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## The Index of Learning Styles: An Investigation of its Reliability and Concurrent Validity with the Preference Test

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**ABSTRACT** - The Index of Learning Styles (ILS) is a widely used instrument for assessing student learning styles. To examine its reliability and validity, the ILS and the Preference Test (PT), a hemispheric cognitive style instrument, were administered to 131 educational psychology students. Reliability analysis found the Sequential – Global scale of the ILS to have unacceptably low reliability. In addition, the Sequential – Global scale did not correlate with the PT, which measures a similar construct. Factor analysis of the ILS suggests a two-factor structure. This research raises questions about the validity of the ILS constructs and argues that widespread classroom use of the ILS cannot be justified at this time.

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Many models of learning styles share the assumption that a better knowledge of students' learning differences could help improve instruction, both through modifications in teaching and improved student self knowledge. Although this approach has strong intuitive appeal results have been mixed (e.g. Lawson & Johnson, 2002, Ford & Chen, 2001, Doyle, Radzicki, Rose, & Trees, 1997). One study by Ford and Chen (2001) is particularly intriguing because the authors were able to devise an experimental test of matching or mismatching instruction to a Depth-first/Breadth-first learning style dimension. They found better performance when instruction was matched to student cognitive style. On the other hand, Lawson and Johnson (2002) tested the relationship between student performance under different instructional treatments and the students' designation on the Kolb Thinking – Feeling learning style dimension. They found that students identified as thinkers always outperformed those identified as feelers in all treatments. Unfortunately, much of the work on learning styles lacks theoretical clarity and adequate measurement instruments, a point made forcefully by Curry (1990).

The Index of Learning Styles (ILS) is a popular instrument for assessing student learning styles. It is available for free on the Internet (Solomon & Felder, 2002). According to Felder (2002) although the ILS was originally created for application in engineering education it has become more widely used. The ILS has been translated to into at least 6 languages and its web site receives about 100,000 hits every year. The ILS was created by Felder and Silverman (1988) using a model that "classifies students according to where they fit on a number of scales pertaining to the ways they receive and process information" (p.674). The ILS classifies students along four dimensions Sensing

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- Intuitive, Visual - Verbal, Active - Reflective, and Sequential - Global. An earlier version of the ILS included an Inductive - Deductive dimension, which has been abandoned in the most recent version (Felder, 2002).

According to Felder (2002) the ILS has not been validated and one study (Van Zwaneberg, Wilkinson, & Anderson, 2000) found the ILS had low internal reliability. The purpose of this study is to test the reliability of the ILS and its concurrent validity with the Preference Test. It is hoped that critical analysis of existing models of learning and cognitive styles will contribute to greater theoretical and methodological clarity.

In order to test the validity of the ILS the Preference Test (PT) was chosen as the concurrent criterion. The PT is a 20-item instrument created by Zenhausern (1978) that measures respondents on a Left - Right hemispheric cognitive style dimension. Research has found the PT to have acceptable psychometric properties (Merckelbach, Muris, Pool, DeJong, & Schouten, 1996,) and to correlate with biophysical measures of hemisphericity (Russo, Persegani, Torlini, Papeschi, & Trimarchi, 2001). Zenhausern's (1978) description of right and left hemispheric style is similar to Felder's and Silverman's (1988) description of the Global - Sequential learning style.

Hemispheric models of cognitive style usually posit a "Left hemispheric" style that is both analytic and verbal, and a "Right hemispheric" style that is holist and visual (Vernon, 1984, Zenhausern, 1978). This grouping of cognitive styles is controversial and is specifically rejected by Riding and Rayner (1998) who have argued for the existence of two orthogonal dimensions of cognitive style; the Holist - Analytic dimension and the Visual - Verbal dimension. On the other hand, Silverman (2002), a co-author of the ILS, has recently endorsed the idea of two basic types of learners, Visual-spatial and Auditory-sequential, which she identifies with right and left hemispheric functioning respectively. This dichotomous typology seems at odds with the model implicit in the ILS. Thus, beyond the issue of the reliability of the ILS this study hopes to investigate the following questions:

1. What are the intercorrelations between scales on the ILS? Van Zwaneberg, et al., (2000) found a significant correlation between the sequential - global dimension and sensing - intuitive dimension ( $r = .41, p < .0001$ ). Based on Silverman's (2002) claim that learners can be classified as Visual-spatial or Auditory-sequential it is hypothesized that there should be a correlation between the Visual - Verbal scale and the Sequential - Global scale of the ILS.

