

The Factor Structure and Validity of the Learning Styles Profiler (LSP)

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Abstract. The Learning Styles Profiler (LSP; Jackson, 2002) is a modern measure of individual differences in learning style. The LSP is based on a neuropsychological model of learning, modeled on principles of approach and avoidance, and argues for the division of personality into temperament and character. There has been little research into the psychometric structure and predictive validity of this instrument. In Study 1, the factor structure of the LSP is examined, and in Study 2 the criterion-related validity of the LSP is assessed. Results support the proposed factor structure of the LSP and show that 3 of the 4 LSP scales are significant predictors of Job Performance.

Keywords: learning, personality, impulsivity, conscientiousness, responsibility

Introduction

Recently, the concept of "learning styles" has emerged as a focal point of much psychological research. In particular, the impact of learning styles has been examined in the areas of educational psychology (e.g., Farkas, 2003; Hendry et al., 2005; Honigsfeld & Schiering, 2004; Price, 2004; Veenman, Prins, & Verheij, 2003), organizational psychology (Hayes & Allinson, 1998; Rodrigues, 2005; Rodwell, 2005; Yazici, 2005), and health and clinical psychology (e.g., Armstrong & Parsa-Parsi, 2005; Fujii, 1996; Linker, Miller, Freeman, & Burbacher, 2005; Tsatsanis, 2004). The widespread study and application of learning styles necessitates the need for thorough investigations into the predictive validity of such styles, along with their associated measurement devices. In this paper we outline Jackson's (2002) model of learning and evaluate the latent structure and criterion-related validity of a questionnaire designed to measure Jackson's (2002) learning styles.

Jackson (2002) proposed a model of learning based on the neuropsychology of personality. The model draws on Cloninger's (1987) and Cloninger, Svrakic, and Przybeck's (1993) highly influential framework, in that it attributes observable behaviour to individual differences in two fundamentally distinct types of learning. These learning types are termed "temperament" and "character," with individual differences in temperament reflecting biases in unconscious information processing related to neurogenetic mechanisms, and individual differences in character reflecting higher level biases in conceptual learning.

The inclusion of temperament in Jackson's (2002) model of learning implies that some learning styles are biologically based and relatively stable. Jackson (2002) suggests that temperament is comprised of two dimensions of learning, including impulsivity and emotional independence. According to

the model, impulsivity is an approach motivation associated with the dopaminergic system, whereby people high in impulsivity generate learning opportunities which may have functional or dysfunctional consequences. Emotional independence, on the other hand, is an avoidance motivation associated with the serotonergic system and is described as self-reliance, self-control, and a rejection of chance, luck, and intuition in favour of rationality (Jackson, 2002). It is characterized by a learning style associated with low anxiety and high emotional intelligence. Jackson's proposed structure of the learned basis of temperament is consistent with biological models of personality that describe personality in terms of similar approach and avoidance systems (e.g., sensation seeking, Zuckerman, 1994; novelty seeking and harm avoidance, Cloninger, 1987; Cloninger et al., 1993; extraversion and neuroticism, Eysenck, 1967; behavioural activation [BAS] and inhibition system [BIS], Gray, 1970, 1991).

Character is the more sociocognitive component of learning related to the concept of *will* or the ability to inhibit instinctive responses. Jackson (2002) suggests character comprises two learning systems including responsibility and practicality. Responsibility is regarded as the defining aspect of mature character, and the development of responsible learning is seen to inhibit impulsivity. Individuals high in responsibility are said to direct learning experiences toward functional outcomes in both educational and professional contexts (Jackson, 2002). The central role of responsibility in Jackson's model is therefore akin to the conceptually important role of conscientiousness in the Big Five model of personality (Costa & McCrae, 1992) and self-directedness in Cloninger et al.'s model of personality (Cloninger et al., 1993). Practicality, the second aspect of character, is also thought to reflect sociocognitive as opposed to temperament processes. Unlike the other learning styles, however, practicality reflects experiential interest in learning as opposed to being a basis of learning. Practical-

