

Learning Styles and End-User Training: A First Step

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Ruble and Stout disagree with the conclusions of Bostrom, et al. (1990) because they believe our findings are inconsistent and that these inconsistent findings are the result of the psychometric limitations of the Kolb Learning Style Inventory (KLSI-1976). They state that "the conclusion that learning styles are important factors in end-user training (EUT) is unsupported at the present

time." We believe that Ruble and Stout have valid arguments concerning the psychometric properties of KLSI-1976, but in our opinion, the greater issue goes beyond a debate about the merits of KLSI.

In this note, we argue that: (1) research on important issues cannot be (and is not, in practice) suspended until highly valid instruments are constructed, and (2) that imperfections in the KLSI-1976 did not significantly affect the operationalization of learning styles in our studies, and, thus, our findings are credible.

Instrument Validation

It is correct to question the findings of a study. The advancement of knowledge depends on critical examination of published and unpublished research. It is certainly correct to criticize an instrument such as KLSI-1976 for its poor psychometric properties. We questioned the instrument ourselves and pointed out our concerns in the article. But that is just half of the story. In order to say "no" to one instrument, an alternative must exist. At the time of our studies, we found KLSI-1976 to be the best available alternative.

Because the KLSI-1976 had questionable validity, we used it in a way that led to the most valid results. On the basis of the available research literature, we used the difference scales (a combination of the opposite learning modes) because they had consistently exhibited higher reliability (overall average of .78). Ruble and Stout argue that the reliability estimates for the difference scores are biased and should not be used to justify the use of the instrument, and they suggest focusing on test-retest reliabilities for the difference scores. But, there is a potential problem here also.

Many of the studies that use KLSI-1976 focus on university-style classroom learning. Our concern was with short, one-shot organizational training sessions. In the former, there is time for changing learning styles over several months of instruction. In the latter, there is little likelihood of change in a one-day (or less) time frame. In software training, the issue of test-retest reliability is moot. Learning style does not have to be stable; it only has to provide a reference point for the trainer. The more critical issue is the accuracy of the one-time measurement.

Ruble and Stout point out that the learning style instruments available today—KLSI-1985 (Marshall and Merritt, 1986) and LSQ-E (Kolb, 1985)—are still inadequate from a validation perspective. Obviously, the available learning style instruments require additional validation research. But important research cannot always wait for the perfect measure. This was our approach when we chose to use the KLSI-1976 in our studies.

Thus, we still recommend moving ahead on research in this area using the best available instrument. This is common practice in the social sciences. For example, several articles have criticized the validity of the Job Diagnostic Survey (JDS) (see Sein and Bostrom, 1991, for a review). Yet the constant stream of papers in the organizational psychology and organizational design literature using the JDS has neither suggested suspension of the JDS nor, more importantly, suspension of research on job redesign. Authors have, of course, examined ways of refining JDS and have offered alternatives to the JDS to study job redesign. It is in this spirit of re-examination that we welcome Ruble and Stout's comments.

Operationalization of Learning Style

While Ruble and Stout raise some legitimate concerns about KLSI-1976, they miss key implications of our article. Our contribution to the body of knowledge on end-user training was that we examined a specific variable—learning style (*not* KLSI-1976 itself)—based on a model with sound theoretical underpinnings. The paradigm of experimental research, at least in the strong inference mode (Platt, 1964), focuses on testing such models.

It is erroneous to suggest that the findings do not represent a pattern in the predicted direction. On the contrary, *all* observed differences are consistent with predictions. A careful reading of our paper clearly shows that there is a pattern (although it is true not all effects are statistically significant).

Certainly, reported results vary in terms of level of support, but they are the strongest where internal validity is high. Study 3 has the largest

sample size and was conducted in a controlled laboratory setting. Thus, with higher internal validity than the other studies, it has statistically significant p-values in four of six ANOVA tests. The other studies were conducted in the context of providing "real" training sessions, so experimental controls were enforced to the extent possible. It is perhaps for this reason that for these studies our results are not as strong as in Study 3. It is up to future researchers to replicate this work to determine whether the consistent pattern observed is a mere artifact of particular experimental settings or whether there is an underlying phenomenon at work.

Of course, we would have liked to obtain statistically significant results across the board. Yet the finding that all the results, significant or not, are in the predicted direction gives evidence in favor of our operationalization of learning style (see Hunter, et al., 1982, for a discussion of interpretation of a pattern of mixed findings). One can make a case, echoing Ruble and Stout, that our findings are based on a flawed instrument. Because of this potential instrumentation threat, the possibility exists for a methods bias. However, we can rule out methods bias because the dependent measures were gathered using entirely different methodologies from other study variables, including learning style. Consistent results in the predicted direction across studies exhibit nomological validity (Bagozzi, 1980; Cronbach, 1971). We can infer that whatever imperfections there may be in the KLSI in general, such imperfections did not significantly affect the operationalizations of learning styles in our studies.¹ Thus, we can conclude our findings are credible.

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¹ We thank one of the reviewers for suggesting this point.

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