Final Report

Cognitive Learning Style and Academic Performance

Frank Osborne
Department of Psychology
Morehead State University
April, 1996
ABSTRACT FORM D

Final Report of Grant Funded by the Research and Creative Productions Committee

Title of Research or Creative Production: Cognitive Learning Style and Academic Performance

Department: Department of Psychology

Name of Grant Recipient: Frank Osborne

UPO: 1355 Telephone: 783-2984

Date of Final Report: Apr 1996

Date Grant was Funded: Oct 1990

Amount for which grant was funded $2300 Amount expended $2300

Research Summary:

Schmeck (1983) has proposed an Inventory of Learning Processes instrument (ILS) to evaluate deep processing, elaborative processing, fact retention and methodical study learning styles. Schmeck’s inventory was used in two experiments to determine the relationship between learning style and academic performance (Experiment 1) and with dogmatism and developmental stage (Experiment 2). One hundred and twenty three volunteer introductory psychology students participated in this research. The major findings were: 1. Students with more defined learning styles -- those scoring above the median on Schmeck’s ILS categories -- were also above the median in course performance. Conversely, below median ILS students performed below the median academically. 2. Dogmatism led to less utilization of the deep and elaborative processing cognitive learning styles. Also, all students found methodical study least appealing as a learning style. 3. Developmental stage formed a complex interaction with learning style, but formal operational students rely more heavily on deep and elaborative processing than concrete operational students.

Final use of project results.

Portions of experiment 1 were reported in:


Portions of experiment 2 were reported in an applied project by A. Gould in partial fulfillment of her masters degree in experimental psychology in 1993.
Cognitive Learning Style: Final Report

Detailed Report

Cognitive Learning Style and Academic Performance

We do not all input or comprehend information in the same fashion. Different students employ different strategies while learning. Learning styles have been described as individual differences that effect learning. They can be preferences for where, when and how we learn. They can be preferences for environmental factors such as lighting, food, music or television while studying. They can be tendencies to learn better from visual versus verbal materials. The present research examines cognitive differences in learning style.

Craik and Lockhart (1972) first proposed a continuum for levels of cognitive processing. They described a continuum ranging from shallow processing in which information is repeated in rote fashion to deep processing in which meanings and associations are evaluated. Generally, students who employ deep processing perform better on laboratory memory tasks than do shallow processors. More recent information suggests that deep processors perform better in college courses than do shallow processors.

Schmeck (1983) has devised a 62 item Inventory of Learning Processes instrument (ILS) which purports to measure the following learning styles:

1. Deep Processing. -- the extent to which students critically evaluate, conceptually organize, and compare and contrast the information they study.

2. Elaborative Processing. -- the extent to which students translate new information into their own terminology, generate concrete examples from their own experience, apply new information to their own lives and use visual imagery to encode new ideas.

3. Fact Retention. -- how individuals process (and thus store) details and specific pieces of new information regardless of what other information-processing strategies they might employ.

4. Methodical Study. -- claim to study more often and more carefully than other students, and the methods that they claim to employ that are the systematic techniques recommended in 'how to study' manuals (e.g., type notes, outline text, make up practice tests, etc.).

College GPA and ACT scores have been found to correlate with several of the Schmeck’s subscales. For example, high GPA students use deep processing more than do low GPA students. High ACT score students use deep processing, elaborative processing and fact retention more than low ACT students who use methodical study more than high ACT students.
Dogmatism has been described as a personality variable referring to the extent to which an individual receives, analyzes and synthesizes information relative to pre-existing beliefs (Brightman & Urban, 1974). Brightman and Urban suggest that subjects scoring high in dogmatism tend to develop simple strategies for processing information. Their findings might mean that an emphasis on fact retention and methodical study methods may be associated with dogmatism.

