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ABSTRACT

Study strategies are the activities that an individual uses to facilitate learning. Although no consistent findings exist to show the factors that comprise the study-strategy concept, a three-factor conceptualization (cognitive, affective, and behavioral) is often suggested. These factors were studied with 128 undergraduates of high and low ability based on their scores on the ACT Assessment. The Survey of Study Habits and Attitudes and the Learning and Study Strategies Inventory were completed by each student. To assess construct validity, correlation coefficients were also computed between the various scale scores of the two instruments. The instruments were found to measure at least some of the same constructs or factors. Results indicated that the study-strategy concept is composed of: (1) a personality factor of personal values and feelings; (2) a cognitive skills factor; and (3) a behaviors and techniques factor concerned with the use of study skills. Results do support a three-factor structure of the concept. (Contains 6 tables and 29 references.) (SLD)

An Analysis of the Measurement of Study-Strategy

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Since the early 1940's researchers and educators alike have been interested in the differences in academic ability between high- and low-achieving students. Some of the variables that have been shown to differentiate these two groups of student are study skills (such as highlighting and outlining), information processing activities (such as mental organization and the drawing of inferences) and activities that help maintain a positive attitude and extended concentration. Activities and attitudes that can enhance and improve academic achievement include such areas as systematic study, better knowledge of study skills, self motivation, organizational skills, and goal direction. These activities, and others, have been grouped together and labeled "study strategies." Specifically, study strategies are "techniques, principles, or rules which enable a student to learn to solve problems and complete tasks independently" (Schumaker & Sheldon, 1985). These rules, principles, procedures, and behaviors are frequently applicable to a wide variety of learning tasks. In general, study strategies are a group of cognitive, affective, and behavioral activities that an individual utilizes to facilitate learning.

One of the reasons that educators and researchers have taken an interest in study strategies is that these activities (strategies) have been shown to affect academic achievement. Thus, when students are taught the effective use of study strategies, an increase in their academic ability and performance is expected. Over the years a large number of instruments have been developed to assess study strategies. In a thorough review of *Buros Tests in Print*, the *Mental Measurements Yearbooks*, and *Tests on Microfiche*, and in locating the citations found in the various studies reviewed, eight different instruments were identified that assess general study strategies for use with college freshmen. These were: (a) the *Study Habits Inventory* (Wrenn, 1933, 1941); (b) the *Study Habits Inventory*, revised edition (Wrenn, 1941); (c) the *Study Habits Inventory* (Brooks & Heston, 1945); (d) the *Survey of Study Habits and Attitudes* (Brown & Holtzman, 1965); (e) the *Student Attitudes Inventory* (Entwistle et al., 1971); (f) the *Study Attitudes and Methods Survey*

(Michael, Michael & Zimmerman, 1972); (g) the *Study Behavior Inventory* - Form D (Mueller, 1984); and (h) the *Learning and Study Strategies Inventory* (Weinstein, Palmer & Schulte, 1987). Seven other instruments were mentioned by name, but neither the instrument itself, nor other information concerning them could be located. Of the eight instruments identified, only two provided any information as to their scoring method and interpretation of results. These two instruments, the *Survey of Study Habits and Attitudes* - Form C and the *Learning and Study Strategies Inventory*, are currently being used at institutions of higher learning around the country as a screening and diagnostic tool for students, and as evaluation instruments for classes which teach study strategies. (For an indepth discussion of the eight instruments named above, see Gordon, 1992.)

Most of these instruments, however, lack a theoretical framework or paradigm and a concern for comparability with other study-strategy assessment instruments. This lack of concern for comparability between study-strategy instruments is evidenced by the lack of research involving instrument comparison. In addition to the lack of research comparing the various instruments, there is little overlap in the factors they assess, or in the terms they use to label those factors. It was further noted that even though the instruments are reported to measure many of the same constructs or factors contained in the study-strategy concept, no two instruments were developed from the same definition or conceptualization of study-strategy. In fact only one study could be found that compared any two study-strategy instruments, and in that study only certain scales from one of the inventories were used. This lack of comparability is further seen in a comparison of the content and psychometric properties of the eight identified study-strategy instruments. As seen in Table 1, some of these differences include the type of rating scale used, the number of items, the number and type of subscales, and the amount of information concerning validity and reliability. Given this paucity of study-strategy research, empirical evidence is needed that clarifies the study-strategy concept and shows the relationships among the instruments. This advances both the soundness of study-strategy measurement and the field of study-strategy itself.

The present study responds to this need by examining the concept and measurement of several critical factors of the study-strategy concept.

