Educational Psychology, Vol. 24, No. 1, February 2004

Carfax Publishing
Taylor & Francis Group

Kolb's Learning Styles and Learning Preferences: Is there a linkage?

Robert Loo*
University of Lethbridge, Canada

Much has been written about the relationships between learning styles and learning preferences with the aim of tailoring teaching methods to the ways that students prefer to learn. This study used a sample of 201 management undergraduates to examine the relationships between Kolb's four learning styles and four learning types, and 12 different learning preferences. Only three significant relationships were found. It is suggested that large individual differences in learning preferences within each style and type, and small differences in learning preference mean scores show that, overall, there are weak linkages between learning styles and learning preferences. It is recommended that researchers control for Type I error rates and present effect sizes when statistically significant relationships are found to prevent chance and trivial findings from influencing educators. It is recommended that educators use a variety of learning methods and encourage students to be receptive to different learning methods rather than try to link specific learning methods to specific learning styles.

Researchers studying learning styles and learning preferences underscore the potential value of this line of research for tailoring teaching methods to the ways that students prefer to learn. One such researcher is Kolb, who developed the experiential learning model and the four learning styles indicated by the model together with learning preferences associated with each style.

Kolb's Model of Experiential Learning

Kolb's experiential learning model (ELM) is a well-established model that has attracted much interest and application. His model is founded on Jung's concept of types where development is accomplished by higher-level integration and expression of nondominant modes of dealing with the world (Kolb, 1984). As shown in Figure 1, experience is translated into concepts that, in turn, guide the choice of new experiences. Learning is conceived as a four-stage cycle starting with concrete experience which forms the basis for observation

*Faculty of Management, University of Lethbridge, Lethbridge, Alberta, Canada T1K 3M4. Email: loo@uleth.ca

ISSN 0144-3410 (print)/ISSN 1469-046X (online)/04/010099-10

DOI: 10/1080.0144341032000146476

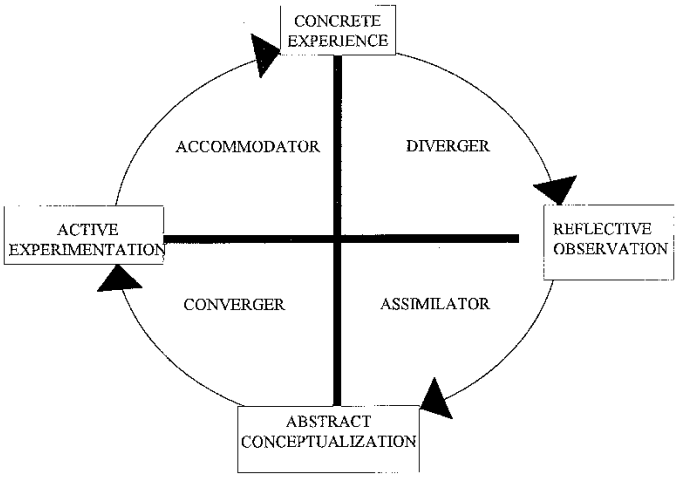

Figure 1. Kolb's two-dimensional learning model and four learning styles

and reflection upon experiences. These observations are assimilated into concepts and generalisations about experiences which, in turn, guide new experiences and interactions with the world.

This model, as shown in Figure 2, reflects two independent perceiving and processing dimensions: the concrete experience-abstract conceptualisation perceiving dimension and the active experimentation-reflective observation processing dimension. As seen in Figure 2, these two dimensions form four quadrants reflecting four learning styles: accommodator, diverger, assimilator, and converger. Kolb (1985) describes accommodators as people who learn primarily from hands-on experience and "gut feelings" rather than from logical analysis; divergers are best at viewing concrete situations from many different points of view; assimilators are best at understanding a wide range of information and putting information into a concise and logical form; while convergers are best at finding practical uses for ideas and theories. The effective learner is one who can use each of the four styles effectively in different learning situations rather than relying upon their preferred style.

As seen in Figure 2, four learning types are associated with the extremes of the two dimensions. The "feeling" type is associated with the concrete experience end of the perceiving dimension while the "thinking" type is associated with the abstract conceptualisation end of the perceiving dimension. The "doing" type is associated with the active experimentation end of the processing dimension while the "watching" type is associated with the reflective observation end of the dimension.

