formation of abstract concepts and generalisations and the testing of the implications of these concepts in new situations. Kolb suggested that pairs of these activities may be represented as polarities with a dialectical tension between concrete experience and abstract conceptualisation (a comprehension dimension) and between reflective observation and

active experimentation (a transformation dimension). Kolb suggested that individual learners have particular strengths which form the basis of their preferred 'learning style' and that an individual's style may be identified by assessing her or his position on each of these two bipolar dimensions using a self-report inventory (the Learning Styles Inventory; Kolb, 1985).

The Learning Styles Inventory (LSI) and its revisions have been criticised for an apparent lack of validity and reliability (Sims, Veres, Watson & Buckner, 1986). Freedman and Stumpf (1980) found that the LSI items loaded on two bipolar dimensions, but the factor loadings were low and accounted for only 20.6% of the total variance. Cornwell, Manfredo and Dunlap (1991) analysed the responses of 317 subjects who completed the revised LSI. Their results 'afforded support for only two of the individual ability dimensions and little support for Kolb's two bipolar dimensions' and they suggested that the LSI should be used 'with some caution as a means to inform adults about how they learn best' (Cornwell et al., 1991). More recently a validity study by Willcoxson and Prosser (1996) gave mixed findings, but Yahya's (1998) re-analysis of their data supported the notions of two bi-polar dimensions. Loo (1999) observed that although confirmatory factor analysis failed to support the LSI-1985, exploratory factor analysis using scores on the four scales (as opposed to items) supported the two bipolar dimensions and Yahya's conclusion that 'Kolb's LSI has high construct validity' (Yahya, 1998).

Furnham (1992) examined the relationships between the LSI and the Eysenck Personality Questionnaire (EPQ) (Eysenck & Eysenck, 1975). He found statistically significant correlations ($r \geq \pm 0.33$) between the Kolb learning style scores and psychoticism ($r = 0.44$), neuroticism ($r = -0.34$), extraversion ($r = 0.33$). This suggests that the LSI dimensions are correlates of these fundamental aspects of personality. The Kolb dimensions themselves are derived in part from Jung's theory of psychological type, the most widely used measure of which is the Myers–Briggs Type Indicator (MBTI). Furnham (1996) found statistically significant correlations ($-0.70 \leq r \leq +0.48$) between the scores on the MBTI and the 'big five' personality dimensions (NEO Personality Inventory; Costa & McCrae, 1985).

The present study aimed to examine the validity of Kolb's LSI, its relationship with learning style and the relationships between styles and learning preferences. Previous research has suggested that cognitive style and learning preferences may be related, but that this relationship appears to be mediated by gender (Sadler-Smith & Riding, 1999; Sadler-Smith, Allinson & Hayes, 2000).

2. Method

2.1. Participants and procedure

The sample comprised second year business and management students who were following undergraduate programmes in a range of business and management disciplines at a university business school in the UK. This opportunity sample was tested during the course of several 'learning styles' workshops which were part of a second year undergraduate module on human resource development. Participation in the workshops was voluntary, subjects worked through the materials individually and were offered feedback on their scores after the entire sample had been tested.

2.2. Measures

The measures used were as follows:

1. learning styles measure: the Learning Style Inventory (Kolb, Rubin & Osland, 1995) which consists of 24 items comprising single adjectives in six sets from which respondents are required to rank (1–4) according to the extent to which they feel the adjective applies to them. The four scales are concrete experience (CE), reflective observation (RO), abstract conceptualisation (AC) and active experimentation (AE). Scores on pairs of LSI scales may be combined to give a new score for each bi-polar dimension of learning style as follows: AC-CE (AC minus CE) and AE-RO (AE minus RO), thus enabling individual positions on these two dimensions, which are hypothesised as being orthogonal, to be plotted;
2. cognitive styles measure: the Cognitive Styles Analysis (CSA) (Riding, 1991) is a computer-presented test which identifies an individual's position on two dimensions of cognitive style — the wholist-analytic (WA) and verbaliser-imager (VI) dimensions. A high score on the WA dimension indicates an analytic style and vice versa. The WA dimension is hypothesised to be broadly equivalent to field dependence — field independence (Witkin & Goodenough, 1981). A high score on the VI dimension indicates an imagery style and vice versa. By combining scores on these two dimensions Riding suggests that it is possible to identify four cognitive style types — wholist imager (WI), analytic verbaliser (AV), wholist verbaliser (WV) and analytic imager (AI);
3. learning preferences measure: this consisted of a list of teaching and learning methods to which participants had been exposed during the normal course of their studies (seven items in total). Three groups of teaching and learning methods were distinguished as follows: autonomous methods (open/distance/flexible learning and computer-assisted learning); collaborative methods (role play, group work and business games and simulations); dependent methods (tutorial/surgery and lecture). Respondents were required to indicate their preferences for each of the seven items on a five point scale (strong preference to strong dislike) which were subsequently combined to give scores for each of the three scales.

3. Results

3.1. Descriptives and inter-correlations

One hundred and seven usable scores were obtained (57 males and 50 females). Participants' ages ranged from 19 to 55 years (Mean = 21.47, SD = 6.03). Means, standard deviations and inter-correlations for learning style and cognitive style are shown above the diagonal in Table 1. Willcoxson and Prosser's correlations from their LSI study are shown below the diagonal.

The correlations between AC and CE ($r = -0.50$) and AE and RO ($r = -0.71$) are suggestive of two bipolar dimensions and support the observations of Yahya (1998) and Loo (1999). The correlation between AE-RO and AC-CE was low ($r = 0.20$) and only marginally significant ($P = 0.05$) and that the two bipolar dimensions of learning style are virtually orthogonal. There were no statistically significant correlations between cognitive style and learning style. The correlation

between the two dimensions of cognitive style was also low and non-significant which supports previous findings (Riding & Rayner, 1998).

