DOCUMENT RESUME

ED 359 221 TM 019 982

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TITLE Identifying Latent Variables Measured by the Study Activity Survey.
PUB DATE Apr 93
NOTE 13p.; Paper presented at the Annual Meeting of the American Educational Research Association (Atlanta, GA, April 12-16, 1993).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement; *College Students; Construct Validity; Factor Analysis; Higher Education; *Predictive Validity; Rating Scales; Self Efficacy; Self Evaluation (Individuals); *Study Habits; Study Skills
IDENTIFIERS *Latent Variables; Self Report Measures; Student Surveys; *Study Activity Survey

ABSTRACT

Possible relationships between student study behaviors and academic achievement were studied in an extension of a large-scale project at the Far West Laboratory. Factor analysis was used to identify latent variables measured by the 76-item Study Activity Survey (SAS) that might be more strongly related to college course achievement than are the individual subscales identified by instrument developers. Subjects were 184 college students in an introductory psychology course. Study activities were assessed with the SAS, and self-efficacy was assessed with a form of the Self-Concept of Academic Ability Test. The Concept Mastery Test, the Adult Nowicki-Strickland Internal-External Control Scale, and the Everyday Memory Questionnaire were also administered. Factor analysis reveals three latent constructs assessed by the SAS (Form R), reconstructive study strategies, study management abilities, and self-evaluation of cognitive ability. However, obtained latent factors for the SAS do not prove to be more potent predictors of achievement than do the original individual subscales of the instrument. This finding raises important issues about predicting achievement among college students and whether self-reports are valid indicators of study activity. Another question is the extent to which course characteristics mediate the relationships among study activities, student characteristics, and course achievement. Four tables present study data. (SLD)

Identifying Latent Variables Measured by the Study Activity Survey

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Objectives and Perspectives

This research was designed to examine possible relationships between student study behaviors and academic achievement and represents an extension of a large-scale project begun by John Thomas and his colleagues at the Far West Laboratory (e.g., Thomas, Iventosch, & Rohwer, 1987). In one study, Thomas et al. (1987) examined the relationship between study processes, self-efficacy, and academic achievement in specific courses, with self-efficacy defined as the extent to which students believe that they can control the outcomes of their attempts at learning. They found that the best single predictor of achievement in a course for junior high, senior high, and college students was a measure of self-efficacy, with a measure of academic aptitude and a very limited number of indices of study behavior accounting for much smaller but significant shares of the achievement variance.

In a study in which a measure of locus of control and a self-assessment measure of memory were also included as possible predictors of college course achievement, Wilhite (1990) found a different pattern of

results. He found that scores on the self-assessment measure of memory ability were the best predictors of final course grades, followed by scores on the locus of control measure and on the Self-Concept of Academic Ability Test (SCAAT), used by Thomas and his associates as the measure of self-efficacy. Of the 14 subscales from the Study Activity Survey (SAS), Form R., developed by the Autonomous Learning Project (e.g., Christopoulos, Rohwer, & Thomas, 1987) to assess routine study activities employed in a specific course, only the cognitive scale of Focus on Test Relevance and two self-management scales of Assiduous Resource Management and Means of Resource Management were significant predictors of course achievement. In contrast, Thomas et al. (1987) found only the cognitive subscale of Duplicative Processing to be a significant predictor of course achievement in their college sample.

As a prelude to pursuing possible reasons for this different pattern of findings, the present study reanalyzed the data of Wilhite (1990) using factor analysis techniques in order to try to identify latent variables measured by the SAS, Form R, that might be more strongly related to college course achievement in the sample studied than were the individual subscales identified by the developers of the instrument. Such a reanalysis of Wilhite's (1990) data was also motivated by the research of Olejnik and Nist (1992) in which they identified three latent variables underlying the 10 subscales of the Learning and Study Strategies Inventory (LASSI, Weinstein, Schulte, & Palmer, 1987), an alternative instrument for measuring the learning characteristics of adults. Olejnik and Nist (1992)

relate the three factors identified in their study to Rohwer and Thomas' (1987) learning model for adults that identifies the constructs of selective allocation activities, processing activities, and cognitive monitoring activities. Thus, the present study was also intended to determine whether similar factors to those identified by Olejnik and Nist for the LASSI could be found for the SAS, Form R.

