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Kathleen M. Kirby Ed.D.
University of Louisville

Patricia K. Leitsch Ph.D.
University of Louisville

Timothy L. Kennedy M.A.

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Kathleen M. Kirby*

Patricia K. Leitsch

Timothy L. Kennedy

Abstract: The benefits of incorporating learning style theories in the educational process are well-documented. The problem facing educators is the choice of assessment tools that provide useful and significant information. The purpose of this study was to compare Kolb's Learning Style Inventory-1985 (LSI-85) and the Myers-Briggs Type Indicator-Form G (MBIT-G) to identify existence, strength and direction of correlations. Data were collected from 132 nursing and physical therapy students. Results show some correlations between the two instruments. However, the strength of the correlations is weak and not in predicted directions. Overall, the MBTI-G appears superior to the LSI-85 for assessing learning styles in the classroom.

'Kathleen M. Kirby, EdD, is Assistant Professor and Licensed Psychologist, Educational and Counseling Psychology, University of Louisville, KY; Patricia K. Leitsch, PhD, is Assistant Professor, Occupational Training and Development, University of Louisville, KY; Timothy L. Kennedy, MA, is a Private Consultant, Louisville, KY.

Teachers can no longer assume that all students will learn regardless of teaching strategies used. Keffe (1979) recognized the importance of adapting curricula and teaching methods to the needs of learners. He suggested that diagnoses of learning style preferences allowed for both the individualization of instruction and provision of a more rational argument upon which to base curriculum and instructional decisions. Moreover, concordance between teaching style and learning preference has been demonstrated to be a positive factor in students' success (Butler, 1988; Derry, 1988/89).

Learning style refers to "a student's consistent way of responding to and using stimuli in the context of learning" (Claxton & Ralston, 1978, p 10). Six major advantages of using learning style assessment to guide instruction have been identified (Butler, 1988; Derry, 1988/89). One, the process assists in the identification of how instructors prefer to learn. Second, it allows instructors to explore their preferred teaching style. Third, it facilitates the examination of the relation between student learning style and teaching style. Fourth, it allows instructors to use their knowledge of the different learning styles in the curriculum development process. Fifth, it permits instructors to employ various tactics for learning to help students most readily acquire the information. Six, it enables students to develop varied learning styles in light of the problem solving skills required.

There are a variety of instruments applied to the measurement of learning styles. One group of instruments is based on a direct assessment of learning style and includes, for example, the Learning Style Inventory-1976 (Kolb, 1976), the Learning Style Inventory-1985 (Kolb, 1985), the Grasha-Riechmann Student Learning Style Scales (Riechmann & Grasha, 1974), the Dunn Learning Style Inventory (Dunn, Dunn & Price, 1975), the Gregorc Style

Delineator (Gregorc, 1985), and the Learning Styles Questionnaire (Honey & Mumford, 1982).

Indirect assessments of learning styles often employ personality type inventories and one, the Myers-Bnggs Type Indicator[1] (MBTI), has been extensively applied in this regard (Brown & DeCoster, 1991; Carey, Fleming& Roberts, 1989; Lawrence, 1982, 1984; Murray, 1990). The MBTI has undergone a number of revisions, and at least eight versions of this inventory have been used.

Need for the Study

The identification of one measure of learning styles that yields accurate and beneficial information, and yet is quick and easy to use, would assist educators. The Learning Style Inventory (LSI-76 and LSI-85) and MBTI (Forms F and G) take little time to complete, are self-administered, are easily scored, and are inexpensive to use. In addition, these inventories produce profiles consisting of positive concepts and terms that appear applicable to learning environments. Moreover, these inventories are extensively researched instruments and used for a wide variety of purposes, including learning style assessment (Allison & Hayes, 1990; Pittenger, 1993).

However, few studies were found that pair the LSI and the MBTI, and none were found which pair the MBTI Form F or G with the IX-85. Jonassen (1981) and Penn (1991) compared the MBTI and LSI. Unfortunately, these studies remain unpublished and no summary findings could be located. Studies by Gordon, Coscarelli, and Sears (1986) and

[1]Myers-Briggs Type Indicator and MBTI are registered trademarks of Consulting Psychologists Press, Inc.