Insert table 1 here

Weinstein and MacDonald (1986) describe study-strategy as "any cognitive, affective, or behavioral activity that facilitates encoding and storing, and retrieving or using knowledge." The cognitive factor includes activities such as forming mental bridges between newly acquired information and pre-existing information, using elaboration and mnemonic techniques, and drawing inferences and conclusions. Examples of activities connected with the affective factor include methods of dealing with frustration, managing anxiety, maintaining a positive attitude throughout a project, and avoiding procrastination. And lastly, activities associated with the behavioral factor include outlining, note-taking, highlighting, rereading, self-testing, and other activities commonly referred to as "study skills." Other researchers have also articulated this three-factor model of study-strategy (O'Neil & Spielberger, 1979; Weinstein & Mayer, 1985; Wittrock, 1978).

Dansereau (1978), in some of his early research concerning study-strategy, identified two "mutually supportive" types or classes of strategies. The first class, termed "primary strategies," are the methods and techniques used to acquire, comprehend, store, and recall acquired information. The second class, termed "support strategies," are the techniques used to both establish and maintain an appropriate learning attitude and to set goals and schedule activities, and the methods used for coping with loss of concentration due to fatigue and frustration. In using the terminology articulated by Weinstein and MacDonald (1986), primary strategies would most closely correspond to the behavioral factor, whereas the support strategies would include both the cognitive and affective factors.

Brown an Holtzman in revising their original *Survey of Study Habits and Attitudes* (*SSHA*) inventory into two separate instruments, one for use with high school students (*SSHA-H*)

and the other for use with college level students (*SSHA-C*), identified four primary components of study-strategy which clustered first into two subscales and then into an overall scale. A panel of 15 experts used the items' commonly-shared content to group them into the four primary scales. In a study designed to both evaluate the *SSHA-H* inventory's usefulness with high school students and to validate the seven a-priori scales, Holtzman and Brown (1968) collected academic data along with scores on the *SSHA-H* for 10,888 students in grades 7 through 12 from six states. Intercorrelations between the four primary scales ranged from .51 to .75. The two highest correlations were between the pair of primary scales making up the Study Habits subscale and the pair of primary scales making up the Study Attitudes subscale. Given the lower correlations among the other various pair combinations, the study concluded that the Delay Avoidance and Work Methods scales (r=.70), and the Teacher Approval and Education Acceptance scales (r=.75) had more in common with each other than with the other scales. Similar findings were also reported for the *SSHA-C* in a study involving 3,054 college freshmen: the Delay Avoidance and Work Methods scales had a correlation of .70, and the Teacher Approval and Education Acceptance scales had a correlation of .69 (Brown & Holtzman, 1968). Visual examination of the items that make up the two subscales showed that the items comprising the Study Habits subscale (Delay Avoidance and Work Methods) are concerned with the activities and behaviors associated with study-strategy, while the items comprising the Study Attitudes subscale (Teacher Approval and Education Acceptance) are concerned with both the cognitive and affective aspects of study-strategy.

As Brown and Holtzman noted, implicitly built into the *SSHA* inventory is the notion of a hierarchy of factors. This hierarchy has the Study Orientation factor (or overall scale) at the top of the pyramid, the Study Habits and Study Attitudes factors at the second tier, and the four primary scales at the third tier. In a study designed both to empirically assess the validity of the seven a-priori scales and to test the hypothesis of the hierarchical structure of study-strategy, Khan and Roberts (1975) sampled 243 senior high school students and 603 freshman university students on the *SSHA-C* (total N=846). Pearson Product Moment correlations were obtained among the 100

items on the SSHA-C. To determine whether covariation among responses could be explained by the four primary scales, the inter-item correlation matrix was analyzed by means of principal component analysis. To aid in the psychological interpretation, the four components associated with the first four eigenvalues were transformed to a simple structure by the normalized varimax procedure. Interpretation was made by noting the proportion of items which showed loadings higher than the critical value (arbitrarily selected as .35) on the appropriate scales. Examination of the loadings indicated that 64% (15 out of 25) of the items were above the critical value on the first scale; 68% (17/25) on the second scale; 80% (20/25) on the third scale; and 12% (3/25) on the fourth scale. Results of the analyses of transformation of the observed factor matrix to the constructed matrix yielded coefficients of congruence of .54, .71, .66 and .28 for the four primary scales, respectively. Using the rule of thumb that coefficients of .90 or above indicate good correspondence, .80-.90 fair, and .70-.80 poor, Khan and Roberts (1975) reported that there seems to be at best a poor correspondence between the hypothesized scales and the observed scales.

