On the Effect of Learning Style on Scholastic Achievement

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The present study was designed to explore the influence of learning styles on scholastic achievement levels. The participants in this study were undergraduate students studying social sciences at a Division 1 research university, The frequencies of the participants in the four learning style categories are the following: Convergent ($n = 28$), Divergent ($n = 49$), Assimilator ($n = 76$), and Accommodator ($n = 40$). The instruments used in the study were the Kolb learning style inventory and a demographic form. The major findings of the study are that the dominant learning style was Assimilator and that learning style and gender influenced academic achievement.

Keywords: academic achievement, social sciences, learning styles.

Learning styles are characteristic ways of perceiving and processing information. Considering the importance of learning styles, educational organizations have assessed the learning styles of students and tailored instruction to fit student learning styles. In a comprehensive review of learning style literature, Pashler, McDaniel, Rohrer, and Bjork (2008) concluded that there is little evidence that matching instruction with learning styles produces superior learning.

However, there is also research that indicates that learning styles can influence student academic performance (e.g., Hayes & Allinson, 1998; Kolb & Kolb, 2009; Matthews, 1996; Rasmussen, 1998; Riding & Grimley, 1999; Ross & Schultz, 1999; Snyder, 2000; Tinajero & Paramo, 1998; Zhang & Sternberg, 2006). In addition, Reynolds and Gerstein (1992) found that teachers and administrators are able to improve the quality of instruction in their schools when they are aware of the learning styles of their students.

One prominent model of learning styles is that of David Kolb (1984) that posits four learning styles: (1) Converger; (3) Diverger; (3) Assimilator; and (4) Accommodator. The Kolb learning styles are combinations of two ways to process experience, Abstract Conceptualization (AC) and Concrete Experience (CE), and two ways to transform experience, Active Experimentation (AE) and Reflective Observation (RO).

The Convergent thinker is someone who is personally best at solving problems with single correct solutions. The Convergent learning style makes use of Abstract Conceptualization to process experience and Abstract Experimentation to transform experience. Convergers tend to take abstract ideas and actively experiment with them to find the best solutions to problems. Such thinkers perceive abstractly and process actively. This style has advantages in completing traditional intelligence tests and in making decisions. Persons with this learning style tend to do well in technical tasks and less well in interpersonal relations.

The Divergent thinker is different in being someone who is able to generate and explore multiple answers to problems. To Kolb (1984), the Divergent learning style depends on Concrete Experience to process reality and Reflective Observation to transform reality.

Divergers perceive concretely and think reflectively and imaginatively. Divergent thinking is related to fluency (i.e., the ability to produce multiple ideas in response to a task rapidly), flexibility (i.e., the capacity to consider multiple approaches to a problem), originality (i.e., the tendency to produce novel ideas in response to a task), and elaboration (i.e., the ability to consider the implications and consequences of ideas). Divergent thinkers tend to choose the liberal arts and humanities.

A third learning style is that of the Assimilator who perceives information through Abstract Conceptualization and transforms that information through Reflective Observation. Assimilators tend to be rational, unemotional, and more interested in abstract concepts than in people. They tend to be solitary and avoid practical activities.

Finally, Accommodators perceive information through Concrete Experience and process it through Active Experimentation. They base their decisions on feelings and prefer to work with people. In summary, the four Kolb learning styles result from different combinations of perception, Abstract Conceptualization (AC) vs. Concrete Experience (CE), and subsequent information processing, Active Experimentation (AE) vs. Reflective Observation (RO).

There is a difference in learning styles of male and female. Females prefer to perceive new information from Concrete Experience; whereas, males prefer to perceive new information through Abstract Conceptualization. Females tend to be Accommodators and/or Divergers; whereas, males tend to be Assimilators and/or Convergers (Philbin, Meier, Huffman, & Boverie, 1995).

Much of the research on Kolb's learning styles has focused on the assessment of individual learning styles (Kolb & Kolb, 2009). Because of the possible effect of learning styles on student achievement, there is a definite need for research to address the relationship between Kolb's learning styles and academic achievement (Cano-Garcia & Hughes, 2000). This study provides an investigation of that relationship among undergraduates enrolled in the social sciences.