Method

Subjects. A total of 184 students enrolled in an introductory psychology course participated as part of a course requirement. The subjects were drawn from six different sections of the course, involving five different instructors.

Materials and Procedure. Subjects participated in the one-hour session in groups ranging in size from three to 35 during weeks 9-11 of a 13-week academic semester. First, subjects' study activities in their introductory psychology course were assessed using the Study Activity Survey (SAS), Form R, developed by the Autonomous Learning Project (e.g., Christopoulos, Rohwer, & Thomas, 1987). The 76 study activity items from the instrument have been classified into 14 subscales, 11 of which concern cognitive activities and three of which concern self-management activities. These subscales are listed in Table 1. An additional 15 items of the survey assessed students' allocation of study time on a routine basis. Self-efficacy was then assessed using the abbreviated form of the Self-Concept of Academic Ability Test (SCAAT)

used by Thomas et al. (1987), with higher scores indicating a more negative self-concept. The Concept Mastery Test was then administered as a measure of academic aptitude, followed by the Adult Nowicki-Strickland Internal-External Control Scale, with higher scores indicating a more external locus of control. The final measure completed by the subjects was the Everyday Memory Questionnaire (EMQ, Martin, 1983), a 37-item measure that asks respondents to rate on a 5-point scale their memory for information and events ranging from the "gist of what someone said" to "zip codes".

Results

Factor analyses. The interscale correlation matrix is reported in Table 1. Excluding the correlation coefficients for the Receptive Processing Subscale, almost half of the coefficients are greater than .30. As the Receptive Processing Subscale did not have a large correlation with any of the other subscales, it was dropped from the analysis. With this variable removed, the value of Bartlett's test of sphericity was 774.26, $p < .00001$. Only 24.4% of the off-diagonal elements of the anti-image correlation matrix were greater than .09, and the Kaiser-Meyer-Olkin measure of sampling adequacy was .82. Thus, the data were judged to be appropriate for factor analysis.

A principal axis factor analysis was performed, employing the oblimin oblique rotation (Norusis, 1988). Using the Kaiser-Guttman rule of 1.0 as the minimum eigenvalue to be used to determine the number of

factors, the results indicated that three latent variables were being measured, with three initial eigenvalues of 4.60, 1.67, and 1.12. Examination of the scree plot was consistent with a three-factor solution. Table 2 shows the factor loadings for the 13 SAS subscales included in the analysis and the correlations among the three factors. The subscales that loaded most strongly on Factor 1 were Generation of Constructed Information, Generation of Interpreted Information, and Selective Notetaking. The two subscales that loaded most strongly on Factor 2 were Assiduous Resource Management and Self-Evaluation of Management Ability. Only the subscale Self-Evaluation of Cognitive Ability loaded strongly on Factor 3. Table 3 contains the characterizations of these subscales provided by Christopoulos et al. (1987) and some example subscale items. On this basis, Factor 1 was labeled Reconstructive Study Strategies, and Factor 2 was labeled Study Management Abilities. The same pattern of results was obtained using the alpha method of factor extraction with oblique rotation.

Regression analysis. A stepwise multiple regression analysis was performed to predict course achievement, as reflected in students' final semester grades for the introductory psychology course. Instead of entering the 14 subscale scores from the SAS as possible predictor variables, as Wilhite (1990) did, the estimated factor scores for the three factors obtained in the factor analysis were included in the regression analysis. Also included as possible predictor variables were the scores on the SCAAT, the Concept Mastery Test, the locus of control measure, and

the EMQ. One additional variable included in the analysis as a possible predictor was an estimate of total study time obtained from the two study time questions included in the SAS.

The results from this regression analysis are shown in Table 4. As in Wilhite's (1990) analysis, the student characteristic variables reflected in scores on the EMQ, the locus of control measure, and the SCAAT were better predictors of course achievement than were assessments of study activities provided by the SAS. Only scores on the Study Management Abilities factor were a significant predictor of course achievement. The more positively students evaluated their study management abilities, the more poorly they tended to do in the course.