Thus, the results of factoring the four primary scales did not substantiate the type of structure or the hierarchy proposed by Brown and Holtzman in their (*SSHA-C*). The factors of Study Habits and Study Attitudes did not emerge; rather, the one general factor, Study Orientation, resulted from the analysis of inter-relationships among the four primary scales. Intercorrelations of the general factor with the factor loadings of the four primary scales showed the general factor to be composed mainly of items from two scales, the Delay Avoidance scale and the Teacher Approval scale (.78 and .73, respectively), compared to .52 for Work Methods and -.42 for Education Acceptance. Further analyses showed the general factor explained 61% of the variance in the Delay Avoidance scale, 53% of the variance in the Teacher Approval scale, 27% of the variance in the Work Methods scale, and only 18% of the variance in the fourth scale, Education Acceptance, which Khan and Roberts renamed Academic Diligence. (As a reminder to the reader, according to Brown and Holtzman, it was theorized that the Study Habits subscale [factor] was

composed of the Delay Avoidance and Work Methods scales, and the Study Attitudes subscale [factor] was composed of the Teacher Approval and Education Acceptance scales.)

Khan and Roberts (1975) summarized their findings by reporting that their results somewhat support the a-priori classification of the items for three of the primary scales (Delay Avoidance, Work Methods and Teacher Approval), but not for the fourth primary scale (Education Acceptance), and that when taken as a whole, the results do not support the three tier-hierarchy in the *SSHA-C* as suggested by Brown and Holtzman. Furthermore, Khan and Roberts' results also failed to support the notion of two distinct factors in the study-strategy concept: Study Attitudes and Study Habits.

The *Learning and Study Strategies Inventory* (Weinstein, Palmer & Schulte, 1987; *LASSI)* is one of the most recent instruments developed to examine study strategies. It's development took over ten years and resulted in an inventory that assesses ten primary skills, which are hypothesized to form two subscales, one concerned with the affective domain and the other concerned with the cognitive or learning/study strategy domain (Mealey, 1988). Only one study was found which performed some type of factor analyses upon the scales. In that study, Cole (1988) performed two separate factor analysis on the *LASSI* using principal component analysis with varimax rotation. The first analysis involving only the *LASSI* resulted in two factors containing seven of the ten primary scales. And in the second analysis, involving the *SSHA-C* and the *LASSI* together, a three-factor structure resulted. In neither one of the analyses did Cole attempt to name the factors. However, in the second analysis two of the factors uncovered were the same ones she found in the *LASSI*-only analysis, while the third factor was composed of the Delay Avoidance, Teacher Approval, and Education Acceptance primary scales from the *SSHA-C*. Interestingly, there was no overlap between the two instruments' scales on any of the factors. This would indicate there is no intercorrelation among any of the factors on the two instruments, contrary to what would be expected if both instruments were measuring the same aspects of study strategy.

Though not specifically stated by Cole (1988), the findings from her analysis would lead one to believe there are a total of three factors comprising the general study strategy concept: the

two factors containing seven of the primary *LASSI* scales (Factor 1: Information Processing, Study Aids, and Self-Testing; Factor 2: Anxiety, Concentration, Selecting Main Ideas, and Test Taking Strategies), and the third factor defined by the Delay Avoidance, Teacher Approval, and Education Acceptance primary scales on the *SSHA-C*. Labels for the three factors were never reported, nor did she discuss what happened to the three other scales on the *LASSI* and the one scale on the *SSHA-C*.

Although research on study-strategy has been ongoing for close to 50 years, no information could be found about what work has been done to systematically develop a working paradigm. Such a paradigm would not only bring about convergence in theory development and measurement, but also would begin to allow for valid comparison among instruments. Weinstein and Underwood (1985), in their report on an extensive review of the commercially-available and experimental/diagnostic instruments, concluded the following: (1) there seems to be no consistent definition of study skills, (2) though many instruments have subscales, the reliability of them is often so low that they cannot be used separately, (3) no instrument has been validated for use as a diagnostic instrument, and (4) although recent research has suggested that there are two components to effective study--consistent and regular study, and an "active" learning style--most items in published inventories deal primarily with the first

Recognizing the lack of agreement among researchers and educators as to the components that make-up the study-strategy concept, Wilson and Weinstein (1989) attempted to address this issue through the use of a three-round modified Delphi Technique. (See Barnett, Danielson and Algozzine, [1978], or Delbecq, Van De Ven and Gustafson, [1975] for a detailed description of the Delphi technique.) Following an extensive review of the literature and a clarification of the identified material, Wilson and Weinstein isolated 53 skills or components which were associated in some way with study-strategy. These items, with a brief description, formed the research instrument. A three-round modified Delphi technique followed to generate consensus about the content categories. From the original 53 items, the panel came up with 12 components which they believed comprise the study-strategy concept. Though no further reduction was done on the 12

components or factors, a visual inspection of the items suggested that the components could be further regrouped to form three categories: one dealing with behavior (e.g., note-taking, time management, test readiness); a second dealing with cognitive activities (e.g., problem solving, drawing inferences, goal setting); and a third dealing with the affective domain (e.g., self-directional process, concentration/attention).