Stice, Bertrand, Leuder, and Dunn (1989) collected MBTI and LSI-76 data but did not report comparisons of the inventories. Summaries were reported by Myers and McCaulley (1985) on studies by Kolb and Harbaugh which compared the MBTI and LSI-76. Bokoros, Goldstein, and Sweeney (1992) reported a factor analytic comparison of the MBTI and LSI-76, along with three other learning style inventories. Direct comparisons of the MBTI and LSI-76 were not provided.

Purpose

The goal of the present research was to compare the utility of the LSI-85 and the MBTI-G as inventories for assessing learning styles in the classroom. Specifically, what correlations existed? Were these correlations in the predicted direction? Were the magnitude of correlations sufficient to suggest that the inventories are interchangeable? From these analyses, recommendations were developed for classroom learning style assessment.

Methodology

Instrumentation

LSI-85. The theoretical basis for the LSI is experiential learning theory based **largely** on the works of Piaget (Bokoros et al., 1992), and Lewin. Jung's concepts of the integration of styles into preferred and auxiliary ways of dealing with the environment are also incorporated into the LSI (Smith & Kolb, 1986).

The LSI-85 operationalizes these theories by measuring learning styles on four scales: abstract conceptualization (AC), concrete experience (CE), reflective observation (RO), and active experimentation (AE). Respondents are asked to rank four statements for each of 12 questions on learning preference. Responses are scored as least descriptive (coded as 1) to most descriptive (coded as 4). The instrument is scored by addition of scale items. Each of the scales has a range of 12 to 48.

These scales form two dimensions roughly corresponding to preferences for information acquisition (AC minus CE) and for information processing (AE minus RO). Dimensions can range from -36 to +36. The intersection of the two dimensions produce one of four learning styles: assimilator (high CE and low AE), converger (high AC and low AE), accommodator (high AE and high AC) or diverger (high AC and low AE). According to the instructional manual, learning styles are not defined by the 0,0 origin. Rather, the demarcation is ≥ 4 for information acquisition and ≥ 6 for information processing (Kolb, 1985).

The design and implementation of the inventory has been criticized due to its (a) ipsative format, (b) dependent scaling, (c) reliability, and (d) the potential for response-set bias. Ipsative format refers to scoring the relative strength of items in relation to other items within the same question. That is, each of the four items on a question must be scored with 1, 2, 3 or 4 and total 1(). As a result of this systematic restraint, scores between individuals should not be compared since strength of learning style is not assessed (Merritt & Marshall, 1984).

Dependent scaling, meaning scores on one scale are determined to some extent by scores on other scales, is problematic since it violates assumptions of statistical independence found in many tests. As a result, negative correlations are assured (Kerlinger, 1973). "Interdependence of scores, then, artificially supports the underlying theory of two bipolar learning dimensions" (Atkinson, 1991, p.. 152).

The LSI-85 inter-item reliability, measuring internal consistency by examining the average covariance among items on a scale, was widely reported (Geiger & Pinto, 1991; Ruble & Stout, 1990, 1991; Sims, Veres, Watson, & Buckner, 1986; Veres, Sims, & Locklear, 1991; Veres, Sims, & Shake, 1987). For the AC scale, alphas ranged from .73 to .85. For the CE scale, alphas ranged from .62 to .85. For the AE scale, alphas ranged from .56 to .88. For the RO scale, alphas ranged from .67 to .85. Nunnally (1978) suggested that internal consistency coefficients below .70 indicate inadequate measurement reliability of stable constructs.

LSI-85 test-retest reliability, measuring the same people at various times, were reported in several studies (Atkinson, 1988, 1989; Geiger & Pinto, 1991; Sims et al., 1986; Veres et al., 1987). Excluding studies employing scrambled versions of the LSI-85, test-retest coefficients ranged from .36 to .67 for AC, .14 to .57 for CE, .28 to .68 for AE, and .36 to .72 for RO. Kolb (1981), in specific reference to LSI-76 but presumably applicable to LSI-85, argued “Although these results [citing five test-retest studies with coefficients ranging from .33 to .74] would not be satisfactory for measurement of a stable psychological trait, they are more acceptable for a construct that is theoretically conceived of as situationally variable” (p. 291). Notwithstanding an appeal to constructs that are situationally variable, the inventory demonstrated poor stability, particularly when applied within classroom settings over the course of a semester. Moreover, while situational variability may be theoretically posited as a reason for poor stability, such reasoning does not exclude the possibility of measurement error.