2. Are there any significant correlations between ILS scales and the Right - Left hemispheric preference as measured on the PT? A reasonable hypothesis is that there should be a strong correlation between the sequential - global ILS dimension and the Right - Left preference on the PT.

## Method

### *Participants*

One hundred thirty one educational psychology students (95 females, 36 males) completed the ILS and the PT. Their mean age was 27.9 years ( $SD = 8.5$ , range 19 - 58). The sample included both preservice and inservice teachers attending classes at a large Midwestern open admissions university. Ethnic composition of the sample was Asian 1.5%, Black 13.1%, Hispanic 3.8%, White 78.5%, and other 3.1%.

### *Measures*

*The Index of Learning Styles (ILS).* The ILS is a 44 item forced choice instrument that classifies students along four dimensions Sensing - Intuitive, Visual - Verbal, Active - Reflective, and Sequential - Global (Solomon & Felder, 2002). The ILS has not been

validated (Felder, 2002) and one study (Van Zwaneberg, et al., 2000) found the ILS had low internal reliability.

*The Preference Test (PT)*. The PT is a 20-item instrument created by Zenhausen (1978) that measures respondents on a Left - Right hemispheric cognitive style dimension. Research has found the PT has acceptable reliability (Merckelbach, et al., 1996,) and correlates with biophysical measures of hemisphericity (Russo, et al., 2001).

### Analysis

Data analysis was performed using SPSS (1999). Following the procedure used by Merckelbach et al. (1996) the internal consistency reliability for the right and left items of the PT were assessed separately. For the correlational analysis the PT difference scores (Right - Left) were employed.

## Results

Table 1 displays the descriptive statistics for the ILS. The sample was slightly more active than reflective, more sensing than intuiting, more visual than verbal, and more sequential than global.

**Table 1**  
*ILS and PT Scores: Descriptive Statistics*

	Mean	SD
Active - Reflective	0.74	2.38
Sensing - Intuitive	2.59	2.73
Visual - Verbal	2.48	2.54
Sequential - Global	1.53	2.15
Right - Left (PT)	0.89	13.91

**Table 2**  
*Internal Reliability of the ILS and PT scales*

	$\alpha$	Classification by DeVellis (1991) Criteria
Active - Reflective	.63	Undesirable
Sensing - Intuitive	.72	Respectable
Visual - Verbal	.71	Respectable
Sequential - Global	.53	Unacceptable
Left (PT)	.68	Minimally acceptable
Right (PT)	.58	Unacceptable

Reliability coefficients (Cronbach's  $\alpha$ ) for the 4 scale scores of the ILS and two scale scores of the PT are shown in Table 2. Reliability for the ILS scales are all higher than those found by Van Zwanenberg et al. (2000), although the rank order is the same (Sensing - Intuitive > Visual - Verbal > Active - Reflective > Sequential - Global). Using a minimum standard of  $\alpha = .80$ , Van Zwanenberg et al. found all the ILS scales to have unacceptably low reliability. If Van Zwanenberg and colleagues had used the more generous criteria suggested by DeVellis (1991) the Sensing - Intuitive scale would have been classified as having undesirable reliability, while the remaining 3 scales would have been classified as having unacceptable reliability. This study found that two of the ILS scales had a DeVellis classification of respectable reliability, the Sensing - Intuitive ( $\alpha = .72$ ) and the Visual - Verbal ( $\alpha = .71$ ). The Active - Reflective ( $\alpha = .63$ ) scale had undesirable reliability and the Sequential - Global ( $\alpha = .53$ ) had unacceptable reliability.

Dropping items with low or negative correlations to item totals would not have changed the DeVellis classification of any of the scales.

The reliabilities of the PT scales were found to be lower than reported in other research (Merckelbach et al., 1996). Using the DeVellis (1991) criteria the Left Hemisphere scale ( $\alpha = .68$ ) would be labeled minimally acceptable and the Right Hemisphere scale ( $\alpha = .58$ ) would be labeled unacceptable. Dropping items would raise the reliability of the two PT scales but some writers have raised questions about the advisability of such a procedure because it may result in an overestimation of reliability (Kopalle & Lehmann, 1997) and it was not pursued in this study.