Though no formal paradigm of study-strategy has been proposed or accepted by the field-at-large, those working in the field of study-strategy would concur with the view that it is composed of three factors: one cognitive, one affective, and one behavioral (O'Neil & Spielberger, 1979; Weinstein & MacDonald, 1986; Weinstein & Mayer, 1985; Wittrock, 1978). The cognitive factor is most closely connected with information processing. Forming mental bridges between old and new information, creating analogies, and organization of information fall into this category. The affective factor takes in such things as maintaining a positive outlook about one's work and managing frustration and anxiety. And the behavioral factor includes activities which are more commonly known as study skills (i.e., outlining, highlighting, note-taking, rereading).

To summarize, it can be concluded that no consistent finding exists as to what factors comprise the study-strategy concept. Both theoretical research and the instruments developed which purport to measure study-strategy suggest three possible factors: (a) a factor concerned with behaviors or physical activities that enhance the capacity for acquiring, retaining, and using information, which are more commonly referred to as study skills and include activities such as highlighting, rereading, outlining, scheduling and planning, and self-testing; (b) a factor concerned with cognitive processes such as creating mental images, organizing notes and reading material into some logical order, and drawing inferences and conclusions; and (c) a factor concerned with the affective domain which include maintaining a positive attitude, believing one has control over what happens to oneself in school, and effectively managing stress and anxiety. When only two factors are measured, either the cognitive and affective factors are grouped together as one, or only a cognitive factor or an affective factor is measured, along with a behavioral factor.

This three-factor conceptualization can be used to provide a framework for analysis and comparison of study-strategy instruments for two reasons. First, each of the three factors has been shown to be related to academic success; and second, all of the instruments that could be located contained items that, through a visual inspection, could be placed under one of the three factors. Evidence for the construct validity of the study-strategy paradigm as outlined above has not been reported in the literature. To provide such evidence, the factor or factors that comprise the constructs measured by each instrument must be determined; then the instruments must be compared for similarities. Ferrell (1983), in her analysis of four learning-styles instruments, used just such a technique and found it both useful and effective. Thus the fundamental research question driving this study is: "What factors are valid measures of study-strategy?

Method

Subjects

Subjects for this study were recruited from fulltime undergraduate students enrolled at a large research institution in the Southwest. The sample consisted of a total of 128 students, with 63 (49.2%) students enrolled in the Undergraduate General Honors Program and 65 (50.8%) students enrolled in the Introductory Studies/Developmental Studies Program. The Undergraduate General Honors Program is open to all freshman students who scored a 29 or above on the English section of their *ACT* and to upperclass undergraduate students who have obtained a minimum cumulative GPA of 3.2. Admission into the Introductory Studies/Developmental Studies Program is based upon the student having received an *ACT* score of 15 or less (if taken), or having failed one of the general placement tests for math and reading given to entering freshmen by the university. Students who volunteered to serve as research participants were asked to complete: (a) a Participant Consent and Release of Information Form , (b) a Research Participant Biographical Data Sheet designed to obtain general information about the student, and (c) two study-strategy inventories: the *Survey of Study Habits and Attitudes* - Form C, and the *Learning and Study Strategies Inventory* .

Instruments

The instruments used in this study are the *Survey of Study Habits and Attitudes* - Form C (*SSHA-C* ; Brown & Holtzman, 1965), and the *Learning and Study Strategies Inventory* (*LASSI*; Weinstein, Palmer & Schulte, 1987). These instruments were selected for two reasons. First, they are widely used both as research tools and for academic counseling at universities across the country, and second, the authors of both instruments report that one of the uses of their inventories is to help students who are experiencing (or are predicted to experience) academic problems, by identifying their deficiencies and suggesting possible remediation.

Survey of Study Habits and Attitudes - The most current version of the *Survey of Study Habits and Attitudes* -Form C (*SSHA-C*) contains 100 items that measure four primary components (Delay Avoidance, Work Methods, Teacher Approval, and Education Acceptance), with 25 items in each scale. These four primary scales are then grouped to form two subscales, Study Habits (composed of Delay Avoidance and Work Methods) and Study Attitudes (composed of Teacher Approval and Education Acceptance). An overall scale, Study Orientation, is then formed by totaling the two subscales (Study Habits and Study Attitudes). For each of the items, the student responds with one of five choices: Rarely, Sometimes, Frequently, Generally, or Almost always.

Learning and Study Strategies Inventory - The *Learning and Study Strategies Inventory* (*LASSI*) was developed over a ten-year period and contains 77 items on ten primary scales (Attitude, Motivation, Time Management, Anxiety, Concentration, Information Processing, Selecting Main Ideas, Study Aids, Self-Testing and Test Strategies). Nine of the primary scales contain eight items each, while the tenth scale (Selecting Main Ideas) consists of only five items. It has also been postulated that the first five scales make up what has been labeled the affective component of the instrument, while the last five scales constitute the cognitive or learning/study-strategy component of the instrument (Mealey, 1988). Items are responded to by selecting one of the choices on a five-point rating scale consisting of: Not at all typical of me; Not very typical of me; Somewhat typical of me; Fairly typical of me; or Very much typical of me.