Piaget has suggested that children progress through a series of definable stages: sensorimotor; preoperational; concrete operational; and formal operations. The latter two stages are most important for our purposes. In the concrete operational stage children can handle the concepts of time, space and number. Categories and principles are used and the child can think logically about concrete objects or situations. In the formal operations stage thinking is based on abstract principles and these children are able to consider hypothetical possibilities. Previous research (and our own) has found that approximately 25 percent of college freshmen test at the formal operations stage, about 50 percent achieve at the concrete operational stage and the remainder are transitional (Arons, 1976; Lawson & Renner, 1974).

Cognitive learning styles emphasizing deep and elaborative processing would seem consistent with formal operational logic. Cognitive learning styles relying on fact retention and methodical study would seem more appropriate for concrete operational students. Therefore, this research sought to determine the relationship between cognitive learning style and stage of cognitive development.

Thus, the primary variables of interest in this research were cognitive learning style, dogmatism, and stage of cognitive development. The first set of hypotheses tested were that students scoring high on the deep and elaborative processing scales and the fact retention scale of the ILS will tend to demonstrate better academic performance (i.e., have higher midterm grades in the course).

The second set of hypotheses tested were that less dogmatic students -- those scoring below the median on the S-F D scale -- score higher on the deep and elaborative processing scales of the ILS than do more dogmatic students. Conversely, the high dogmatic students score higher on the fact retention and methodical scales of the ILS than the less dogmatic students.

Finally, students categorized as formal operational by the IPDT score higher on the ILS scales than concrete operational students; however, group differences may be attenuated for the fact retention and methodical scales.
Method

This research consisted of two related studies in which cognitive learning style was evaluated relative to performance in an introductory psychology class (Experiment 1) and to measures of dogmatism and cognitive development (Experiment 2).

Subjects.
One hundred and twenty three introductory psychology students voluntarily participated in this research during the Spring and Summer of 1990. The Learning Style Inventory was administered to all subjects; however, 100 subjects completed the Piagetian Inventory successfully and 104 subjects completed the short-form dogmatism scale which limited the final sample in the analyses that follow.

Materials.
Cognitive learning style was evaluated by Schmeck’s Learning Styles Inventory (ILS, 1983). The ILS was scored for deep processing, elaborative processing, fact retention and methodical study. Dogmatism was measured by Trodahl and Powell’s Short-Form Dogmatism Scale (S-F D Scale, 1965) which produces a unitary measure of dogmatism. Stage of cognitive development was assessed and categorized by means of Furth’s Inventory of Piaget’s Developmental Tasks (IPDT, 1970).

Procedure.
Tests were administered in separate sessions to volunteer introductory psychology students. During the first session students completed an informed consent form, the ILS and the S-F D Scale. The IPDT was administered during the second session. Class performance was inferred from numerical midterm grades for these students. Since more than one section of introductory psychology was used, numerical grades were converted to Z-scores based on the separate sections.

Results and Discussion

The first hypothesis tested was students scoring high on the deep and elaborative processing scales and the fact retention scale of the ILS tend to demonstrate better academic performance. To test this hypothesis each of the four ILS scale were examined separately. All ILS scores were weighted by the number of questions for that category to make comparison between categories more meaningful. The resulting ILS scores could then range between 0 and 1. Higher scores mean that the student claimed to adopt strategies more consistent with that category. Students were assigned to a low or high style category on the basis of each subscale of the ILS and four separate independent t-tests were performed on mean midterm performance. All midterm data was transformed to Z-scores on the basis of the mean and standard deviation for the particular section that the student was in. Table 1 presents these means and the results of the statistical tests.
Table 1 indicates that in each case students scoring above the median on a particular learning style category scored above the mean on their midterm grade. Students scoring below the mean on a learning style category also scored below the mean on their midterm grade. Statistically, the difference was significant for deep processing ($p = 0.005$) and approached significance for elaborative processing ($p = 0.09$) and fact retention ($p = 0.08$). The difference was not significant for methodical study which was also the least preferred learning style for these students (see below). Therefore, hypothesis 1 was supported by the data. Deep processing in particular and elaborative processing and fact retention to a lesser extent appear to be associated with better academic performance.