LSI-85 reliability can also be assessed by measures of inventory stability, the degree to which inventories consistently classify a person along major learning styles of accommodator, diverger, converger and assimilator. This information is particularly relevant to the practitioner since it assesses stability in learning styles rather than scale scores. Again, the results are disappointing. Two studies (Ruble & Stout, 1991; Sims et al., 1986) reported marginal classificatory stability over 5 week intervals, kappa coefficients range from .24 to .41. Since a random guess should produce a 25% correct assignment rate, the demonstrated classification stability is not encouraging.

Response-set bias may be introduced by LSI-85 scoring methods. AU items from a scale were presented in one column. Ruble and Stout (1990) examined this phenomenon by comparing the standard J-N-85 with a scrambled version. The test-retest stability at a five week interval was substantially greater: .37 for the standard version and .54 for the scrambled version. Ruble and Stout suggested that neither version of the LSI-85 provides reasonably stable measures of learning styles.

<u>MBTI-G</u>. The theoretical basis of the MBTI is Jung's theory of personality types. As Bokoros et al. (1992) explained, the theory "rests upon three orthogonal, bipolar dimensions: (a) a perceiving dimension, which is concerned with the ways we initially process information; (b) a judging dimension, which characterizes decision-making; and (c) an attentional dimension, which defines preferences for internal versus external focus" (p. 100). A fourth dimension, judging versus perception, was implied by Jung (Carlyn, 1977).

The MBTI-G operationalizes individuals' preferences on four bipolar personality indicators. The first dimension measures the way individuals prefer to interact with their environment: (E) extraversion and (I) introversion. The next dimension yields preference for how individuals gather information: (S) sensing and (N) intuition. The way individuals prefer to evaluate the information they receive is identified as (T) thinking or (F) feeling. The individuals' preferred orientation to information is labeled (J) judgement or (P) perceiving.

The MBTI forces a choice of two equally desirable polar dichotomies of a dimension. The MBTI-G consists of 95 phrased questions and word pairs. Respondents are directed to choose the word that appeals most to them or to indicate their most preferred answer. Items for each pole of a scale are totaled including the weights assigned. Different weights have been assigned to particular answers in an attempt to compensate for social desirability bias. The difference between scale scores defines direction of preference on a dimension. Preferences are combined to form one of sixteen types (e.g., ESTJ) (Myers, 1962).

A review of the psychometric Literature suggested no serious problems with MBTI inventory construction. Continuous score conversions violated some statistical assumptions for categorical data, but algorithms were provided to ensure consistency among researchers performing these transformations (McCaulley, 1990). McCaulley also noted that data suggest the weighting schemes might need corrections for specific age groups. Other researchers found dimensional covariance, particularly between SN and JP (Carlyn, 1977). This suggested less than optimal operationa.lization of the dimensions, although such problems are not structurally forced as with the IX-85.

Numerous studies reported reliability findings for the METI, and the majority are summarized in the instrument's technical manual. The split-half reliability estimate (Forms F and G) ranges were. EI .75 to .86, SN .73 to .91, TF .77 to .88, and JP .80 to .92 (Myers & McCaulley, 1985). Cronbach's alpha estimates of inter-item reliability (Form F) ranged from: EI .74 to .83, SN .74 to .85, TF .64 to .82, and JP .78 to ,84. Compared to the LSI, MBTI item reliability estimates should be higher since such statistics are influenced by the number of items in a scale.

Test-retest correlations (measured at less than a 2 year interval for Forms F and G) ranged from: EI .73 to .89, SN .69 to .91, TF .48 to .86, and JP .69 to .87. These estimates generally supported the MBTI as possessing adequate reliability. Classificatory stability was also generally better than chance but somewhat lower than desirable for the measurement of personality types (Myers & McCaulley, 1985).