The following questions guided this research: (1) what are the primary learning styles of undergraduate students enrolled in the social sciences?; (2) do learning styles affect academic achievement?; and (3) do gender and learning style interact?

Method

Participants

The participants were undergraduates at the University of Minnesota from three randomly selected classes in sociology.

Instruments

The instrument used in the study to identify the learning styles of the participants was the Kolb learning style inventory (Kolb, 2005). Kayes (2005) reported internal consistency values ranging from .78 to .84 for the four scales with a sample of 221 undergraduate and graduate students in business. Weistra and DeJong (2002) reported similar relatively high internal consistency values ranging from .78 to .84 for the four scales with a sample of 101 business employees and students. Wilcoxson and Prosser (1996) found levels of high internal consistency for the four scales of the instrument with a sample of 187 Arts and Science undergraduate students from Australia.

As for the validity of the Kolb learning style inventory, Wilcoxson and Prosser (1996) found four factors in a factor analysis of test data to confirm the two hypothesized bipolar dimensions underlying the instrument. That finding provided evidence for the construct validity of the instrument. Data from a normative sample for the inventory version 3.1 indicated a linear relationship between amount of education and abstraction (Kolb, 2005). That finding provided additional support for the construct validity of the inventory.

Those prior studies are only some of the studies discussing the psychometric features of the Kolb learning style inventory. Some research has questioned the reliability and validity of the instrument (e.g., Cornwell & Manfredo, 1994; Sims, Veres, & Shake, 1989); whereas, other research has supported its reliability and validity (e.g., Kayes, 2002). The studies critical of the reliability and validity of the Kolb instrument tended to be critical of earlier versions of the instrument and those criticisms led to improvements in the reliability and validity evident in the instrument used in this study, i.e., Kolb learning style version 3.1 (Kolb, 2005). However, from a review of learning style inventories, Hawk and Shaw (2007) recommended further research on the reliability and validity of all learning style instruments intended to enhance student learning and that includes the Kolb learning style inventory.

The Kolb Learning Style Inventory describes the way an individual learns and deals with ideas and daily situations. It consists of 12 sentences. Each sentence has a choice of four endings. Individuals are asked to rank the endings for each sentence ranging from "4" for the sentence that best describes the way that he/she learns to "1" for the sentence that least describes the way that he/she would learn. The four endings correspond to the four learning modes of Active Experimentation (AE), Concrete Experience (CE), Reflective Observation (RO), and Abstract Conceptualization (AC).

In addition to four primary scores that measure one's preference on the four learning modes, there are two combination scores that measure one's emphasis for action over reflection (AE-RO) and abstractness over concreteness (AC-CE). Kolb (2005) used these scores to identify Convergers, Divergers, Assimilators, and

Table 1
GPA Descriptive Statistics for Four Learning Styles

Learning Style	Mean	SE	95% Confidence Interval for Mean	
			Lower Bound	Upper Bound
Converger	3.399	.097	3.207	3.591
Diverger	3.163	.070	3.025	3.300
Assimilator	3.325	.053	3.221	3.430
Accommodator	3.099	.089	2.923	3.275

Accommodators.

Accompanying the inventory was a short demographic form on which each participant could provide information as to personal gender (sex) and GPA. Participants were instructed to provide that information prior to completing the Kolb learning style inventory.

Procedure

Researchers requested participation from various social science departments at a large Midwestern Division 1 Research university. Those departments were Education, Sociology, Social Work, Curriculum and Instruction, Educational Psychology, Family Social Science, Organizational Leadership, Policy, and Development, Postsecondary Teaching and Learning. Only the Department of Sociology agreed and participated in the research. A sample of 200 undergraduate students received the consent forms for this study. 193 students completed the consent forms and agreed to participate in the study. Those participants were then given the Kolb learning style inventory to complete.

Results

All 193 participants completed Kolb learning styles inventory. Among the 179 participants who indicated their gender, there were 108 females and 71 males. 174 of the participants indicated both their GPA and their gender (sex).

SPSS software was used in the analysis of the resulting data. The frequencies of the participants in each learning style category and their respective percentages of the total sample are the following: 76 Assimilators (39.4%), 49 Divergers (25.4%), 40 Accommodators (20.7%), and 28 Convergers (14.5%). More of the participants had the Assimilator learning style than any other learning style.