Both instruments are self-administered, and were administered at two separate class meetings, with each student completing both inventories. The order of administration of the inventories was counterbalanced to control for fatigue and/or possible testing carry-over effect.

Results

Instrument Reliability

First, descriptive analysis was performed to gain a better understanding of the two instruments. For the *Survey of Study Habits and Attitudes*, internal consistency (reliability) of the scales was obtained using Cronbach's alpha, whereas those reported by the authors in the manual utilized the K-R 8 method. Reliability coefficients from the present study ranged from .85 (Education Acceptance) to .90 (Teacher Approval), while the reliability coefficients found in the manual ranged from .87 for three of the primary scales (Work Methods, Teacher Approval, and Education Acceptance) to .89 for the fourth primary scale (Delay Avoidance). Though different coefficients were used to determine the scales' reliabilities, in this study the *SSHA-C* primary scales were found to be reliable and the reliability coefficients were comparable to those found by the authors.

For the *Learning and Study Strategies Inventory* (*LASSI*) internal consistency (reliability) of the scales was also obtained. Reliability coefficients from this study ranged from .67 (Study Aids) to .86 (Concentration), while the reliability coefficients found in the manual ranged from .68 (Study Aids) to .86 (Time Management). This study showed the reliability coefficients for the *LASSI* scales to be comparable to those reported in the manual and thus the *LASSI* scales were deemed reliable.

Next, construct validity was assessed by computing the correlation coefficients between the various scale scores on each of the two instruments. Of the 91 total correlations between the scales on the two instruments, all but three were significant at the $p<.01$ level. Examination of Table 2, and using the rule of thumb that correlations of .10 to .30 show a weak correlation, correlations of .31 to .60 show a moderate correlation, and correlations of .61 to .99 show a high or strong correlation, showed that 12 of the correlations are weak, 48 are moderate, and 31 are high. Thus,

results showed the majority (86.81%) of the correlations between scales on the two inventories were either moderately or highly correlated, thus showing a large amount of overlap in the assessment of study-strategy activities. These results would indicate that the *SSHA-C* and *LASSI* are measuring at least some of the same constructs or factors.

Insert table 2 here

Examination of only those correlations between the primary scales on the two instruments reveals the following picture. The Delay Avoidance scale on the *SSHA-C* is highly correlated with the Motivation, Time Management and Concentration scales on the *LASSI*, and moderately correlated with Attitude, Information Processing, Selecting Main Ideas, Study Aids, Self Testing, and Test Strategies. The Work Methods scale on the *SSHA-C* is also highly correlated with the Motivation and Concentration scales as well as the Selecting Main Ideas and Test Strategies scales on the *LASSI*; the Work Methods scale is also moderately correlated with the Attitude, Time Management, Anxiety, Information Processing, Selecting Main Ideas, and Self Testing scales. Finally, the Education Acceptance scale on the *SSHA-C* is highly correlated with the Attitude and Concentration Scales on the *LASSI*, and moderately correlated with the Motivation, Time Management, Information Processing, Selecting Main Ideas, Self Testing and Test Strategies scales. Overall, the Concentration scale on the *LASSI* is highly correlated with the Delay Avoidance, Work Methods, and Education Acceptance scales on the *SSHA-C*; and the Motivation scale on the *LASSI* is highly correlated with the Delay Avoidance and Work Methods scales on the *SSHA-C*. The Teacher Approval scale on the *SSHA-C* is not highly correlated with any of the scales on the *LASSI*, although it is moderately correlated with the Attitude, Motivation, Concentration, Selecting Main Ideas, and Test Strategies scales.

It is interesting to note that the subscales on the *SSHA-C* (Study Habits and Study Attitudes) are either moderately or highly correlated with all but two of the primary scales on the *LASSI*, and the two subscales on the *LASSI* (Affective and Cognitive) are either moderately or

highly correlated with all of the primary scales on the *SSHA-C*. In addition, the *SSHA-C* Study Orientation scale is highly correlated with both the Affective and Cognitive scales and with the overall *LASSI* scale, whereas the overall *LASSI* scale is highly correlated with the *SSHA-C* Study Habits and Study Orientation scales, and moderately correlated with the Study Attitudes scale. From these results it can be concluded that the *Survey of Study Habits and Attitudes* - Form C, and the *Learning and Study Strategies Inventory* are measuring many of the same or similar behaviors and activities associated with study strategies. Next this study will determine what those activities and behaviors are and how they group together.

Principal Component Analysis

The basic assumption of principal component analysis is that unobservable underlying dimensions, or factors, in a set of variables can be used to explain a complex phenomenon which is composed of many observable or measurable variables. Thus, principal component analysis is the statistical technique used to identify a relatively small number of factors that can be used to represent the relationships among a larger set of interrelated variables. In most instances, the derived factors themselves cannot be directly measured or observed (Norusis, 1985).