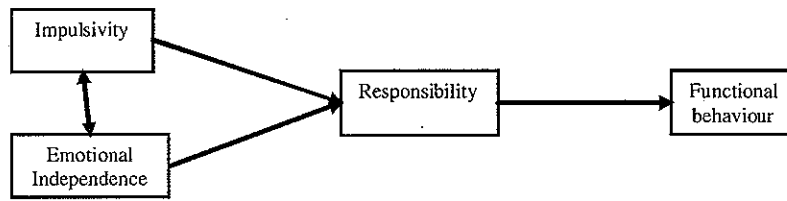


Figure 1. The proposed relationship between learning styles and functional behaviour.

ity should not, therefore, be linearly related to learning or generalized performance. A *practical* person is someone who tends to be expedient, functional and tends to engage in learning only when it serves a practical purpose (Jackson, 2002). Practicality is conceptually similar to the proposed learning styles from a number of other models, such as "active experimentation" (Kolb, 1976).

An important claim of Jackson's (2002) model is that the four learning styles are moderately interdependent. Specifically, dimensions of temperament are thought to influence the development of character dimensions. Jackson argues that impulsive individuals are *less* likely to develop mature levels of responsibility, whereas emotionally independent individuals are *more* likely to develop mature levels of responsibility and, thus, engage in functional behavior. Therefore, the model suggests that responsibility mediates the relationship between temperament and functional behaviour. In terms of workplace behaviour, Jackson's proposed association between temperament, character, and functional behaviour is illustrated in Figure 1.

The model also suggests that the two dimensions of temperament (impulsivity and emotional independence) are related. Accordingly, people high in emotional independence should be low in impulsivity, since self-control will tend to inhibit impulsivity. Indeed, most research on approach and avoidant temperament tends to find this negative correlation (e.g., Pelissolo & Lepine, 2000). Finally, the two dimensions of character should also be related, as their development is influenced by the same temperament and environmental antecedents. Based on these theoretical links between learning styles, it is expected that a factor model of Jackson's learning styles should be oblique.

Jackson's use of impulsivity as a biological basis for approach is similar to Zuckerman's use of sensation seeking and Gray's original use of impulsivity to represent BAS, and different to Eysenck's use of extraversion (see Smillie, Pickering, & Jackson, 2006), and different from all of these models in the use of responsibility as a mediator of biologically based approach tendencies. In fact, such a model provides an important new perspective concerning the possible construction of approach and reward mediated pathways which have yet to be fully explored.

The Learning Styles Profiler (LSP)

The LSP represents the measurement scales of Jackson's (2002) learning theory. It utilizes scales adapted from the

Eysenck Personality Profiler short version (EPP-S, Eysenck, Wilson, & Jackson, 1997) and develops the known overlap between personality and learning (see Jackson & Lawty-Jones, 1996; & Furnham, Jackson, Forde, & Cotter, 2001). The LSP is a multidimensional instrument that measures learning preferences on four scales which are termed impulsivity, emotional independence, responsibility and practicality. Example items from each of the scales are as follows: "Do you generally do and say things without stopping to think (impulsivity)?" "Do you often feel that you have little influence over the things that happen to you (emotional independence)?" "Can you always fully be relied upon (responsibility)?" "Do you like work that involves action rather than profound thought and study (practicality)?" Each scale has 20 items, answered as "yes," "no," or "can't decide." When scoring the LSP, "yes" is coded as "2" "no" is coded as "0," and "can't decide" is coded as "1." Some items are reverse scored.

According to the model, individuals who score highly on emotional independence and responsibility are likely to engage in functional behaviours, based on effective learning. Impulsive individuals, despite initiating more learning opportunities, are likely to become easily distracted and are therefore less likely to engage in functional behaviours. Individual differences in practicality are not thought to affect learning effectiveness, just preferred learning interest (i.e., practical vs. reflective). There have been no published studies assessing the predictive validity of the LSP.