Kolb's Learning Styles Inventory

Kolb (1976) developed the 12-item self-report learning styles inventory (LSI) to assess learning styles; 12 short statements concerning learning situations are

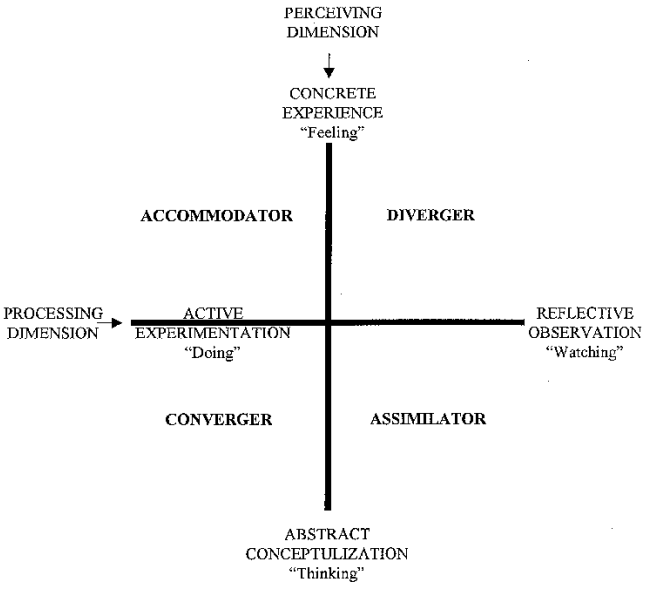

Figure 2. The perceiving and processing dimensions and four learning types

presented and respondents are required to rank-order four sentence endings that correspond to the four learning styles. Later, Kolb (1985) refined the LSI resulting in the LSI-1985 which shows some psychometric improvements.

Learning Styles and Learning Preferences

Rezler and Rezmovic (1981) defined "learning preference" as simply the choice of one learning situation over another. Kolb (1984) identified a number of commonly-used learning methods and whether each was helpful to a particular learning style or not. For example, projects and small-group discussions were seen as helpful for those classified at the active experimentation end of the active experimentation-reflective observation dimension, but lectures were not seen as helpful to their learning. In the same vein, Svinicki and Dixon (1987) linked a wide variety of specific learning methods with each end of the active experimentation-reflective observation and concrete experience-abstract conceptualisation dimensions. Ronchetto, Buckles, Barath, and Perry (1992) also advocated the tailoring of teaching methods in marketing education for students with different learning styles.

Turning to more recent empirical research, Sadler-Smith (1997), in a study involving 245 business undergraduates, reported some statistically significant, albeit weak, correlations between scores on the learning style questionnaire (Honey & Mumford, 1992) and his seven-item learning preference inventory (LPI). More recently, Sadler-Smith (1999) extended his LPI to 13 items which reflected three independent factors: active (preference for active and participatory situations such workshops and practical classes), reflective (preference for

didactic and self-directed activities), and individual (preference for individual work). In related work on cognitive styles, Sadler-Smith and Riding (1999) developed an instructional preferences inventory assessing three areas (instructional methods, instructional media, and assessment methods) with seven items for each area. Focusing on studies that used Kolb's learning style instruments, Gardner and Korth (1998) used LSI scores from 178 first-semester graduate students to examine the relationships between the four learning styles and attitudes toward four learning methods (lecture, writing a paper, reading, and paired one-on-one learning) as well as attitudes toward group work. Post-hoc paired comparisons (student-Newman-Keuls test) from their ANOVA revealed some significant effects; for example, assimilators showed a preference for attending lectures and writing papers, and accommodators preferred group work. Gardner and Korth also presented a figure listing learning activities targeted for each learning style to assist instructors.

Based upon a review of the literature (Gardner & Korth, 1998; Sadler-Smith, 1997; Sadler-Smith, 1999; Sadler-Smith & Riding, 1999) on learning styles and preferred learning situations (individual versus group learning) and activities (for example, writing a term paper), the author developed a 12-item measure to address the individual and group learning activities typically found in university programmes, especially business programmes. Appendix 1 presents the 12 items in the actual order used. A five-point response scale was used ranging from dislike (1) to indifferent (3) to like (5).

The main purpose of this exploratory study was to examine the relationships between Kolb's four learning styles and four learning types on the one hand, and students' preferences for 12 specific learning situations on the other hand. A secondary purpose was to examine the role of gender in learning preferences. Another purpose was to examine the factor structure of the 12-item learning preferences inventory in light of Sadler-Smith's (1999) finding of a three-factor structure (active, reflective, and individual) for his 13-item LPI.

Method

Participants

Access was gained to eight undergraduate management classes at a small Canadian liberal-education university. The LSI-1985 and the new 12-item learning preferences measure were administered in class under untimed conditions to 201 voluntary participants (113 males and 88 females).