<u>Sample</u>

The sample (n = 153) consisted of half the undergraduates enrolled in nursing and physical therapy programs at a large, urban, midwestern university. Participants were asked to complete two inventories: the LSI-85 and the MBTI-G. Inventones were completed during regularly scheduled classes. Participation was voluntary and subjects were assured anonymity. Inventory responses were scored by the investigators. A total of 132 (86% of 153) subjects completed both inventories and, thereby, were included in the analyses.

Demographic, educational background, academic achievement and work experience data about the individual were not collected. Demographic variability was highly restricted. Respondents were third and fourth year students, nearly all were female and white, ages ranged from 21 to 30. The collection of educational and work experience data may have been advisable, but was not undertaken. First, limited variability y was foreseen. Second, small sample size would preclude extension of these exploratory findings to sub-sets, particularly across multi-categorical constructs such as work experience.

Analyses

The four raw LSI-85 and eight raw MBTI-G scores were entered into a statistical program (SPSS-X, 1988). From the raw LSI-85 scores, AC minus CE, AE minus RO and four learning styles were computed. The raw MBTI-G scores were entered and converted into preference, continuous and type indicator values according to algorithms in the MBTI-G manual (Myers & McCaulley, 1985). Correlational analyses were performed to investigate dimensional similarities between inventories. Categorical analyses were performed to examine similarities in defined styles.

Results

In these analyses, the focus is on instrument dimensions and resultant types. Analyses of underlying scales may be interesting and important to research. However, learning styles inventories need to provide information on dimensions (e.g. MBIT-G El or LSI-85 AC minus CE). Moreover, how dimensions interact to form learning styles (e.g. ISTJ or Accommodator) is critical information for both instructor and student.

Table 1 presents measures of central tendency and dispersion on the two instruments. The mean AC minus CE score was 5.8. That mean was 13.9 among respondents with a preference for abstract conceptualization (56 %) and -4.6 among respondents with a preference for concrete experience (44 %). The mean AE minus RO score was 1.9. That mean was 14.4 among respondents with a preference for active experimentation (41%); and

Table 1

LSI-85 and MBTI-G Dimensions Scores for Sample and Sub-Groups.

Instrument / Dimension Scores	N	Mean	Mean Confidence Interval 95%	Std. Dev,
Kolb Learning Style Inventory				
AC minus CE	132	5.8	3,7- 7.8	11.8
Abstract Concept. Preference	74	13.9		7.6
Concrete Experience Preference	58	-4.6		7.1
AE minus RO	132	1.9	-0.2 -4.0	12.3
Active Experimentation Pref.	54	14.4		5.2
Reflective Observation Pref.	78	-6.7		7.5
Myers-Briggs Type Indicator*				
Extravert-Introvert	132	98.1	92.9 -103.3	30.0
Extravert Preference	73	74.1		12.2
Introvert Preference	59	127.8		14.8
Sensing-Intuiting	132	85,8	81.0 -90.7	28.2
Sensing Preference	86	68.9		16.9
Intuiting Preference	46	117.4		14.4
Thinking-Feeling	132	102.0	97.4 -106.7	26.9
Thinking Preference	52	73.6		17.3
Feeling Preference	80	120.5		11.5
Judging-Perceiving	132	96.2	90.4 -102.1	33.8
Judging Preference	74	70.6		17.2
Perceiving Preference	58	128.9		17.6

*M BTI-G cent i nu ous scores.

-6.7 among respondents with a preference for reflective observation (59%). The LSI-85 yielded: 37% assimilators, 22% accommodators, 22% divergers and 19% converges. Relatively high standard deviations on these dimensions were noted.

On the four MBTI-G dimensions, the sample demonstrated a preference for: extraversion (55%) over introversion (45%), sensing (65%) over intuition (35 %), feeling (61 %) over thinking (39%), and judging (56%) over perceiving (44%). Sub-group means among respondents displaying a preference for dimensional poles are provided. Distributed across 16 possible types, the MBTI-G yielded: ISTJ, ESTJ and ESFJ each between 11 % and 13% of the sample; and ISFJ, ISFP, INFP, ESFP, ESTP and ENFP each between 5 % and 10% of the sample. The remaining MBTI-G types were each less than 5 % of the sample.