The correlations between scale scores are shown in Table 3. This study confirms the finding of Van Zwanenberg, et al. (2000) of a significant correlation between Sensing – Intuitive and Sequential – Global scales of the ILS ( $r = .37, p < .05$ ). However, while Van Zwanenberg, et al. found no other significant intercorrelations between ILS scales, this research found a significant correlation between the Active – Reflective Scale and the Visual – Verbal scale ( $r = .21, p < .05$ ).

**Table 3**  
*Correlations between ILS and PT scale scores (n = 131)*

Scale	1	2	3	4	5
1. Active - Reflective	-	.02	.21*	.04	.27*
2. Sensing - Intuitive		-	-.03	.37*	-.28**
3. Visual - Verbal			-	.02	.37**
4. Sequential - Global				-	-.08
5. Right - Left (PT)					-

\* $p < .05$ . \*\* $p < .01$

**Table 4**  
*Factor Loadings for Varimax Orthogonal Two-Factor Solution*

	Factor Loadings		Communalities
	1	2	
Active - Reflective	.67		.46
Sensing - Intuitive		.83	.70
Visual - Verbal	.74		.55
Sequential - Global		.79	.63
Right - Left (PT)	.75		.66
% Of total variance explained	33.30	27.05	

Three of the ILS scales are significantly correlated with PT; Active – Reflective ( $r = .27, p < .05$ ), Sensing – Intuitive ( $r = -.28, p < .01$ ), and Visual – Verbal ( $r = .37, p < .01$ ). The Sequential – Global scale of ILS was virtually uncorrelated with the PT ( $r = -.08, p = .357$ ).

Exploratory factor analysis (Table 4) was conducted using a varimax rotation and two factors, explaining 60.34% of the variance, were extracted. The PT and two ILS scales (Active – Reflective and Visual – Verbal) loaded on the first factor. The Sensing – Intuitive and the Sequential – Global scales of the ILS loaded on the second factor.

Using the convention of labeling a factor by its largest loading, we can see an underlying factor structure with a hemispheric factor and a Sensing – Intuitive factor. This result is interesting because the hemispheric dimension is usually thought of as a cognitive style, while Sensing – Intuitive dimension is often thought of as a personality style.

## Discussion

As noted, ILS co-developer Silverman (2002) has recently endorsed the idea "that there are two basic learning styles" (p. 56), the Auditory – Sequential and the Visual – Spatial. Although not acknowledged, this view seems at variance with the constructs that undergird the ILS. Because the ILS has 4 bipolar scales that categorize respondents into types, this instrument implicitly assumes the existence of 16 possible learning styles. Two of the ILS scales (the Sequential – Global and the Visual – Verbal) do, however, seem relevant to Silverman's new model. This study hypothesizes that if the ILS scales are valid measurements of the associated constructs and if Silverman's new dichotomous model of learning styles is correct, then there should be a significant correlation between the Sequential – Global and the Visual Verbal scales of the ILS.

The results here are clearly negative; these scales show a non-significant correlation of .02. These results suggest that the Sequential – Global and the Visual – Verbal scales are orthogonal and it must be decided if the fault lies with the instrument, the constructs, or both. This study suggests that there are good reasons to question the usefulness of the ILS Sequential and Global scale. First because of its low internal reliability and, second, because of its low correlation ( $r = -.08$ ) with the PT, a measure of a similar construct. Thus the Sequential – Global scale of the ILS can be said to lack concurrent validity with the PT.

The Visual – Verbal scale of the ILS does correlate at a reasonable level with the PT ( $r = .37, p < .01$ ) and Silverman (2002) sees her model as being related to hemispheric models of cognitive style. The two remaining scales of the ILS (Active – Reflective and Sensing – Intuitive) also correlate with the PT.

Until additional research is conducted with larger and more representative samples users of the ILS should be cautioned about the low reliability of the Sequential – Global scale and that scale's lack of concurrent validity with the PT. In addition, better evidence is needed for the construct validity of the remaining three scales before application in the classroom could be justified.

Like many learning style instruments the ILS groups together constructs that cannot properly be considered learning styles (for useful discussions of learning style taxonomy see Riding & Rayner, 1999). For example, the Sensing - Intuitive dimension in the ILS is clearly drawn from the Myers Briggs/Jungian typology (Myers & Myers, 1995) and is usually considered a personality dimension. The factor analysis suggests that the ILS may have a two-factor structure, one a Hemispheric cognitive style factor and the other a Sensing – Intuitive personality factor.