3.2. Factor analysis

In order to further analyse these data the scores for each of the separate scales were subjected to a principal components analysis. The sample size, though small for factor analysis, met the minimum size criterion (100) and subjects-to-variables ratio (2:1) specified by Kline (1994). There were three factors with eigenvalues greater than one and these accounted for 72.5 % of the total variance. The matrix of factor loadings was rotated to simple structure using the Varimax method (the factors were not highly correlated). A clean factor structure emerged — there were no cross-loadings and each scale loaded at more than the salient value (0.55) on one factor only. The resultant rotated factor matrix is shown in Table 2.

The AE and RO scales of the LSI loaded highly on Factor 1 and corresponds to Kolb's 'transformation' dimension whereas Factor 2 consisted of the AC and CE scales and corresponds to the 'comprehension' dimension of learning style. The VI and WA scores loaded exclusively on Factor 3 (labelled 'cognitive style').

Table 1
Inter-correlations (shown above the diagonal), means, standard deviations and reliabilities[a]

	Learning style				Cognitive style	
	CE	RO	AC	AE	VI	WA
CE	**0.60**	0.07	−0.50***	−0.19*	−0.07	−0.01
RO	−0.24**	**0.65**	−0.24*	−0.71***	−0.07	0.01
AC	−0.42**	−0.17*	**0.50**	0.11	−0.01	0.09
AE	−0.34***	−0.47***	−0.32***	**0.50**	0.11	−0.05
VI	–	–	–	–	–	−0.08
Mean (SD)	15.05 (2.63)	14.68 (3.70)	16.78 (3.12)	16.27 (3.10)	1.07 (0.19)	1.40 (0.52)

[a] Note: *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; Willcoxson and Prosser's (1996) correlations are shown below the diagonal. Cronbach α shown in bold along the diagonal.

Table 2
Factor analysis

	Factor 1	Factor 2	Factor 3
CE	−0.07	*−0.86*	−0.01
RO	*−0.91*	−0.10	−0.01
AC	0.11	*0.86*	0.03
AE	*0.92*	0.09	0.02
VI	0.17	−0.06	*0.74*
WA	−0.14	0.10	*0.75*
Eigenvalue	1.95	1.30	1.09
% of variance	32.5	21.7	18.2

Table 3
Correlations between style and preference[a]

Gender	Style	Learning preference		
		Autonomous	Collaborative	Dependent
Males ($N=50$)	AC-CE	−0.15	0.05	0.14
	AE-RO	0.08	0.42**	0.01
	VI	−0.07	−0.09	−0.05
	WA	0.01	0.14	−0.04
Females ($N=57$)	AC-CE	0.09	−0.10	0.03
	AE-RO	0.22	0.21	−0.11
	VI	−0.35*	−0.07	0.18
	WA	0.06	−0.24	0.10

[a] Note: $^{**}P<0.01$; $^{*}P<0.05$.

2.2. Relationships with learning preferences

The zero-order correlations with learning preferences are shown in Table 3. Since previous research has shown an interaction between style and gender in their effect upon preferences it was decided to compute the correlations separately for males and females. The four LSI sub-scales scores were combined to give scores for the two dimensions revealed by the factor analysis thus, comprehension (AC-CE) and transformation (AE-RO).

A number of statistically significant correlations may be observed. For male participants collaborative methods were positively correlated with the AE-RO dimension of learning style ($P<0.01$). Male individuals who, according to Kolb's theory, transform their experiences of the external world through active experimentation appear to prefer those learning methods which involve social interaction. For females there was a negative correlation between preference for autonomous methods and the VI dimension of cognitive style ($P=0.01$); a verbaliser style is associated with a preference for autonomous learning methods. Also worthy of note is the negative correlation between the WA dimension of cognitive style and collaborative learning preferences, however this result was statistically significant at only the 10% level ($P=0.09$).

4. Conclusion

Curry (1983) devised a simple taxonomy which distinguished between cognitive style, learning style. More recently Riding (1997, 2000) has posited a cognitive control model in which style provides the organisational and representational interface between the internal state and the external world. The cognitive control is conceived of as independent of the personality source:

> The validity of the construct of cognitive style, as assessed by the Cognitive Styles Analysis approach, is supported by evidence that the dimensions are independent of one another, separate from intelligence, independent of, but interacting with, personality, related to

behaviours such as learning performance, learning preferences, subject preferences and social behaviour.(Riding, 2000)

The present study may assist in the elaboration of the cognitive control model by suggesting that, like cognitive style and personality, cognitive style and learning style are independent. This result may be anticipated since studies by Furnham (1992, 1996) found that the MBTI scales (which is based on Jungian theory) are correlates of the 'big five' personality dimensions whereas the CSA interacts with personality (Riding, 2000). These findings lend support to both the 'onion' taxonomy (Curry, 1983) and the cognitive control model. Cognitive styles and learning styles may therefore comprise four separate psychological functions: comprehension (AC-CE); transformation (AE-RO); representation (VI); and organisation (WA). Style and gender appear to interact in their relationship with preferences which supports the findings of Riding and others (for example: Sadler-Smith et al., 2000). In terms of an explanatory mechanism for this Riding and Rayner (1998) have argued that 'there is a hint that the verbal-imagery style dimension interacts with gender in terms of the location of brain activity'. The present study suggests that future research into individual differences in style should take into account the effect of gender upon style-related behaviours and treat learning style and cognitive style as separate constructs.

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