Accordingly, the primary goal of the principal component analysis in this study was to determine the underlying dimensions or factors of the study-strategy concept as measured by the various scales on the two study-strategy inventories. Since the instruments contain different numbers and types of scales, and since no definitive set of factors was found in the literature, it was hypothesized that the three categories articulated by various researchers (O'Neil & Spielberger, 1979; Weinstein & Mayer, 1985; Wittrock, 1978) working in the area of study-strategy would serve as the initial hypothesized factors. The hypothesized factors are: (a) a Cognitive/Psychological factor, (b) an Affective factor, and (c) a Behavior/Mechanics factor. In order to confirm this hypothesis, each inventory was analyzed separately to extract its underlying factor structure, and then the two inventories were combined and analyzed together to extract the composite set of underlying factors. Assignments were made based on a visual inspection of the

items, and then placing it in the most appropriate factor. Table 3 shows which factor each of the scales were hypothesized to load on.

Insert table 3 here

Results of the principal component analysis, using varimax rotation to aid in factor interpretation, resulted in a single factor solution for the *SSHA-C*, whereas the *LASSI* analysis resulted in a three-factor solution. For the *SSHA-C* the results support not the three-factor hypothesis but rather a single overall factor. For the *LASSI* the results do support a three-factor hypothesis, but the factor structure was different than hypothesized. For all scales the rotated factor matrix value showed a strong loading. Table 4 shows the factor loadings for the two inventories.

Insert table 4 here

Since one of the goals of this study was to determine the underlying structure of the study-strategy concept, the two instruments were next analyzed together. Results of that principal component analysis, using varimax rotation, resulted in a three-factor solution. Here again, though the three factor structure did emerge as hypothesized, the scales did not load on the hypothesized factors. Table 5 shows the factor loadings for the two inventories combined.

Insert table 5 here

Interpretation of the derived factors was made by visually examining the items from each scale that loaded on each factor. Factor 1 items were mainly concerned with emotions, personal values, keeping up to date on work, paying attention and keeping on task, and locus of control (internal vs. external). This factor was labeled the Personality factor. Factor 2 items were mainly

concerned with methods of coping with anxiety, focusing on the task or work at hand and paying attention to detail, and organization. This factor was labeled the Cognitive Skills factor. Factor 3 items were mainly concerned with the use of external aids and tools, study skills (note-taking, rereading, outlining and underlining), and making work personally meaningful. The most appropriate label for this factor was Behaviors and Techniques.

In comparing the results from the two separate principal component analyses to the analysis involving the two inventories together, it is interesting to note that the factor structures were almost identical. In both analyses, the scales from the *LASSI* loaded on the same factors, and for the *SSHA-C*, three of the four scales (DA, TA, EA) loaded on one factor while the fourth scale (WM) loaded on another. In addition, although the Work Methods scale did load on Factor 2, examination of the factor matrix values of the Work Methods scale showed that the matrix loading values for factors one and two (.54322 and .63828) are close enough that the Work Methods scale could possibly load on either one or both of the two factors. Table 6 lists the scales on each instrument that were expected to load on each hypothesized factor.

Insert table 6 here

In summary, when principal component analysis was performed individually on each of the two study-strategy inventories the results showed a single-factor solution for the *SSHA*-C, a three-factor solution for the *LASSI*, and when both instruments were analyzed together, a three-factor solution was obtained. The three factors for the analysis involving both inventories were identified as a Personality factor, a Cognitive Skills factor, and a Behaviors and Techniques factor.

Summary

To assess construct validity, correlation coefficients were also computed between the various scale scores on each of the two instruments. Results showed that the majority (86.81%) of the correlations between scales on the two inventories were either moderately or highly correlated, thus showing a large amount of overlap in the assessment of study-strategy activities. These

results also indicate that the *SSHA-C* and *LASSI* are measuring at least some of the same constructs or factors. Furthermore, this overlap is mainly concentrated on the Delay Avoidance and Work Methods scales on the *SSHA-C*, and the Motivation and Concentration scales on the *LASSI*. Here too, all correlations were significant ($p<.01$).

Principal component analysis was then performed individually on each of the two study-strategy inventories, followed by a principal component analysis involving both of the inventories combined. The principal component analyses were performed to determine the true factors that comprise the study-strategy concept as measured by each instrument individually and then by the two inventories together. Results showed that the number of factors varied depending upon the inventory; the *SSHA-C* resulted in a single-factor solution; the *LASSI* resulted in a three-factor solution; and the two inventories together resulted in a different three-factor solution. The three factors from the analysis involving both inventories were identified as a Personality factor, a Cognitive Skills factor, and a Behaviors and Techniques factor.