The purpose of this study is to examine the latent structure of the LSP, test theoretical elements of this model, and demonstrate the criterion-related validity of this instrument. In Study 1, the structure of the LSP is examined with exploratory factor analysis, and then examined more thoroughly with a confirmatory factor analysis. Based on the theoretical relationships between Jackson's learning styles, it is hypothesized that scales of the LSP will fit optimally under an oblique structure. As yet, there have been no studies that assess the structure of the LSP using confirmatory factor analysis, despite this being the most appropriate technique for validating the latent structure of this kind of questionnaire (Mulaik, 1987). In Study 2, the criterion-related validity of the LSP is assessed in terms of workplace performance. It is hypothesized that subscales of the LSP, in particular responsibility, will be significant predictors of supervisor rated workplace performance. Specifically it is predicted that responsibility will mediate the relationship between temperament and supervisor rated workplace performance.

Study 1

Method

Participants and Procedure

Data from internet administrations of the Learning Styles Profiler were collected from 3,779 workers and students from many different organizations in the UK and Australia over a period of 2 years. The organizations represented a variety of different fields of interest including blue chip, training, insurance, private tertiary education, and public tertiary education. Participants were provided with the voluntary opportunity to complete the Learning Styles Profiler by these cooperating organizations so that the participants could obtain an electronic self-development report based on their test scores. No participants were internet surfers. The sample was 64% male and 36% female. The mean age was 31.2 years ($SD = 9.9$). As the online survey required all items to be completed prior to saving the data, there was no missing data. The complete sample of 3,779 workers was randomly divided into two subsamples (EFA, $n = 1,887$; CFA, $n = 1,892$).

Data Analysis

The latent structure of the LSP was assessed, first, through exploratory factor analysis, and second, through a confirmatory factor analysis. An exploratory factor analysis was required to establish the correct number of factors and assess the unidimensionality of factor loadings. Unidimensionality was considered to occur when items loaded *maximally*¹ onto their respective factor and cross-loadings were less than 0.2. The confirmatory factor analysis was conducted to confirm the hypothesized 4-factor solution. It should be noted that the CFA was not modified as a result of the EFA solution (see Mulaik, 2007, for the problems with modifying a CFA model based on an EFA solution).

Item parcels instead of raw items were used as indicators of respective factors in the CFA. Item parcels were used in this analysis for a number of reasons. First, item parcels simulate continuous, normally distributed variables more closely than do raw item scores derived from a 3-point rating scale (Little, Cunningham, Golan, & Widaman, 2002). Second, the formation of item parcels reduces the complexity of large measurement models and, thus, results in more stable parameter estimates (Hau & Marsh, 2004), and produces indicators with greater reliability (Rushton, Brainerd, & Pressley, 1983). Third, parcelling is likely to reduce impact of idiosyncratic items (Hau & Marsh, 2004). Furthermore, this procedure is in line with similar analyses of alternative learning styles instruments that also use parcelling (e.g., Sadler-Smith, 2001; Swailes & Senior, 1999).

We note that the use of parcels in this analysis does not allow us to assess item dimensionality. It does, however, allow us to test the hypothesized 4-factor orthogonal solution.

The single-factor (SFA; Mathieu & Farr, 1991) method was used to create item parcels. In this method, items on each scale are subjected to a factor analysis, whereby a single-factor solution is specified. Parcels are formed by combining items with the highest and lowest loadings, then combining items with the second-highest and second-lowest loadings, and continuing this process until all items have been assigned to a parcel². This parcelling strategy is designed to create composites that are empirically balanced measures of the construct (Mathieu & Farr, 1991) and, conceptually, should provide similar composites that reproduce the dimensionality of the initial construct (Landis, Beal, & Tesluk, 2000).

The indices used to assess model fit in all CFA's included the goodness of fit index (GFI), standardized root mean square residual (SRMR), comparative fit index (CFI), and the root mean square error of approximation (RMSEA).

Results

The means, standard deviations, correlations, and internal reliabilities of the four learning styles over the two samples are shown in Table 1. Scales have a minimum score of 0 and a maximum score of 40. As can be seen from the table, means are generally located in about the centre of each scale, and variance is similar over the four scales. Correlations between scales are small to moderate in magnitude.

