Visual-Verbal and Analytic-Holistic Strategies, Abilities, and Styles

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ABSTRACT Learners were told to study a science chapter by using either an imagery or verbal repetition strategy and were also told to be either analytic by focusing on details or holistic by relating specifics to more inclusive concepts. Posttest scores were positively related to the learner's abilities and reported use of deep processing strategies, but were not affected directly by the strategy manipulations. Learning was more often correlated with abilities not matching the study strategy than with matching strategies. However, learners reported more favorable attitudes toward the study strategy when the strategy matched strengths in cognitive ability.

There is mounting evidence that the way a learner processes information affects what is learned and remembered. Theorists claim that learners who process information deeply and elaboratively should recall more than those who do not (Craik & Lockhart, 1972; Craik & Tulving, 1975). According to the depth of processing concept, learning is facilitated when the learner thinks about the deeper meaning and conceptual associations of new information where depth "implies a greater degree of semantic or cognitive analysis" (Craik & Lockhart, 1972). Elaboration, on the other hand, facilitates learning as the learner associates new information with past experiences and knowledge. The differences between deep processing and elaboration is as follows: "Elaboration is an exercise in applying information to one's own level of personalizing it, while deep processing is a more 'academic' exercise in verbal classification and categorical comparison" (Schmeck, in press). We contend that deep processing involves more analytic information processing while elaboration involves more holistic processing. Similar to the definitions used by previous researchers (Clark & Frisby, Note 1), we define analytic thinking as that which enables an individual to reduce information such as a stimulus array to its essential component parts—that is, to extract what is relevant from potentially distracting surroundings. During deep processing, the learner attends to the parts rather than the whole. Analytic ability in a learner should facilitate learning by contributing to the learner's use of deep processing strategies to critically categorize and classify information. Holistic or synthetic thinking, on the other hand, enables an individual to put the discrete parts of an information presentation together into a meaningful whole by focusing on the whole rather than on the parts. During elaboration, a learner probably uses holistic thinking to see how new information relates to prior knowledge—that is, how the new part fits into the existing whole of cognitive structure. Ability in holistic thinking, then, should facilitate learning by enabling the learner to use elaborative processing strategies.

Several studies have tried to manipulate analytic-holistic information processing to investigate the effects on learning while other studies have focused on the correlation of learning with analytic-holistic abilities and strategies. One problem with most previous work in the area is that the analytic-holistic processing variable has been confounded with the factor of pictorial-verbal mode. This study included all four combinations of the mode and process factors (verbal-analytic, verbal-holistic, pictorial-analytic, and pictorial-holistic) to fully investigate the relative contribution and possible interaction of the two factors. The importance of the mode factor has been fairly well established since a good deal of evidence indicates that learning is facilitated when the learner processes information visually by drawing pictures or mentally imagining pictures (Alesandrini, 1982). One study manipulated both mode and analytic-holistic processing by telling learners to draw pictures or write paraphrases that were either analytic and focused on details, or holistic, with specifics related to more inclusive concepts (Alesandrini, 1981). According to judges' ratings in that study, the drawings focused on details of a specific concept when learners were told to draw analytic pictures to illustrate science concepts, while the drawings showed how each concept

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related to the broader context when learners were told to process the information holistically. Using the holistic strategy facilitated learning for female students in the study while all students benefited by using the visual strategy. Unfortunately, the study included only two measures of ability and we would classify both as tests of holistic ability. Therefore, it was not possible to test the interaction of both levels of each treatment factor with both levels of each ability factor in that study. A recent study of the relationship of abilities and reading comprehension did include all four types of abilities (Alesandрини & Wilson, Note 2). According to the results of that study, analytic ability is related to reading comprehension, especially to the recall of details from a passage, while synthetic or holistic ability does not correlate with overall comprehension although it is weakly correlated with comprehension of the central purpose of a passage. Reading comprehension is also correlated with reports of using deep processing strategies but not elaboration strategies (Schmeck, 1980; Alesandрини & Wilson, Note 2). One explanation of these results is that when learners encounter new material, they may first subject the information to verbal classification and categorical analysis as they read. Analytic ability and deep processing strategies may be most helpful at the initial stage of the reading/learning process. Elaboration strategies may then be valuable in promoting longer term retention after the learner has analyzed and categorized the information and proceeds to relate it to prior knowledge. One limitation of the Alesandрини and Wilson study is that the effects of analytic and holistic processing on the reading/learning process cannot be determined because the variable was not manipulated. The present study extends previous work by investigating the relationship between learning and manipulated strategies, abilities, and self-reported strategies relative to analytic and holistic information processing.