Final Summary and Conclusions

Results from the present study seem to suggest that the study-strategy concept is composed of three factors: (a) a personality factor which addresses personal values and feelings about education, emotions, keeping on task and paying attention, and locus of control; (b) a cognitive skills factor which is concerned with mental processes such as methods of dealing with anxiety, focusing on the problem and paying attention to detail, and organization of information; and (c) a behaviors and techniques factor which is concerned with the use of study skills such as outlining, note-taking, and self-testing, use of external aids and tools, and making the work personally meaningful. These results do provide support for the three-factor structure of the study-strategy concept as discussed by various researchers (O'Neil & Spielberger, 1979; Weinstein & Mayer, 1985; Wittrock, 1978), but with slightly different labels and content.

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Table 1

Comparison of Content and Psychometric Properties of Study Strategy Instruments

Title	*Study Habits Inventory*	*Study Habits Inventory*	*Study Habits Inventory*
Author	Wrenn (1933)	Wrenn (1941)	Brooks & Heston (1945)
Uses	research/commercial	research/commercial	research
Rating Scale	4-point rating scale Rarely or never to Almost always	not available	bi-polar Yes / No
Number of Items	46	28	75
Scales	General study attitudes & behaviors Reading & note-taking techniques Coping with examinations	Reading & note-taking techniques Habits of concentration Distribution of time & social relationships in study General habits & attitudes of work	Separate scales not used; only overall score which is the total number of "correct" responses
Hypothesized Factors	Behaviors Affective	Behaviors Affective Cognitive	Behaviors Affective Cognitive
Validity	not available	correlation with GPA: .24 to .58	not available
Reliability	not available	not available	not available

(cont. on next page)

Table 1 (cont.)

Comparison of Content and Psychometric Properties of Study Strategy Instruments

Title	*Survey of Study Habits and Attitudes*	*Study Attitudes Inventory*
Author	Brown & Holtzman (1967)	Entwistle, Nisbet, Entwistle & Cowell (1971)
Uses	research/commercial	research/commercial
Rating Scale	5-point rating scale Rarely to Almost always	bi-polar Agree / Disagree
Number of Items	100	47
Scales	Primary scales Delay Avoidance (DA) Work Methods (WM) Teacher Approval (TA) Education Acceptance (EA) Subscales Study Habits (DA + WM) Study Attitudes (TA + EA) Overall scale Study Orientation (SH + SA)	Motivation Study methods Examination techniques Lack of distraction towards academic work Overall score
Hypothesized Factors	Behaviors Affective	Behaviors Affective Cognitive
Validity	correlation with GPA: DA .31; WM .32; TA .25; EA .35	correlation with GPA: Overall score .28 correlation with ACT: Overall score .14
Reliability	Kuder-Richardson Formula 8 coefficients DA .89; WM .87; TA .87; EA .87 Test-retest 4 week interval DA .93; WM .91; TA .88; EA .90 SO .94 Test-retest 14 week interval DA .88; WM .86; TA .83; EA .85 SO .88	not available

(cont. n next page)

Table 1 (cont.)

Comparison of Content and Psychometric Properties of Study Strategy Instruments

Title	*Study Attitudes and Methods Survey*	*Study Behavior Inventory - Form D*
Author	Michael, Michael & Zimmerman (1972)	Mueller (1984)
Uses	research/commercial	research
Rating Scale	4-point rating scale Not at all like me, or Different from me to Almost always, or Very much like me	4-point rating scale Rarely or never, to Almost always
Number of Items	150	46
Scales	Academic interest-Love of learning Academic drive/conformity persistent Study methods & systems Study anxiety Manipulation Alienation toward authority	General study habits and behaviors Reading and note-taking techniques Coping with examinations
Hypothesized Factors	Behaviors Affective Cognitive	Behaviors Affective Cognitive
Validity	correlation with GPA: .13 to .37; median .19	not available
Reliability	Test-retest: .68 to .79 Internal consistency .83 to .90	Test-retest .94

(cont. on next page)

Table 1 (cont.)

Comparison of Content and Psychometric Properties of Study Strategy Instruments

Title	*Learning and Study Strategies Inventory*
Author	Weinstein, Palmer & Schulte (1987)
Uses	research/commercial
Rating Scale	5-point rating scale Not at all typical of me to Very much typical of me
Number of Items	77
Scales	Affective subscale[1] Attitude Motivation Time Management Anxiety Concentration Cognitive subscale Information Processing Selecting Main Idea Study Aids Self Testing Test Strategies Overall scale
Hypothesized Factors	Behaviors Affective Cognitive
Validity	not available
Reliability	Test-retest: ATT .75; MOT .84; TMT .85; ANX .83; CON .85 INP .72; SMI .78; STA .75; SFT .78; TST .81

1. The authors do not themselves identify the subscales or overall scale; however, in a review of the instrument these scores were reported as scales being used (Mealey, 1988).