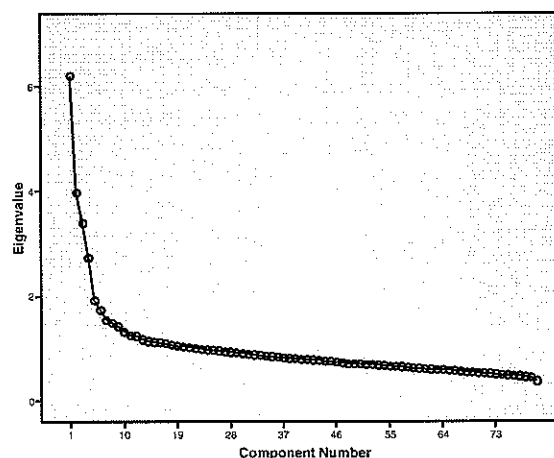


Figure 2. Scree plot indicating a possible 4-, 5-, or 6-factor solution.

¹ Maximally means that items loaded more on their intended factor, than on other factors.

² A variation of this technique was used, whereby four instead of two items were used for each parcel.

Table 1. Means, standard deviations and intercorrelations for the four LSP scales. Sample 2 statistics are summarized below Sample 1 statistics. Sample 2 α values refer to parcel reliability

	<i>M</i>	<i>SD</i>	α	Responsibility	Impulsivity	Emotional Independence
Responsibility	22.34	7.22	0.69			
	22.43	7.28	0.73			
Impulsivity	14.86	7.45	0.72	-0.30**		
	14.95	7.54	0.74	-0.30**		
Emotional Independence	28.62	7.42	0.76	0.37**	-0.13**	
	28.73	7.48	0.76	0.38**	-0.16**	
Practicality	17.02	7.68	0.74	0.09**	0.09**	0.13**
	16.70	7.80	0.74	0.10**	0.09**	0.13**

** $p < .01$, two-tailed.

Exploratory Factor Analysis

An exploratory common factor analysis was conducted to provide an initial assessment of the factor structure of the LSP. Theoretically, a 4-factor, oblique solution was expected, however, to ensure the 80 items were not clearly measuring more than four dimensions, the scree plot was inspected (see Figure 2). The scree plot revealed four clear factors, however it also suggested that a 5-factor or 6-factor solution was plausible. Therefore three oblique common factor analyses were conducted; the first specified a 4-factor solution, the second specified a 5-factor solution, and the third specified a 6-factor solution. The 4-factor solution

was supported as it provided the clearest simple structure, was consistent with underlying theory, and the majority of items loaded maximally onto their respective factors. The 5-factor and 6-factor solutions were much more ambiguous, and seemed to be caused by minor measurement artefacts (specifically, reverse scored items tended to load on the extra factors).

The pattern matrix was inspected to assess the magnitude of item loadings. In total, 87% of items loaded maximally onto their respective factor and 78% of items had cross loadings of less than 0.2 with other factors. 65% of items loaded onto their respective factor greater than 0.3, and 92% of items loaded onto their respective factor greater