This is not to say that the dimensions identified in the ILS are irrelevant to instruction, but the failure to make appropriate distinctions is indicative of the theoretical confusion that plagues many of the models of learning styles.

It is important to acknowledge certain limitations of this study. Because the respondents were students at a college of education, the sample may not be representative of all students and generalizability of the findings may be limited. In addition only one criterion measure, the PT, was used. It would be important in future research to compare the ILS to other learning and cognitive style measures. Until such research is conducted the results reported here must be considered preliminary.

The potential benefits of modifying instruction to student learning differences are too valuable to ignore. Future research will need to continue to evaluate the validity of existing learning and cognitive style constructs and the reliability and validity of the instruments used to assess those constructs. There is a tremendous need for theoretical clarity and empirical verification.

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**References**

- Curry, L. (1990). *Learning styles in secondary schools: A review of instruments and implications for their use*. Ottawa: Curry Adams and Associates, Inc.
- DeVellis, R. F. (1991). *Scale development: Theory and application*. Newbury Park, CA: Sage Publications
- Doyle, J. K., Radzicki, M. J., Rose, A., & Trees, W. S. (1997). Using cognitive style typology to explain individual differences in dynamic decision making: Much ado about nothing. *Center for the Quality of Management Journal*, 6, 5 – 15.
- Felder, R. M. (2002). Author's preface – June 2002. Retrieved January 7, 2003 from <http://www2.ncsu.edu:8010/unity/lockers/users/f/felder/public/Papers/LS-1988.pdf>
- Felder, R. M. & Silverman, I. K. (1988). Learning styles and teaching styles in engineering education. *Engineering Education*, 78, 674 – 681.
- Ford, N. and Chen, S. Y. (2001). Matching/mismatching revisited: An empirical study of learning and teaching styles. *British Journal of Educational Technology*, 32, 5 – 22.
- Kopalle, P. K. & Lehman, D. R. (1997). Alpha inflation? The impact of eliminating scale items on Cronbach's alpha. *Organizational Behavior and Human Decision Processes*, 70, 189 – 197.
- Lawson, A. E. & Johnson, M. (2002). The validity of Kolb learning styles and neo-Piagetian developmental levels in college biology. *Studies in Higher Education*, 27, 79 – 90.
- Merckelbach, H., Muris, P., Pool, K. De Jong, P. J., & Schouten, E. (1996). Reliability and validity of a paper-and-pencil test measuring hemispheric preference. *European Journal of Personality*, 10, 221-231.
- Myers, I. B. & Myers, P. B. (1995). *Gifts differing: Understanding personality type*. Palo Alto, CA: Davies-Black Publishing.
- Riding, R. & Rayner, S. (1999). *Cognitive styles and learning strategies*. London: David Fulton Publishers Ltd.
- Russo, P., Persegani, C., Torlini, M., Papeschi, L. L., & Trimarchi, M. (2001). Sex differences in EEG correlates of a self-report measure of hemisphere preference. *International Journal of Neuroscience*, 106, 109 – 121.
- Silverman, L. K. (2002). *Upside-down brilliance: The visual-spatial learner*. Denver, CO: Deleon Publishing.
- Solomon, B. A., & Felder, R. M. (2002). *Index of Learning Styles*, Retrieved January 7, 2003 from <http://www.ncsu.edu/felder-public/ILSpage.html>.
- SPSS Inc. (1999). *SPSS Base 11.0 for Windows User's Guide*. SPSS Inc., Chicago IL
- Van Zwaneberg, N., Wilkinson, L. J., & Anderson, A. (2000). Felder and Silverman's Index of Learning Styles and Honey and Mumford's Learning Styles Questionnaire: How do they compare and do they predict academic performance? *Educational Psychology*, 20, 365 – 380.
- Vernon, P. E. (1984). Intelligence, cognitive styles, and brain lateralization. (pp. 135 – 155). In P. S. Fry (Ed.). *Changing conceptions of intelligence and intellectual functioning: Current theory and research*. Amsterdam: North Holland.
- Zenhausen, R. (1978). Imagery, cerebral dominance, and style of thinking: A unified field model. *Bulletin of the Psychonomic Society*, 12, 381 – 384.