The second set of hypotheses tested were that less dogmatic students -- those scoring below the median on the S-F D scale -- would score higher on the deep and elaborative processing scales of the ILS than do more dogmatic students. Conversely, the high dogmatic students score higher on the fact retention and methodical scales of the ILS than the less dogmatic students.

Figure 1 summarizes these data. Mean ILS score is plotted as a function of ILS category for the high and low dogmatism groups in this figure. The Figure suggests that elaborative processing was most highly favored by these students and methodical study was least preferred. Also, the low dogmatism group employed deep and elaborative processing more than did the low dogmatism group. The groups appear equivalent on fact retention and methodical study.
Figure 1. Mean ILS score as a function of ILS and dogmatism categories.
In order to determine if dogmatism and learning style category result in significantly different mean learning style scores, a two factor mixed anova was performed with dogmatism as a between groups factor and learning style category as a repeated measure. This analysis indicated that both dogmatism and ILS category were significant factors, $E(1,121) = 12.03$ and $E(3,363) = 35.44$, p's < 0.001 respectively. The interaction approached but did not attain conventional levels of significance, $E(3,363) = 2.54$, p = 0.06. Therefore, the first part of this hypothesis was supported in that less dogmatic students did employ deep and elaborative processing strategies more than did the more dogmatic students; however, the groups were equivalent on fact retention and methodical study.

The IPDT was used to categorize students as formal vs. concrete operational by using a median split for total formal category scores and for the total concrete category scores. They were then assigned to one of three categories: 1. Formal operational if they scored above the median on both formal and concrete questions; 2. Concrete operational if they scored below the median on both formal and concrete questions; and 3. Transitional if they scored above the median on concrete questions but below the median on formal questions. A few anomalous students (n=10) were dropped from the analysis if they were above the median of formal questions and below the median on concrete questions. It was hypothesized that students categorized as formal operational by the IPDT would score higher on the ILS scales than concrete operational students; however, group differences may be attenuated for the fact retention and methodical scales.

Figure 2 presents mean ILS score as a function of ILS category for the formal, concrete and transitional developmental groups. The figure suggests that all groups favored elaborative processing most and deep processing and methodical study least. Also, the formal group appears to use deep and elaborative processing more than did the concrete group.

In order to determine whether or not the three cognitive groups' mean ILS scores differed significantly over the ILS categories, a two factor mixed anova was performed with cognitive group (IPDT) as the between factor and ILS category as the repeated measure. This test indicated that the main effects of IPDT and ILS were statistically significant, $E(2,108) = 12.73$ and $E(3,224) = 33.20$, p's < 0.001 respectively. However, the IPDT by ILS category interaction was also significant, $E(6,324) = 5.41$, p < 0.001, thus precluding interpretation of the main effects.

The interaction was analyzed by means of a Duncan's post hoc test. Post hoc analysis indicated that the formal operators employed elaborative processing more than the other ILS categories and differed significantly from the concrete and transitional subjects in using elaborative processing. Concrete subjects used deep processing significantly less than did either formal or transitional subjects who did not differ. All subjects
Figure 2. Mean ILS score as a function of ILS and IPDT categories.
used methodical study less than the other learning styles except for concrete subjects who were comparable on their deep and methodical styles.

Thus, formal operators appear to capitalize on their greater cognitive skills by using deep and elaborative processing; whereas, concrete subjects use elaborative processing and fact retention more heavily. Therefore, our third hypothesis also seems to be supported by the data. Finally, transitional subjects are also transitional in their use of learning styles showing no clear cut distinction between deep, elaborative and fact retention styles.

Returning to our original thesis, the results of this study indicate that cognitive style, personality factors such as dogmatism, and developmental level all act and interact in affecting student academic performance. It appears that academic aptitude is has multiple antecedents and requires further research to examine and understand its complex nature.

References.