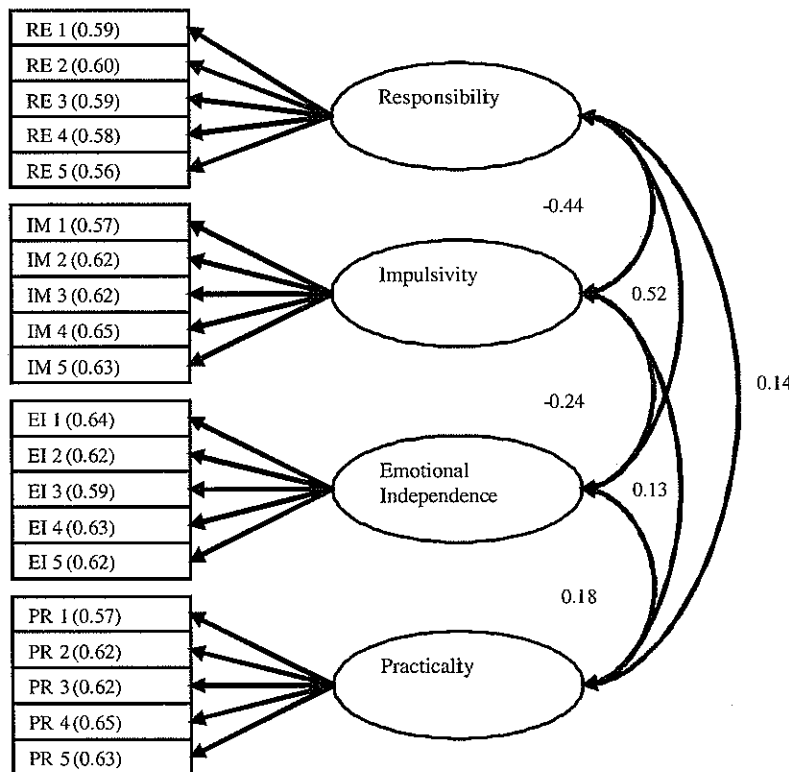


Figure 3. Factor structure of the LSP and standardized factor loadings. All parameter estimates are significant at $p < .01$.

than 0.2. No items were excluded from further analyses (see Figure 2).

Confirmatory Factor Analyses

A confirmatory factor analysis (using maximum likelihood estimation) was conducted on the hypothesized model of the LSP. The specific model, along with parameter estimates is illustrated in Figure 3. Overall, the model provided a good fit to the data. The SRMR and RMSEA were both less than 0.05 (SRMR = 0.04, RMSEA = 0.04) and the goodness of fit index (GFI) was 0.97. The comparative fit index (CFI) was 0.95. The χ^2 was not used to assess fit, as this statistic is problematic with large sample sizes (Kline, 1998; Tabachnick & Fidell, 2001). Overall, the fit indices indicated adequate fit. The significant correlations between learning styles are consistent with Jackson's (2002) claim that Responsibility, Emotional Independence, Impulsivity and Practicality are interrelated. We interpret these results as being supportive of the proposed factor structure of the LSP and therefore provide evidence that, in this sample, the LSP is a structurally sound tool for the measurement of individual differences associated with Jackson's model of learning.

Study 2

Method

Participants and Procedure

Participants were 69 part-time employees working across a large variety of different organizations. Participants self ratings of learning styles were paired with supervisor ratings of job performance, such that the data consisted of 69 pairs of supervisor-subordinate dyads. As all subordinates were from different organizations, all pairs of supervisor-subordinate ratings were pure dyads independent from one another such that no supervisor rated more than one subordinate.

Measures

A composite measure of job performance was used, which consisted of Johnson's (1998) six-item measure as well as Griffin, Neal, and Parker's (2001) Multi-Scale Work Performance Questionnaire (22 items). High scores on these scales indicate high levels of job and organizational performance. Job and organizational performance scales were completed by participants' supervisors. An example item is: "He/she has avoided mistakes and errors when completing core tasks." Items were responded to on a 5-point Likert-type scale assessing level of agreement with each item.

Results

The means, standard deviations, and correlations of the four learning styles in this sample are shown in Table 2. Correlations between learning styles and measures of job performance are also included in this table. This table indicates that responsibility, emotional independence, and impulsivity are significant bivariate predictors of job performance. Internal reliability for the composite measure of job performance was adequate ($\alpha = 0.93$).

Table 2. Means, standard deviations, and intercorrelations for the four LSP scales and supervisor rated Job Performance

	<i>M</i>	<i>SD</i>	Resp	Imp	EI	Prac
Responsibility	20.77	6.11	-			
Impulsivity	19.73	7.63	-0.48**	-		
Emotional independence	23.70	8.28	0.34**	-0.48**	-	
Practicality	17.99	6.49	-0.01	-0.02	-0.05	-
Job performance	150.81	24.32	0.37**	-0.26*	0.30*	0.06

* $p < .05$, two-tailed; ** $p < .01$, two-tailed.