The main purpose of this study was to determine the effects on learning and attitude of telling learners to study a chapter using either a visual or verbal processing strategy, along with either an analytic strategy (focus on details) or holistic strategy (relate specifics to more inclusive concepts). Additionally, the study investigated the relationship between learning and: a) the learner’s ability to process information analytically and synthetically in both the pictorial and verbal modes; and b) the learner’s self-reported strategies of deep processing and elaboration. Both levels of the mode and process factors were included to avoid any confounding of mode and process, a problem in previous research on analytic-synthetic strategies and abilities (Alesandрини, 1981; Krevoy, 1978; Leps, 1979).

Method

The subjects included 104 undergraduate college students who volunteered for the experiment. Subjects were paid $5.00 if they finished the 3-hour session. The students were randomly assigned to one of the four treatment conditions.

Students read a 5,200 word selection from Rachel Carson’s book The Sea Around Us, copied with permission from the publisher. The selection was a chapter entitled “The Sunless Sea” and described the conditions and marine life at great ocean depths. Learners were told to apply the study strategy while reading and studying the chapter.

Learners were told to read and study the chapter using one of the following strategies: 1) Visual-analytic strategy—mentally picture passage contents while focusing on details and specific information; 2) Visual-holistic strategy—mentally picture passage contents while relating specific information to broad concepts; 3) Verbal-analytic strategy—mentally paraphrase passage contents while focusing on details and specific information; or 4) Verbal-holistic strategy—mentally paraphrase passage contents while relating specific information to broad concepts.

For example, the following excerpt is part of the directions given to learners in the visual-holistic study condition.

**STUDY DIRECTIONS**

While you are reading, you should stop after reading each page and think about the material you have just read. You should review the material by mentally picturing the information that you have just learned. That means that you should try to picture in your mind the abstract and verbal concepts that you just learned about by thinking of them concretely or pictorially. ADDITIONALLY: As you mentally picture what you have read, please think about the overall nature of the sea and think about how the specifics which you just learned about relate to that overall framework. In other words, you should think holistically by synthesizing the information that you are learning about. Your mental images should try to portray how the specific information that you just read about relates to the rest of the sea. Don’t think of specific information and focus on the details. Instead, think about how the specific information fits into the bigger picture.

To match the four treatment conditions, four types of ability were assessed. For both the pictorial and verbal tests, analytic tests were defined as those that require the respondent to focus more on the parts than on the whole or to pick out the parts from the whole in order to get the correct answer. Holistic tests were defined as those that require the respondent to mentally combine parts into a whole or to focus more on the whole than on the parts in order to get the correct answer. These criteria were applied in the selection of the following four tests of cognitive ability.
To assess pictorial-analytic ability, the Group Embedded Figures test (Olman, Raskin, & Witkin, 1971) was used because it requires the respondent to analyze a spatial whole in order to pick out a component part. The test contains 25 items which are partially shaded line drawings with simpler line-drawn figures embedded in each item. The task is to correctly trace the simpler figure embedded within the more complex figure.

Pictorial-holistic ability was assessed by the Street Figure-Completion test (Street, 1931). The Street test requires the respondent to recognize a spatial whole from the several component parts shown. The 13 items are silhouettes which have been partially omitted so that recognition of the portrayed object is difficult. Respondents must write down the name of the object.

Verbal-analytic ability was assessed by the Nonsense Sylllogisms test (French, Ekstrom, & Price, 1963). The test requires the learner to solve 30 formal syllogisms containing nonsense statements. The task is to indicate which conclusions follow logically from the stated premises and which do not. Respondents must determine whether statements such as the following (not an actual item) are logical: “All lamps are trees. All trees are horses. Therefore, all lamps are horses.” Since the respondent must sequentially focus on pieces of information to derive another piece of information, this test was selected as a measure of verbal-analytic ability.

Finally, verbal-holistic ability was assessed by the Similarities subtest of the Wechsler Adult Intelligence Scale (Wechsler, 1958). The test contains 13 items that require the respondent to see a higher level of relationships between the paired objects. If the respondent gives the higher level commonality of the two objects, a higher score is given than if the response is analytical, focusing on specific attributes of each object in the pair. For example, if the respondent were asked in what way a rabbit and a raccoon are alike (not an actual item), the answer “both are animals” would be given a higher rating than the rating “both have fur skins.”