Implications and Conclusions

The results of the factor analysis revealed three latent constructs assessed by the 14 subscales of the SAS, Form R. These three factors, labelled Reconstructive Study Strategies, Study Management Abilities, and Self-Evaluation of Cognitive Ability, bear some obvious similarity to the factors identified by Olejnik and Nist (1992) in their analysis of the LASSI. Their Effort Related Activities factor is similar to the Study Management Abilities factor identified in the current study, and their Cognitive Activities factor is similar to the Reconstructive Study Strategies factor of the current study. Olejnik and Nist's third factor, Goal Orientation, is also similar to the Self-Evaluation of Cognitive Ability factor derived from the SAS. Olejnik and Nist found that the three subscales of the LASSI that load most strongly on

their Goal Orientation factor are Anxiety, Selecting Main Ideas, and Test Strategies. Examination of the specific items comprising these subscales reveals that all three are focused on cognitive self-evaluation, even though the labels for the latter two subscales do not suggest the self evaluation focus. Example items from the Selecting Main Ideas subscale include: "I have difficulty identifying the important points in my reading." and "Often when studying I seem to get lost in details and 'can't see the for the for trees'." Example items from the Test Strategies subscale include: "I have difficulty adapting my studying to different types of courses." and "In taking tests, writing themes, etc., I find I have misunderstood what is wanted and lose points because of it." Thus, the results of the factor analysis of the SAS, Form R, together with Olejnik and Nist's factor analysis of the LASSI, support Rohwer and Thomas' (1987) proposal for a learning model for adults that includes the factors of selective allocation activities, processing activities, and cognitive monitoring activities.

However, the obtained latent factors for the SAS did not prove to be more potent predictors of college course achievement than were the original individual subscales of the instrument. This finding, together with the findings of Wilhite (1990) and Thomas et al. (1987) showing only a very limited number of the SAS subscales to be significant predictors of course achievement, raises three important issues for research in this area. First of all, specific cognitive factors may be less important in general in predicting study outcomes in a sample of college learners simply because of a loss in discriminative power resulting from restricted variability in

reported use of cognitive activities within the sample. As a result, specific cognitive factors may be less important in predicting achievement than are the much more variable measures of student characteristics.

Secondly, there is the issue of whether subjects' self-reports of their study behaviors, especially those involving relatively complex cognitive activities, are valid indices of their actual study activity. That is, subjects' knowledge of their study activities, especially those that are highly cognitive in nature, may be quite limited. Many adult learning theorists (e.g., Brookfield, 1986) have argued that adult learners' ability to solve problems can be impaired by their difficulty in benefiting from feedback and in integrating new information into their problem-solving approach. Studies employing more focused and in-depth measures of study activities, such daily journal entries of study activities and periodic interviews concerning study practices throughout a specific course of study, would appear to be in order. Furthermore, even if subjects are relatively accurate in reporting their study activities, they may not possess the requisite skill to employ some of the cognitive activities effectively. For example, spending time using a generative strategy such as elaborating newly encountered information can only be expected to be positively related to course achievement to the extent that students elaborate appropriately. It might prove useful to compare subjects who are skilled in the use of a variety of study skills with those who are not in terms of the degree to which various reported study behaviors successfully predict course achievement.

However, a restriction in grade range among the more skilled subjects might prove to be a severe limitation.

A third major issue raised by this study, and by the findings of Wilhite (1990) and Thomas et al. (1987), is the extent to which course characteristics mediate the relationship between study activities, student characteristics, and course achievement. For example, the finding in this study of a significant predictive relationship between the factor labelled Study Management Abilities and course achievement may reflect a greater emphasis by the instructors in this psychology course on study management activities than was exhibited by the history instructors in the Thomas et al. (1987) study, in which no similar relationship was found. The finding that engagement in and attention to study management activities were negatively related to course grade raises interesting questions of possible causation: Does a preoccupation with managing study activities detract from actual effective processing of information and achievement in the course, or does a perception that one is doing badly in a course promote a preoccupation with managing study activities? A longitudinal study that examines how students alter their study patterns in response to successes and failures during a semester course would be helpful in addressing this issue.