Table 2

Correlation Coefficients Between Scales on the SSHA-C and Scales on the LASSI

	SSHA-C Scales						
	DA	WM	TA	EA	SH	SA	SO
LASSI Scales							
ATT	.558*	.509*	.522*	.643*	.597*	.616*	.646*
MOT	.643*	.615*	.353*	.537*	.706*	.468*	.624*
TMT	.722*	.498*	.284*	.476*	.679*	.398*	.572*
ANX	.240*	.553*	.254*	.250*	.453*	.268*	.382*
CON	.613*	.628*	.475*	.611*	.697*	.573*	.676*
INP	.362*	.521*	.303*	.356*	.500*	.349*	.451*
SMI	.435*	.690*	.467*	.506*	.638*	.516*	.613*
STA	.351*	.262*	.051	.219	.342*	.139	.255*
SFT	.574*	.441*	.241*	.407*	.567*	.340*	.481*
TST	.376*	.693*	.463*	.451*	.608*	.486*	.581*
AFF	.713*	.733*	.479*	.637*	.812*	.588*	.744*
COG	.551*	.675*	.391*	.502*	.692*	.471*	.618*
Overall	.689*	.764*	.474*	.621*	.818*	.577*	.741*

*$p<.01$

Table 3

Hypothesized Factors on the SSHA-C and the LASSI

Instrument/ Scales	FACTORS		
	Cognitive/ Psychological	Affective	Behaviors/ Mechanics
Survey of Study Habits and Attitudes - Form C			
[1] Delay Avoidance			✔
Work Methods			✔
[2] Teacher Approval	✔	✔	
Education Acceptance	✔	✔	
Learning and Study Strategies Inventory			
[3] Attitude		✔	
Motivation		✔	
Time Management			✔
Anxiety		✔	
Concentration		✔	
[4] Information Processing	✔		
Selecting Main Ideas	✔		
Study Aids	✔		
Self Testing			✔
Test Strategies			✔

1. Study Habits scale
2. Study Attitudes scale
3. Affective scale
4. Cognitive scale

Table 4

Varimax Rotated Factor Structures for SSHA-C and LASSI for all Subjects

SSHA-C Scales	Factor I		
EA	.93031		
TA	.85227		
WM	.84571		
DA	.81506		
Eigenvalue	2.97140		
% Variance	74.3%		
LASSI Scales	Factor I	Factor II	Factor III
TMT	.83413	.13824	.22488
MOT	.79955	.18228	.28088
CON	.77104	.43006	.09431
ATT	.61450	.37806	.12405
ANX	.12130	.84362	-.00181
TST	.40057	.83406	.07011
SMI	.30615	.75065	.37555
STA	.16860	-.03543	.88442
INP	.11872	.36974	.82072
SFT	.54070	.03418	.70368
Eigenvalue	5.09326	1.55680	1.00171
% Variance	50.9%	15.6%	10.0%

Table 5

Varimax Rotated Factor Structures for SSHA-C and LASSI Together for all Subjects

Scales	Factor I	Factor II*	Factor III
EA	.85482	.23922	.14900
DA	.78721	.09106	.40975
TA	.73281	.33627	-.06363
ATT	.66225	.32606	.18539
CON	.63239	.45208	.27868
MOT	.59565	.24077	.48615
TMT	.57414	.18503	.50037
ANX	.06312	.84855	.02659
TST	.33023	.84660	.12063
SMI	.28067	.75628	.35806
WM	.54322	.63828	.26108
STA	.00949	.01487	.87980
SFT	.32352	.09747	.82102
INP	.07403	.40274	.72846
Eigenvalue	7.17127	1.70300	1.28608
% Variance	51.2%	12.2%	9.2%

* significant group differences, $p<.001$
Total variance accounted for = 72.6%

Table 6

Hypothesized (✔) and Outcome (✘) Factors on the SSHA-C and the LASSI

Instrument/ Scales	FACTORS					
	Personality		Cognitive Skills		Behaviors/ Techniques	
Survey of Study Habits and Attitudes - Form C	Hyp	Out come	Hyp	Out come	Hyp	Out come
[1] Delay Avoidance		✘*			✔	✘
Work Methods		✘		✘*	✔	
[2] Teacher Approval	✔	✘	✔			
Education Acceptance	✔	✘	✔			
Learning and Study Strategies Inventory						
[3] Attitude	✔	✘				
Motivation	✔	✘*				✘
Time Management		✘*			✔	✘
Anxiety	✔			✘		
Concentration	✔	✘*		✘		
[4] Information Processing			✔	✘		✘*
Selecting Main Ideas			✔	✘		
Study Aids			✔			✘
Self Testing					✔	✘
Test Strategies				✘	✔	

1. Study Habits score
2. Study Attitudes score
3. Affective score
4. Cognitive score

* Largest factor matrix loading