Determining Learning Styles and Learning Types

Cut-off scores reported in the LSI-1985 manual (Kolb, 1985) were used to determine the appropriate learning style for each participant. In addition, combinations of learning styles were formed into four learning types to reflect

the two independent dimensions seen in Figure 2. The feeling type was formed by combining accommodators and divergers into one group, while the thinking type was formed by combining the convergers and assimilators to reflect the perceiving dimension. Similarly, the doing type was formed by combining accommodators and convergers, while the watching type was formed by combining divergers and assimilators into one group to reflect the processing dimension.

Results

Table 1 presents the means and standard deviations of scores on the 12 learning preferences for the four learning styles. A multivariate analysis of variance was performed with the four learning styles as the independent variable and scores from the 12 learning preferences as dependent variables. The effects of only two learning preferences were statistically significant: participating in groups ($F = 4.34$, df = 3,183, $P < 0.01$) and doing practical exercises ($F = 3.42$, df = 3,183, $P < 0.05$). Using Scheffe, a relatively conservative test regarding Type I error rate, post hoc multiple-comparison tests showed that convergers (mean = 4.11, SD = 0.83) preferred participating in groups significantly more ($P < 0.05$, effect size = 0.70) than did assimilators (mean = 3.44, SD = 1.08) and that divergers (mean = 4.40, SD = 0.71) preferred doing practical exercises significantly more ($P < 0.05$, effect size = 0.55) than did assimilators (mean = 4.01, SD = 0.72).

Table 2 presents the means and standard deviations of scores on the 12 learning preferences for the four learning types. A multivariate analysis of variance with the thinking-feeling groups as the independent variable and scores from the 12 learning preferences as dependent variables was performed. There were no significant effects. The multivariate analysis of variance for the doing-watching groups showed only one significant effect, for participating in groups ($F = 7.68$, df = 1,185, $P < 0.01$, effect size = 0.43), such that doing (mean = 4.07, SD = 0.92) learning types preferred working in groups significantly more than did watching (mean = 3.63, SD = 1.14) learning types.

Overall, as seen in Table 2, the most preferred learning activities (that is, with the highest mean scores) were for doing practical exercises and solving problems, while the least preferred learning activities were for writing major term papers and giving presentations to the class. The breakdown of the total sample by gender is shown in Table 1. A multivariate analysis of variance, with gender as the independent variable and scores from the 12 learning preferences as dependent variables, showed a significant effect only for doing practical exercises ($F = 6.25$, df = 1,190, $P < 0.05$, effect size = 0.36) such that men (mean = 4.26, SD = 0.74) preferred doing practical exercises significantly more than did women (mean = 4.00, SD = 0.69).

Exploratory principal component analyses (PCA; SPSS, 1998) were performed to determine the number of components that could be extracted using several criteria: the eigenvalue ≥ 1 rule, the scree test, the number of salient

Table 1. Descriptive statistics for learning preferences scores by learning styles and gender

	Accommodator ($n = 34$)		Assimilator ($n = 68$)		Converger ($n = 38$)		Diverger ($n = 47$)		Males ($n = 113$)		Females ($n = 88$)	
Learning preference	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Reading printed materials	3.26	1.02	3.29	1.02	3.32	1.09	3.32	1.11	3.23	1.08	3.39	0.99
Writing major term papers	2.53	1.24	2.66	1.19	2.37	0.91	2.32	1.16	2.52	1.08	2.42	1.19
Participating in groups	4.03	1.03	3.44	1.08	4.11	0.83	3.89	1.18	3.71	1.15	3.81	1.10
Doing major team projects	3.76	1.05	3.31	1.03	3.63	0.88	3.53	1.12	3.49	1.09	3.52	1.03
Doing cases	3.62	0.89	3.59	0.81	3.63	0.97	3.49	0.86	3.48	0.90	3.57	0.95
Multiple choice tests	3.38	1.33	3.43	1.26	3.58	0.95	3.49	1.28	3.56	1.23	3.34	1.22
Giving presentations	2.65	1.32	2.49	1.28	3.00	1.19	2.70	1.23	2.81	1.28	2.47	1.24
Learning different theories	3.62	1.02	3.81	0.85	3.76	0.85	3.51	0.98	3.71	0.86	3.63	0.97
Doing practical exercises	4.00	0.82	4.01	0.72	4.24	0.63	4.40	0.71	4.24	0.77	4.01	0.69
Solving problems	3.97	0.90	4.01	0.78	4.24	0.82	4.34	0.84	4.17	0.85	4.02	0.84
Doing library research	2.68	1.20	2.90	0.99	2.87	1.07	2.81	1.21	2.89	1.02	2.75	1.19
Exercising a lot of creativity	3.91	1.16	3.62	0.98	3.76	1.05	3.77	1.05	3.77	1.02	3.63	1.08