Table 2 presents the product-moment correlations between the LSI-85 and MBTI-G scores. Statistical significance is denoted by single and double asterisks at the .05 and .01 levels. The direction of correlations were positive for I, N, F and P; and, negative for E, S, T and J.

The AC minus CE dimension correlated to 3 dimensions of the MBTI-G with the strongest relation between TF and JP, -.33 and -.30 respectively. The AE minus RO dimension related only to EI, -.30.

Discussion

These findings differ from other studies. Comparing eight possible dimension correlations, one statistically significant and three statistically non-significant correlations were replicated between the present study and Kolb's 1976 study (See Table 2). Compared to Harbaugh's 1982 replication study, the present study duplicates three statistically significant findings and two statistically non-significant findings, Comparing all three studies, agreement was found in the relation between AC minus CE and TF dimensions, a moderately strong, statistically significant and negative correlation. In addition, all three studies replicated negligible and statistically non-significant correlations between the AE minus RO and the SN and JP dimensions. Considering the fact that both inventories purport to measure learning style, the lack of frequent and strong correlations between the inventones is problematic.

The present study also fails to support theoretically proposed relations. Bokoros et al. (1992) postulated a positive relation between AE and Extraversion and a positive relation between the AC and Thinking. Cooper and Miller (1991) postulated a positive relation

Table 2

Correlations Between LSI-85 and MBTI-G Dimensions*.

Kolb Learning Style Inventory	Myers-Bnggs Type Indicator			
	EI	SN	TF	JP
Present Study	.21*	-.05	-.33**	-.30**
Kolb	-.01	.29**	-.35**	.02
Harbaugh	-.04	-.05	-.49**	-.44**
Present Study	-.30**	.10	-.04	.07
Kolb	-.13	.09	.04	-.16
Harbaugh	-.32*	.08	-.26*	-.21

[1]Kolb 1976 unpublished data MBTI vs. LSI-76; Harbaugh 1982 unpublished data MBTI vs LSI-76. Source: Myers and McCaulley, 1985.
*$p < .05$
**$p < .01$

between active experimentation and Extraversion, and a positive relation between abstract conceptualization and Intuition. Although their terminology is identical to the LSI, Cooper and Miller did not specifically reference the LSI while postulating these relations. An examination of Table 2 supports neither of these postulates. Nor is support for either set of proposed relations found by examining cross-classification of major types.

Conclusions and Recommendations

The results of this study do not replicate earlier studies of Kolb and Harbaugh comparing the LSI-76 and some form of MBTI. The few correlations found were weak and not in the direction indicated by the theory underlying each inventory. The inventories do not appear to measure the same constructs of learning styles and do not appear interchangeable.

In the examination of the psychometric properties of each inventory, the MBTI-G appears superior to the J-S-85. The latter's ipsative format and dependent scaling may seriously constrain utilization of the inventory and confound interpretation of results. Moreover, the classificatory stability and construct validity are concerns for the IS-85. While the MBTI-G has some problems with item weighting and intra-scale dependency, overall the psychometric problems of the MBTI-G are less serious than the LSI-85. Comparisons of various measures of reliability also lead to a conclusion that the MBTI-G is superior to the LSI-85.

The lack of correlations between the two instruments and the unstable psychometric properties of the LSI suggest that the MBTI-G should be the inventory of choice for measurement of learning styles. In addition, the MBTI-G provides richer information for the classroom teacher than does the LSI-85. The latter measures two dimensions which yield four learning styles while the former measures four dimensions which yield sixteen learning styles. Another positive aspect of the MBTI, albeit not germane to the task at hand, is that the results of the MBTI-G can be applied beyond the scope of learning styles to other sitnations. For example, there is a large body of literature available that shows how results of the MBTI-G can improve teamwork, decision-making processes and appreciation of individual differences.

Until the psychometric problems associated with the LSI-85 are addressed, the use of the Kolb's inventory should be questioned. The situational variability of LSI scores needs to be addressed and some measure of the environmental fluctuation would assist in the reliability of the LSI. Other measures of learning style that are adaptable to the classroom environment need to be identified and studied in relation to the MBTI-G in order to identify one good measure of learning style.

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