Among the 108 female participants, the frequencies of females in each learning style category and their respective percentages of the female subsample are the following: 35 Assimilators (32.4%), 29 Accommodators (26.9%), 28 Divergers (25.9%), and 16 Convergers (14.8%). Among the female participants, the Assimilator learning style category claimed the largest frequency.

Among the 71 male participants, the frequencies of males in each learning style category and their respective percentages of the male subsample are the following: 38 Assimilators (53.5%), 17 Divergers (23.9%), 8 Convergers (11.3%), and 8 Accommodators (11.3%). The Assimilator learning style category claimed the largest frequency among the male participants as it did among the female participants.

A two-way analysis of variance and Chi-Square test of independence were performed with gender (two categories) and learning style (four categories) being the two factors and GPA being the dependent variable. There was a statistically significant main effect for gender with $F(1, 166) = 6.17$, $p = .014$, partial eta-squared = .036. The partial Eta-squared value of .036 indicates a small effect (Cohen, 1988), as the gender factor accounted for only approximately 3.6% of the variance in the dependent variable GPA after partialling out other effects from the model. Females had a mean GPA of 3.345 with a standard error of .045 and a 95% confidence interval of (3.255, 3.435); whereas, males had a significantly smaller mean GPA of 3.145 with a standard error of .065 and a 95% confidence interval of (3.020, 3.276).

There was also a statistically significant main effect for learning style with $F(3, 166) = 2.92$, $p = .036$, partial eta-squared = .050. The partial Eta-squared value of .050 indicates a close to modest effect, as the learning styles factor accounted for approximately 5.0% of the variance in the dependent variable GPA after partialling out other effects from the model. Table 1 provides the GPA means, standard errors, and 95% confidence intervals for the four learning styles.

The Converger participants had the greatest mean GPA. The interaction effect was not statistically significant. The R-squared value for the model was .091 with an adjusted R-squared value of .052. These values indicate that the model accounted for a relatively small amount of the variance in the GPA variable. The Chi-Square test of independence showed that the relationship between gender and learning styles is significant, $\chi^2 (3, N = 180) = 10.72$, $p = .013$

Discussion

Results of a two-way ANOVA indicated that there is a significant difference between the scholastic achievement of males and females, ($p = .014$). The females had a higher GPA mean, on the average, than the males. In addition, the hypothesis that the GPA means for the four learning style categories were equal was rejected

with p = .036. The individuals with the Converger learning style had a higher GPA mean than the other learning style groups. There was no statistically significant interaction effect (p = .229) between gender and learning style with GPA as the dependent variable. Moreover, the dominant learning style in this sample is Assimilator.

Dominant learning style of students in this sample enrolled in sociology is the Assimilator learning style. These results are in line with the views of Kolb and Boyatzis (1999), and Kolb and Kolb (2009). According to them, individuals with the Assimilator learning style prefer Sociology, Economics, Mathematics, and Chemistry.

Nevertheless, the Converger group performed better than the Assimilators. This may be due to the methods applied for assessment of performance of students - project completion, written assignments, multiple choice questions, class tests, and class participation. This format favors the Converger learning style (Danili & Reid, 2006).

Females performed better than males. This finding may be due to superior linguistic skills, better work habits, better study skills, and better class attendance of females than that of males (Kimball, 1989; Lao, 1980; Leonard & Jiang, 1999; Wainer & Steinberg, 1992; Wilberg & Lynn, 1999).

Findings of this study suggest that current undergraduate teaching tends not to accommodate students of diverse learning styles. A prominent finding in this study is that undergraduate students taking classes in sociology who have the Converger learning style had a higher mean GPA than comparable students with the other learning styles. Many undergraduate courses may be employing instructional methods that favor and better fit the Converger learning style.

As a result, many students with non-Converger learning styles such as the dominant Assimilator learning style many not be performing as well as Converger students. This state of affair is unacceptable. To cope with this situation, courses and programs in the university should be designed with a consideration of multiple student learning styles. Accommodation to learning styles of students could likely facilitate student learning. In this regard, we believe, contrary to the summary judgment of Pashler et al. (2008), that there is continued merit to investigate the interaction of instructional methods and learning styles with the goal of improving the academic achievement of all students including undergraduate students.

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