Table 2. Descriptive statistics for learning preferences scores for the total sample and by learning types

			Abstract conceptualisation-concrete experience				Active experimentation-reflective observation			
	Total Sample ($n = 201$)		Thinking ($n = 111$)		Feeling ($n = 84$)		Doing ($n = 75$)		Watching ($n = 115$)	
Learning preference	M	SD	M	SD	M	SD	M	SD	M	SD
Reading printed materials	3.30	1.04	3.32	1.04	3.29	1.05	3.28	1.04	3.32	1.06
Writing major term papers	2.48	1.13	2.52	1.10	2.41	1.17	2.45	1.06	2.49	1.18
Participating in groups	3.75	1.13	3.63	1.05	3.95	1.12	4.07	0.92	3.59	1.17
Doing major team projects	3.50	1.07	3.40	0.99	3.65	1.07	3.72	0.95	3.38	1.09
Doing cases	3.52	0.92	3.58	0.87	3.54	0.86	3.64	0.93	3.51	0.86
Multiple choice tests	3.47	1.23	3.46	1.16	3.42	1.31	3.44	1.20	3.45	1.26
Giving presentations	2.66	1.27	2.68	1.26	2.67	1.28	2.85	1.28	2.56	1.26
Learning different theories	3.67	0.91	3.80	0.85	3.55	0.98	3.71	0.93	3.68	0.90
Doing practical exercises	4.14	0.74	4.10	0.70	4.21	0.80	4.17	0.73	4.15	0.76
Solving problems	4.10	0.85	4.09	0.80	4.15	0.89	4.12	0.85	4.12	0.85
Doing library research	2.83	1.10	2.90	1.02	2.74	1.20	2.77	1.16	2.87	1.07
Exercising a lot of creativity	3.71	1.05	3.69	1.00	3.81	1.08	3.82	1.09	3.69	0.99

variables (loadings at least ± 0.35) on factors, and factor interpretability. Orthogonal (varimax) and oblique (oblimin) factor rotations were performed and rotated matrices examined to determine the more meaningful structure. The orthogonal four-component solution, which accounted for 56.6% of the variance, was judged to be the best solution. The structure coefficients for this solution are presented in Table 3. The first component was labelled "learning in groups" (eigenvalue = 2.29, 19.1% variance) because the highest loadings were for participating in groups (0.88) and doing major team projects (0.84). The second component was interpreted as "critical thinking" (eigenvalue = 2.03, 16.9% variance) because the highest loadings were for solving problems (0.81), doing practical exercises (0.73), learning different theories (0.64), and doing cases (0.45). The third component was labelled "individual learning" (eigenvalue = 1.44, 12.0% variance) because the highest loadings were for what are usually regarded as individual learning activities, specifically, doing library research (0.80), reading printed materials (0.65), and writing major term papers (0.57). The fourth component, a bipolar component, was labelled "assessing learning" (eigenvalue = 1.03, 8.6% variance) because the highest loadings were for multiple choice tests (− 0.81), writing major term papers (0.53), exercising a lot of creativity (0.40), and doing cases (0.36). Multiple choice tests were seen as the antithesis of tapping creativity and more creative learning activities such as writing a major term paper or doing cases.

Table 3. Structure coefficients for the four-component orthogonal principal component analysis of learning preference scores

Learning preference	1	2	3	4
Reading textbooks and other printed materials	− 0.06	0.13	0.65	− 0.14
Writing major term papers	− 0.12	− 0.04	0.57	0.53
Participating in group activities in class	0.88	− 0.07	− 0.10	− 0.02
Doing major team projects	0.84	− 0.14	− 0.06	− 0.06
Doing cases	0.22	0.45	− 0.18	0.36
Multiple choice tests	− 0.05	0.13	0.06	− 0.81
Giving presentations to the class	0.52	0.18	0.03	0.29
Learning about different theories	− 0.10	0.64	0.16	− 0.02
Doing practical exercises	0.02	0.73	0.04	− 0.08
Solving problems	0.06	0.81	0.07	0.07
Doing library research	0.02	0.06	0.80	0.06
Exercising a lot of creativity	0.40	0.31	0.11	0.40
Eigenvalue	2.29	2.03	1.44	1.03
% variance	19.1	16.9	12.0	8.6