The use of various study strategies and processing behaviors was assessed by the Inventory of Learning Processes (Schmeck, Ribich, & Ramanathan, 1977), which consists of true-false questions about the learner’s information processing strategies. The Inventory contains 62 items grouped into four scales which have a reliability of .79 to .88 (Schmeck et al., 1977). The Deep Processing scale (18 items) assesses the extent to which learners categorize information, critically evaluate the appropriateness of the categories, and compare and contrast categories with one another. The scale was labeled “Synthesis-Analysis” in earlier writings (Schmeck, et al., 1977) but was later termed “Deep Processing” to reflect its similarity to the depth of processing concept. A sample item from the scale is “I find it difficult to handle questions requiring critical evaluation,” which is keyed “false.” The Elaborative process-
verbalizing tendency. For example, a visualizer would answer 'true' to the following item: "My thinking often consists of mental pictures or images.'"

Since the experimental treatment consisted only of instructions to the learners, it was necessary to check whether the directions affected the nature of their thinking. To accomplish this task, two self-report items were used. Learners rated their thinking during reading and studying on two dimensions; namely, pictorial-verbal mode and analytic-holistic processing. Learners described their thoughts during study as: a) "more pictorial" or "more verbal"; and b) "more holistic" or more analytic.'"

**Procedure**

Students were tested in groups of 15–20. Learners took the ability and strategy tests prior to receiving the study directions and the chapter about the ocean. All students read and studied the chapter for 45 minutes after receiving the study directions. Following the study phase, the students handed in all materials and received the recall tests and the attitude questionnaire. Unlimited time was given during the test-taking phase. When all materials had been completed, students were debriefed and paid the fee for participation.

**Results**

As described earlier, the experimental manipulations in this study consisted of instructions to the learners to study and think about the lesson materials in certain ways. Self-report measures were used to determine the effectiveness of the manipulations. Learners were asked to report their thinking on the basis of pictorial-verbal mode and analytic-holistic processing using 2 point rating scales.

The group means for these ratings were calculated and are given in Table 1. As expected, 2 × 2 ANOVAs revealed a main effect for the mode directions on reported visual-verbal mode of thinking, \( F(1,99) = 19.75, p < .05 \), and a main effect for the processing directions on reported analytic-holistic thinking, \( F(1,99) = 40.79, p < .05 \). These results indicate that the two groups told to visualize passage contents reported that they experienced more pictorial thinking while the two groups told to paraphrase reported more verbal thinking. Similarly, learners given the holistic instructions reported more holistic thinking while learners told to analyze reported more analytic thinking. One limitation of these results, however, is that the learners may have been biased in their ratings because they knew what type of thinking was expected of them based on the directions given.

Mean scores on the 72 item analytic test and 15 item holistic test of learning were calculated for each group and are shown in Table 1. Since the two tests were highly correlated, with \( r(102) = .71, p < .01 \), they were combined in subsequent analyses. The four groups did not differ in their performance on the combined recall test according to a 2 × 2 ANOVA which revealed no

<table>
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<th>Group</th>
<th>n</th>
<th>Thinking Mode</th>
<th>Thinking Process</th>
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<th>Recall Tests Holistic</th>
<th>Attitude</th>
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<td>10.84</td>
<td>3.96</td>
<td>.11</td>
<td>97</td>
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*Mode was scored as 1 (more pictorial) or 2 (more verbal).
Processing was scored as 1 (more analytical) or 2 (more holistic).
Maximum possible score was 72.
Maximum possible score was 30.
Maximum possible score was 70.
Due to missing data, \( n = 26 \).
Due to missing data, \( n = 25 \).
Due to missing data, \( n = 103 \).
main effects for the mode factor, the processing factor, or an interaction of the two factors (all p’s > .10).

The effect of the treatment on attitudes was also investigated. The grand mean on the attitude measure is 46.60. (Some students failed to complete the attitude questionnaire, which was attached to the end of the recall tests, resulting in an N of 97.) This grand mean is somewhat closer to the maximum score of 70 (the most favorable attitude) than the minimum score of zero (the most negative attitude). Apparently, the learners tended to like the study tasks. Group means on the attitude test were also computed and are shown in Table 1. Learners who were told to visualize reported slightly more favorable attitudes than those tod told to paraphrase according to the results of a 2 x 2 ANOVA, F(1,93) = 3.8, p = .05.

To investigate the relationship between learning and individual differences, correlations were computed between the tests of learning and the ability tests and other measures. The best single predictor of learning in this study was the Similarities test with r(102) = .50, p < .01. The other three ability tests were also mildly correlated with learning scores as follows: Embedded Figures, r(101) = .35, p < .01; Street Figure-Completion, r(102) = .29, p < .01; and Syllogisms, r(102) = .26, p < .01. According to a stepwise regression designed to maximize R^2, the second best predictor of learning scores in this study was the Deep Processing scale, accounting for 15% of the variance. The Elaborative Processing scale was only weakly correlated with learning in this study, r(102) = .25, p < .05.

