
Research Notes

Learning Styles and End-User Training: An Unwarranted Leap of Faith

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In a recent article in *MIS Quarterly*, Bostrom, et al. (1990) report that, "A consistent pattern of findings emerges that indicates that learning modes is an important predictor of learning performance, both by itself and in interaction with training methods. The findings suggest that in the design of training, it is essential to match training methods to individual difference variables" (p. 101). We do not agree that Bostrom, et al.'s results represent a consistent pattern of findings. Moreover, the results of this research should be discounted because the measures of learning styles were derived from an instrument with very poor psychometric properties. Thus, the conclusion that learning styles are important factors in end-user training (EUT) is unsupported at the present time.

This note addresses two major concerns with the Bostrom, et al. studies: (1) the consistency of the findings, and (2) the psychometric limitations of the KLSI-1976 (Kolb, 1976) used to measure learning styles. Nothing in this review should be taken as criticism of the basic research model for

EUT presented in the Bostrom, et al. article. Indeed, the research model for EUT provides useful suggestions for future research. However, future research should be mindful of the problems associated with the use of instruments lacking sound psychometric properties. In this case, the contribution of the Bostrom, et al. research is questionable due to measurement problems with the KLSI-1976. The need for validating instruments used in MIS research has been noted by Straub (1989), who indicates that the validation of instruments is tied to concerns about rigor in MIS methodology. This rigor contributes to greater clarity in addressing and interpreting MIS research. As noted in the *MISQ* Executive Overview accompanying the Straub article, to have confidence in MIS research, readers must be assured that the instruments used are valid. The information and knowledge base in MIS and EUT should not be built on data fraught with measurement error.

Consistency of Findings in Bostrom, et al. Studies

Bostrom, et al. (1990) hypothesized main effects of learning styles in EUT, as well as an interaction of learning styles and training methods. Four studies were reported, which provided 20 tests for main effects and 20 tests for interaction effects. Using an alpha level of .10, only seven of the 40 tests indicated statistically significant differences. These results do not indicate a consistent pattern of significant differences. Moreover, five of the significant results involved main effects that do not involve the need to match training methods with individual difference variables. To consider the matching of training method with individual differences, the interaction effects must be examined. Of 20 tests for interactions, only two effects reached the .10 level of significance. Of these two effects, only one indicated results in the direction predicted. Thus, the data do not support the conclusion that it is essential to match training methods with individual learning styles. While many factors may explain the lack of significant findings (some factors were identified by Bostrom, et al.), a major problem with their research stems from the use of the KLSI-1976.

Psychometric Limitations of KLSI-1976

Although Bostrom, et al. (1990) acknowledge that the KLSI-1976 had been criticized for questionable psychometric properties, they also assert that its usefulness is generally accepted. However, the criticism of the KLSI-1976 is far more extensive than reported by Bostrom, et al. and indicates that the KLSI-1976 does not enjoy a general acceptance of its reliability or validity (see recent reviews by Atkinson, 1991, and Ruble and Stout, 1992).

Reliability of the KLSI-1976

The first test of instrument reliability should be measures of the internal consistency of items comprising a scale (Nunnally, 1978). Internal consistency can be assessed by coefficient alpha or the split-half method. Coefficient alpha is recommended due to serious problems with the split-half approach (Nunnally, 1978; Pedhazur and Schmelkin, 1991). Many studies have reported low alpha coefficients for the KLSI-1976 (e.g., Freedman and Stumpf, 1978; Merritt and Marshall, 1984; Sims, et al., 1986; Stout and Ruble, 1991).

Although Bostrom, et al. note the low internal consistency of the separate scales of the KLSI-1976, they argue that the instrument is appropriate for their research because they were using dimension scores (combinations of the separate scales). To support this argument, Bostrom, et al. cite data reported in a review of the KLSI-1976 (Sewall, 1986). However, the studies reviewed by Sewall are based on the seriously flawed split-half approach or include estimates of coefficient alpha for the dimension scores. The split-half coefficients should be disregarded due to psychometric limitations. Further, estimates of coefficient alpha for the dimension scores violate basic measurement assumptions. Because the KLSI-1976 uses ipsative scales (a ranking format), the individual items are not independent measures (cf. Nunnally, 1978; Pedhazur and Schmelkin, 1991). Since the ipsative format of the KLSI-1976 leads to upwardly biased estimates of coefficient alpha for the dimension scores, these estimates should not be used to justify the use of the KLSI-1976. Reliability also can be assessed by test-retest correlations. A number of studies indicate low test-retest

reliability of the KLSI-1976 (cf. Atkinson, 1991). For example, Freedman and Stumpf (1978) report a median test-retest reliability of approximately .50 on the four scales and two dimension scores over a five-week interval. Sims, et al. (1986) find similar results. A test-retest correlation of .50 indicates that the variance shared between the two tests is only 25 percent.

Bostrom, et al. note that the "KLSI is expected to give unstable outcomes for an individual across learning contexts, but is stable within a specific context" (p. 109). However, in the studies cited above, the basic context remains stable. An instrument with low internal consistency on one administration is unlikely to be consistent across two administrations. The KLSI-1976 simply includes too much measurement error.