Discussion

Finding only three statistically significant differences, with small (0.43) to moderate (0.55 and 0.70) effect sizes, in learning preferences among the four

learning styles and learning types brings into question much of the literature that asserts such linkages (Hayes & Allinson, 1996; Kolb, 1984; Ronchetto et al., 1992). Even empirical studies reporting statistically significant effects reveal weak relationships (Sadler-Smith, 1997). It is suggested that the large individual differences that exist within each learning style and type, as indicated by large standard deviations and small differences in mean scores, indicate that learning style is not a major determinant of learning preferences. In this sample, all learning styles and types showed a dislike for writing major term papers, giving presentations to the class and doing library research, but showed a liking for doing practical exercises, solving problems, and participating in groups. These trends characterised both male and female participants with the one weak gender difference (effect size = 0.36) being that men preferred doing practical exercises more than did women.

Given the weak to moderate effect sizes for linkages between learning styles and learning preferences, researchers in this area should control for Type I error rates because many statistical tests are usually performed when examining the relationships between four styles and a variety of learning preferences. One has to wonder if Type I error rates account for some of the few significant relationships reported in the literature. When significant relationships are found, then effect sizes should be reported because learning style studies typically use large samples, and statistical significance may be found more easily because of these large sample sizes (that is, large degrees of freedom) than because of any substantial relationship between the variables of interest.

It is recommended that educators use a variety of learning methods, and encourage students to be receptive to different learning methods, rather than try to link specific learning methods to specific learning styles. This recommendation echoes recommendations presented by others over the years (Baker, Simon, & Bazeli, 1986; Check, 1984; Reynolds, 1997).

Finally, the PCA of learning preference scores revealed four orthogonal components that differed from the components that Sadler-Smith (1999) identified in the analysis of his 13-item LPI. This is not surprising because only a few items overlapped in both instruments. It is recommended that a factor-analytic study pools the items from the various learning preference instruments in order to identify a more comprehensive set of factors and then develop a comprehensive, psychometrically-sound learning preferences inventory.

References

Baker, R.E., Simon, J.R., & Bazeli, F.P. (1986). An assessment of the learning style preferences of accounting majors. *Issues in Accounting Education,* Spring, 1–12.

Check, J.F. (1984). Teaching learning preferences of the adult learner. *Education, 105*, 107–112.

Gardner, B.S., & Korth, S.J. (1998). A framework for learning to work in teams. *Journal of Education for Business, 74*, 28–33.

Hayes, J., & Allinson, C.W. (1996). The implications of learning styles for training and development: A discussion of the matching hypothesis. *British Journal of Management, 7*, 63–73.

Honey, P., & Mumford, A. (1992). *The manual of learning styles*. Maidenhead: Peter Honey.
Kolb, D.A. (1976). *Learning style inventory: Technical manual*. Boston: McBer.
Kolb, D.A. (1984). *Experience as the source of learning and development*. Englewood Cliffs: Prentice-Hall.
Kolb, D.A. (1985). *The learning style inventory: Technical manual*. Boston: McBer.
Reynolds, M. (1997). Learning styles: A critique. *Management Learning*, *28*, 115–133.
Rezler, A., & Rezmovic, V. (1981). The learning preference inventory. *Journal of Allied Health, 11*, 28–34.
Ronchetto, J.R., Buckles, T.A., Barath, R.M., & Perry, J. (1992). Multimedia delivery systems: A bridge between teaching methods and learning styles. *Journal of Marketing Education, 14*, 12–21.
Sadler-Smith, E. (1997). 'Learning style': Frameworks and instruments. *Educational Psychology, 17*, 51–63.
Sadler-Smith, E. (1999). Intuition-analysis cognitive style and learning preferences of business and management students. *Journal of Managerial Psychology, 14*, 26–38.
Sadler-Smith, E., & Riding, R. (1999). Cognitive style and instructional preferences. *Instructional Science, 27*, 355–371.
SPSS Inc. (1998). *SPSS user's guide*. Chicago: SPSS.
Svinicki, M.D., & Dixon, N.M. (1987). The Kolb model modified for classroom activities. *College Teaching, 35*, 141–146.

Appendix 1. Your Learning Preferences

1. Reading textbooks and other printed materials.
2. Writing major term papers.
3. Participating in group activities in class.
4. Doing major team projects.
5. Doing cases.
6. Multiple choice tests.
7. Giving presentations to the class.
8. Learning about different theories.
9. Doing practical exercises.
10. Solving problems.
11. Doing library research.
12. Exercising a lot of creativity.