To investigate the possible interaction of treatment conditions with ability and other variables, correlations were computed between the individual difference variables and learning scores for each treatment condition and are presented in Table 2. Group correlations between the individual difference measures and the attitude scores are shown in Table 3. If the treatment conditions capitalized on learner abilities, the coefficients along the main diagonal should be largest. The assumption is that learning is maximized when the study condition matches the learner’s abilities. For example, pictorial-holistic ability as reflected by the Street test should correlate most highly with learning in the visual-holistic treatment group. Visual inspection, however, indicates that such a pattern did not occur. In fact, none of the coefficients along the main diagonal are statistically significant. Conversely, if there is a compensatory relationship between abilities and treatment strategies then the coefficients along the other diagonal should be largest. The observed pattern fits the compensation model more closely than the capitalization model. The Embedded Figures test (visual-analytic ability) was mildly correlated with recall in the verbal-holistic treatment, r(26) = .51, p < .01. A similar correlation was observed between the Similarities test (verbal-holistic ability) and learning in the visual-analytic treatment group, r(24) = .57, p < .01.

Deep Processing was positively correlated with recall for the two groups told to analyze, r(24) = .64, p < .01 and r(21) = .53, p < .01, for the visual-analytic and verbal-analytic treatment groups respectively. Elaboration was not differentially related to learning across the four study conditions.

The correlational pattern was rather different for attitude scores. The only significant correlations fell along the main diagonal. Street test scores (visual-holistic ability) were mildly correlated with attitude scores in the visual-holistic study group, r(21) = .50, p < .05. Similarly, scores on the Syllogisms test (verbal-analytic ability) were correlated with reports of positive attitude in the verbal-analytic study condition, r(19) = .48, p < .05.

Although there was no overall correlation between a preference for visualizing and recall or attitude in this

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Street</th>
<th>Figure</th>
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<td>.43</td>
<td>.57*</td>
<td>.67*</td>
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<td>.05</td>
<td>.47*</td>
<td>-.11</td>
<td>.53*</td>
<td>.33</td>
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*Refers to Nonsense Syllogisms test.
*Due to missing data, n = 25.
*p < .01.
study, VVQ scores related differentially to dependent measures across the four conditions. Preference for visualizing was inversely correlated with recall for learners told to use the verbal-analytic study strategy, $r(21) = -0.43, p < .05$. Preference for visualizing was positively related to attitude scores for learners told to use the visual-holistic study strategy, $r(21) = -0.47, p < .05$.

**Discussion**

Although no main effect for study strategy was observed in this study, noteworthy patterns of relationship emerged between learning and ability across the four treatment conditions. Learning was more often correlated with abilities that did not match the study strategy than with matching strategies. The results suggest that study strategies can facilitate learning when they are not matched to the learner's ability strengths presumably because the strategies compensate for the learner's weakness. Although this mismatch was beneficial to learning, students tended to like the strategy that matched their abilities. Perhaps college students are most comfortable using a strategy that they are more capable of applying but may engage in more elaborate processing when directed to use a strategy that is not typically used. When the study strategy conflicts with a learner's typical style of thinking or habitual strategies, however, it may not facilitate learning as suggested by the inverse correlation between visualizing preference and learning in the verbal-analytic strategy condition. The high correlation between deep processing and learning for the two analytic strategy groups lends support to the notion that strategies can capitalize on a learner's styles and habits while they compensate for weakness in certain abilities.

The lack of a main effect here may have been due to the fact that learners were not trained in the effective use of these strategies nor were they required to respond overtly. One study required learners to draw pictures or write out paraphrases that were either analytic or holistic while studying and results indicated weak but significant strategy effects (Alesandrini, 1981). Students may need more encouragement and training before they can apply the study strategies successfully.

Finally, the success of the deep processing scale in predicting learning in this study suggests that analytic information processing habits may facilitate learning. Several studies have related reading comprehension to the readers' ability and tendency to process information analytically. Elaborative processing has not been correlated with reading. In this study, deep processing was the better predictor of learning especially when the learners were directed to use analytic study strategies. Yet, elaborative processing was weakly, but significantly, correlated with learning. Perhaps elaborative processing would have been more highly correlated with a test of learning that actually assessed the learner's understanding of how the new pieces of information related to the general, organizing concepts. The so-called "holistic" recall test turned out to be highly correlated with the analytic test and therefore did not provide a valid assessment of the intended learning outcomes. Future research efforts should further investigate the relative contribution of deep processing and elaboration at different stages in the learning process.

**REFERENCE NOTES**


**REFERENCES**


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