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Table 1
Correlations Between Subscales of the Study Activity Survey

	UP	HP	FTR	SN	PRP	RP	DP	GII	GCI	CM	SECA	ARM	MRM	SEMA
UP	--													
HP	.28	--												
FTR	.14	.53	--											
SN	.21	.27	.26	--										
PRP	.13	.28	.26	.23	--									
RP	0	.06	.07	-.02	-.25	--								
DP	.30	.45	.37	.32	.31	-.02	--							
GII	.26	.32	.26	.30	.31	-.02	.54	--						
GCI	.27	.46	.38	.56	.45	.02	.45	.55	--					
CM	.17	.32	.40	.24	.37	.08	.30	.32	.45	--				
SECA	.10	.45	.35	-.03	.10	.02	.18	.24	.19	.26	--			
ARM	.26	.47	.33	.25	.36	-.12	.17	0	.30	.29	.22	--		
MRM	.23	.47	.32	.33	.23	.06	.40	.23	.48	.30	.25	.34	--	
SEMA	.19	.34	.28	.08	.19	.03	.06	-.04	.09	.15	.37	.57	.25	--

Abbreviations:

UP - Uniform Processing
HP - Hyperprocessing
FTR - Focus on Test Relevance
SN - Selective Notetaking
PRP - Pre-Reading Preparation
RP - Receptive Processing
DP - Duplicative Processing
GII - Generation of Interpreted Information
GCI - Generation of Constructed Information
CM - Cognitive Monitoring
SECA - Self-Evaluation of Cognitive Ability
ARM - [illegible]siduous Resource Management
MRM - M[illegible]ns of Resource Management
SEMA - [illegible]f-Evaluation of Management Ability

Table 2

Factor Loadings for 13 Subscales of the SAS, Form R, and Correlations Between Factors

Subscales[a]	Factor 1	Factor 2	Factor 3
GCI	.8813	-.0457	-.0848
GII	.6650	-.4026	.1826
SN	.6462	.0569	-.2513
DP	.6369	-.1700	.1563
PRP	.4885	.1429	-.0478
MRM	.4798	.1549	.1196
CM	.4694	.0595	.1333
HP	.4274	.1966	.4082
FTR	.3778	.1365	.3272
UP	.3337	.0942	.0356
ARM	.2631	.7976	-.0253
SEMA	-.0334	.6036	.2847
SECA	-.0055	.0721	.7369

Interfactor correlations

Factor	Factor 1	Factor 2	Factor 3
1	--		
2	.2224	--	
3	.3234	.2099	--

[a]See Table 1 for key to abbreviations.

Table 3

Characterization of Subscales with High Factor Loadings and Example Items Comprising the Subscales

Subscale	Characterization
Generation of constructed information	Elaborating, reorganizing, contrasting, integrating, or summarizing newly encountered, previously recorded or encoded information.
Example item:	When working outside of the class, I write down specific similarities between topics.
Generation of interpreted information	Explicating, investigating, or inquiring into the meaning of target information to enhance comprehension or memory.
Example item:	When I come across something in the assigned reading that is hard to understand, I try to figure it out from the context.
Selective notetaking	Purposeful recording of information selected on criteria of difficulty or substantive relevance.
Example item:	While doing the assigned reading for this course, I highlight what I think is most important.
Assiduous resource management	Voluntary, intense, or earnest preparation for or application of one's energy to the task or activity at hand.
Example item:	When working outside of class, I make a special effort to figure out how to get everything done in the time I have.
Self-evaluation of management ability	Characterizes self as able to and knowledgeable about how to deal effectively with challenging resource management tasks.
Example item:	When working outside of class, I know how to plan my time to get everything done.
Self-evaluation cognitive ability	Characterizes self as able and knowledgeable in dealing with challenging cognitive tasks.
Example item:	During class meetings, I know how to pick out important points.

Table 4

Stepwise Multiple Regression: Student Characteristics and SAS Factors on Course Grade

Variable	R	B	Standard error of B	β	p
EMQ	.505	.139	.018	.505	<.0001
LC	.572	.287	.067	.278	<.0001
SCAAT	.602	-.336	.110	-.188	.0026
SAS Factor 2	.618	-.864	.372	-.145	.0214

Abbreviations:

EMG - Everyday Memory Questionnaire
LC - Locus of Control Measure
SCAAT - Self-Concept of Academic Ability Test