Validity of the KLSI-1976

Construct validity of the KLSI-1976 has been assessed through factor analysis. Numerous studies indicate a low proportion of explained variance for the KLSI-1976 and a lack of support for the two dimensions of the model (cf. Ruble and Stout, 1992). Predictive validity of the KLSI-1976 has been assessed by correlating the instrument with factors that are expected to covary with learning styles. Freedman and Stumpf (1978) were unable to classify the learning styles of graduate students based on such factors as undergraduate major or professional experience. Hunsaker (1984) concludes that there is little or no correlation between the KLSI-1976 and those factors that are supposed to covary with it. Atkinson (1991) reaches similar conclusions.

Summary evaluation of KLSI-1976

The available research raises serious questions regarding the use of the KLSI-1976 for purposes of research and designing EUT. A number of independent researchers using diverse samples obtained evidence that questions both the reliability and validity of the instrument. Freedman and Stumpf (1980) conclude that the KLSI is not valid and that its use in making normative judgments about educational practices should be suspended. Hunsaker (1984) concludes that the KLSI does not demonstrate sufficient reliability to provide predictive ability. According to Sewall

(1986), the validity of the KLSI-1976 had not been confirmed, and he recommends that the use of the KLSI in any setting be suspended pending further careful study. Finally, Atkinson (1991) concludes that the KLSI seems psychometrically deficient in several areas.

We believe that a critical review of the empirical evidence clearly indicates that the KLSI-1976 does not enjoy a general acceptance of its usefulness, particularly for research purposes. The use of the KLSI-1976 in the Bostrom, et al. studies raises serious questions regarding any results obtained.

Conclusions and Recommendations for IS Researchers and Practitioners

We believe that the results of Bostrom, et al. (1990) do not represent a consistent pattern of findings, particularly with respect to the interaction effects. Thus, their recommendations for matching EUT methods with learning styles are unwarranted at this time. We do need further research using instruments with improved reliability and validity. As noted by Straub (1989), researchers and practitioners need to pay greater attention to the validation of instruments used in MIS research. Published research should report basic psychometric statistics, such as coefficient alpha, of the instruments used for the specific sample investigated. Regarding the role of the KLSI in future MIS research, a cautionary note is appropriate. In response to extensive criticism, the KLSI-1976 has been revised (Kolb, 1985). While the revised version, the KLSI-1985, appears to be an improvement in some areas, unfortunately many of the psychometric limitations of the earlier version have remained (cf. Atkinson, 1991). Thus, even the KLSI-1985 needs further revision. Another instrument, the LSQ-E, has been developed by Marshall and Merritt (1986) to avoid problems with ipsative measures and appears to have improved psychometric properties compared to the KLSI. However, further research is needed to validate the LSQ-E. Given the current state of measurement, researchers and practitioners should be wary of any recommendations on how to design EUT to fit an individual's learning style.

References

- Atkinson, G., Jr. "Kolb's Learning Style Inventory: A Practitioner's Perspective," *Measurement and Evaluation in Counseling and Development* (23:1), January 1991, pp. 149-161.
- Bostrom, R.P., Olfman, L., and Sein, M.K. "The Importance of Learning Style in End-User Training," *MIS Quarterly* (14:1), March 1990, pp. 101-119.
- Freedman, R.D. and Stumpf, S.A. "What Can One Learn from the Learning Style Inventory?" *Academy of Management Journal* (21:2), June 1978, pp. 275-282.
- Freedman, R.D. and Stumpf, S.A. "Learning Style Inventory: Less Than Meets the Eye," *Academy of Management Review* (5:3), July 1980, pp. 445-447.
- Hunsaker, J.S. "The Experiential Model and the Learning Style Inventory: An Assessment of Current Findings," *Journal of Experiential Learning and Simulation* (2), 1984, pp. 145-152.
- Kolb, D.A. *Learning Style Inventory: Technical Manual*, McBer and Company, Boston, MA, 1976.
- Kolb, D.A. *Learning Style Inventory: Technical Manual*, McBer and Company, Boston, MA, 1985.
- Marshall, J.C. and Merritt, S.L. "Reliability and Construct Validity of the Learning Style Questionnaire," *Educational and Psychological Measurement* (46), 1986, pp. 257-262.
- Merritt, S.L. and Marshall, J.C. "Reliability and Construct Validity of Ipsative and Normative Forms of the Learning Style Inventory," *Educational and Psychological Measurement* (44), 1984, pp. 463-472.
- Nunnally, J.C. *Psychometric Theory*, McGraw-Hill Book Company, New York, NY, 1978.
- Pedhazur, B.J. and Schmelkin, L.P. *Measurement, Design, and Analysis*, Lawrence Erlbaum Associates, Hillsdale, NJ, 1991.
- Ruble, T.L. and Stout, D.E. *A Critical Assessment of Kolb's Learning Style Inventory*, working paper, Rider College, Lawrenceville, NJ, 1992.
- Sewall, T.J. *The Measurement of Learning Style: A Critique of Four Assessment Tools*, University of Wisconsin-Green Bay, Green Bay, WI, ERIC Document Reproduction Service No. ED 267 247, 1986.
- Sims, R.R., Veres, J.G., Watson, P., and Buckner, K.E. "The Reliability and Classifica-

- tion Stability of the Learning Style Inventory," *Educational and Psychological Measurement* (46), Autumn 1986, pp. 753-760.
- Stout, D.E. and Ruble, T.L. "The Learning Style Inventory and Accounting Education Research: A Cautionary View and Suggestions for Future Research," *Issues in Accounting Education* (6:1), Spring 1991, pp. 45-57.
- Straub, D.W. "Validating Instruments in MIS Research," *MIS Quarterly* (13:2), June 1989, pp. 147-169.