To test the hypothesized association between dimensions of temperament (impulsivity and emotional independence), responsibility, and job performance, a mediated path analysis was conducted. In this analysis, responsibility was modelled as a mediator in the relationship between the two dimensions of temperament and job performance (see Figure 1). Both mediated pathways were tested for significance using the Monte Carlo (parametric bootstrapping) method (see Efron & Tibshirani, 1993; Preacher & Hayes, 2004). Direct effects between dimensions of temperament and job performance were also tested. In line with theory, it was found that responsibility was a significant, unique predictor of job performance (standardized direct effect = 0.29, $p < 0.05$). It was also found, using parametric bootstrapping, that impulsivity was significantly mediated by responsibility in the prediction of job performance (standardized indirect effect = -0.12, $p < .05$). However, as hypothesized, it was not a significant direct predictor of job performance (standardized direct effect = -0.04, $p = .79$).

A test of the second hypothesized pathway (again using parametric bootstrapping) revealed that emotional independence was not significantly mediated by responsibility in the prediction of job performance (standardized indirect effect = 0.04, $p = .26$). This nonsignificant finding was due to the moderate correlation between impulsivity and emotional independence ($r = -0.48$, $p < .05$). Indeed, removing impulsivity from the model resulted in a significant indirect effect between emotional independence and job performance (standardized indirect effect = 0.09, $p < .05$). Finally, as predicted, emotional independence was not a significant direct predictor of job performance when controlling for responsibility (standardized direct effect = 0.16, $p = .19$).

Discussion

The purpose of this contribution was to examine the latent structure of the LSP, and assess a model of the relationship between temperament, character and job performance. In Study 1, an EFA was conducted to assess the correct number of factors and establish that most items were unidimensional. In this study, a CFA was also conducted to confirm the hypothesized 4-factor solution. Results from both of these analyses revealed that the LSP was a sound measure of Jackson's four proposed learning styles.

The purpose of Study 2 was to assess the predictive validity of the LSP and also test an important theoretical element of Jackson's model. Specifically, it was hypothesized that responsibility (a character dimension) would mediate the two dimensions of temperament (impulsivity and emotional independence) in the prediction of job performance. It was found that three of the four learning styles were significantly correlated with job performance, and that, consistent with theory, responsibility was a significant mediator of impulsivity in the prediction of performance. Impulsivity was not a unique significant mediator of emotional independence in the prediction of performance; however, this was due to the large correlation between impulsivity and emotional independence. When impulsivity was removed from the model (illustrated in Figure 1), emotional independence was a significant indirect predictor of job performance.

While our results provide support for several features of Jackson's (2002) model, we note that further research is required to validate aspects of the model. First, Jackson claims that scales from the LSP (impulsivity and emotional independence) are associated with neuropsychological mechanisms, yet there is no empirical research which directly supports these proposed relationships. Second, although Study 2 focussed on the criterion-related validity of learning styles in terms of job performance, it did not focus on the construct validity of the LSP in terms of learning. We therefore suggest that future studies focus on the relationship between Jackson's scales and neuropsychological mechanisms, and also assess whether these scales are associated with performance on learning tasks.

A key element of Jackson's model is that learning styles can be differentiated into temperament and character, and that aspects of character are mediators of temperament. Theoretically, character styles are the product of both environmental and biological influences, and thus have the capacity to be developed. According to Jackson (2002), in applied settings (such as the workplace) training should focus primarily on developing individuals' *responsibility*, as this will theoretically allow them to control their impulsivity and engage in more functional behaviours. Research could further focus on this fascinating aspect of the model, by testing whether character styles are indeed more *trainable* than temperament styles.

To conclude, we believe that the LSP represents a useful

tool for the measurement of learning styles based on Jackson's model of learning. This study has demonstrated that the LSP has good predictive validity, with three of the four learning styles significantly correlated with job performance as rated by supervisors. This study has also found support for a key theoretical element of Jackson's (2002) model; responsibility mediates impulsivity in the prediction of job performance. Given the widespread application of learning styles in training, selection, and assessment, practitioners would benefit from using the LSP, as it represents a theoretically and empirically sound measure of learning styles. From a psychometric point of view, the LSP represents a good first step in the development of psychological tests for use by organizational psychologists that have a basis in neuropsychological theory as opposed to other models of learning and personality which neglect such distinctions.

Authors' Note

The Learning Styles Profiler can be obtained from the second author.

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