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ABSTRACT

During the last two decades of work in predicting and explaining school achievement, much research has emphasized the identification and measurement of student cognitive and affective processes which predict and also promise to help explain and facilitate school achievement. This review focuses on modifiable cognitive and affective processes, as different from aptitude and ability. The results summarized represent but do not exhaust the findings of recent research relevant to school achievement. Findings on cognitive processes concern generative comprehension processes, imagery, attention and cognitive style. Affective processes include motivation, self-concept, test anxiety, and attitude. The purpose of this review is not simply to caution or advise test development institutions, but to communicate ideas to test users as well. The contention is that intelligence measures yield data concerning momentary states of knowledge or ability. These static descriptions are interpreted as descriptions of student potential. Yet the evidence in this review shows that the affective and cognitive processes underlying intelligence scores are dynamic in nature, and they can be taught and improved. To predict potential scholastic success and provide remedial information to increase that potential, an emphasis upon cognitive and affective processes is essential and logical, and has been too long waiting. (CM)

Cognitive and Affective Processes Related to School Achievement: Implications for Assessment

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INTRODUCTION

Since the days of Alfred Binet, educators have traditionally used tests of intelligence to predict academic achievement. In 1905, Alfred Binet and Theophile Simon developed a test for predicting and selecting children who could potentially benefit from conventional classroom teaching in the public schools of France. From this beginning the empirical prediction of academic achievement grew into the widespread, modern-day testing of intelligence.

Shortly after Binet and Simon created the first intelligence scale, Arthur Otis developed an objectively-scored intelligence test (Otis, 1918). By the end of the First World War, verbal and non-verbal group intelligence tests, the Army Alpha and Beta, were being used to measure literacy and intellectual ability among soldiers. These military applications surpassed Binet's original intention to predict academic success in conventional public schools.

Whether these individual or group intelligence tests predicted academic success or classified soldiers as literate or illiterate, the instruments measured intelligence by what people could do or had achieved. The tests measured the products of learning, but not necessarily the cognitive processes people use to achieve in school.

By contrast, during the last two decades of work in predicting and explaining school achievement much research has emphasized the identification and measurement of student cognitive and affective processes which predict and also promise to help us to explain and facilitate school achievement. These process-oriented measures often forecast and explain achievement well enough to compete with and sometimes to supplant the more traditional tests that grew from Binet's pioneering work. In addition, these process-oriented measures often provide useful information for designing and improving instruction.

Process oriented measures include affective as well as cognitive factors. Joe (1971) noted that school success was caused by non-intellectual factors. Compared with successful students, unsuccessful students are more anxious (test and chronic anxiety), aggressive (impulsive or unsocial), dogmatic (inflexible or uncreative), have lower self-confidence (self-concept, task specific or general), lower insight (cognitive styles and attention mechanisms), lower need for social approval (rebellious and antisocial), and are more ego defensive (motivation to avoid failure and external attribution). These affective processes, and other intellectual processes, lead to an understanding of the causes of achievement in school. Some of them are modifiable and can be used, perhaps, to enhance school achievement among some students.

This review focuses on modifiable cognitive and affective processes, as different from aptitude and ability, that not only predict but also help explain school achievement and its causes. The results we summarize represent but do not exhaust the findings of recent research relevant to

school achievement. We have grouped the findings according to the cognitive and affective processes that we found most useful for understanding school achievement. We begin with cognitive processes: generative processes, imagery, attention, and cognitive style. Later we cover affective processes which affect school achievement: motivation, self-concept, test anxiety, and attitude. Finally, we review studies which employed a variety of both affective and cognitive process measures.

GENERATIVE PROCESSES OF COMPREHENSION

Why is it that one is more likely to understand meanings from messages and text he or she generates, as opposed to text generated by others? There are several reasons. First, the effort expended in creating a message underscores both the motivation to understand the content, as well as the experience or knowledge needed. Second, one's attention is concentrated on the message, also increasing the probability of comprehension. Finally, the message is highly relevant to the generator's prior knowledge and experiences. The point is that if one can utilize methods which employ these characteristics of effort, attention, and relevance by applying them to text authored by <u>others</u>, then comprehension should increase.

In essence, learning with comprehension is a process in which students must generate meaning and relevance from material and from knowledge and experience. Through strategies which concentrate upon students' motivation and effort, and which capitalize on attention, comprehension can increase. Students comprehend text by relating parts within the text to one another, and by relating the text to themselves and their personal context. Because

almost all material encountered in schools is written by people other than the learner, school achievement often involves one's ability to employ the generative processes mentioned above. Conventional measures of school achievement do not usually emphasize these generative processes of comprehension.

Interestingly, generative learning processes imply student accountability for achievement. Teachers are accountable for teaching, for presenting material, or supervising learning experiences, but the student is ultimately responsible for his or her own learning. From this perspective students should be taught the skills of comprehension, and then through practice and guidance be held accountable for employing the generative skills in their own learning experiences.

Various methods have been explored for improving students' abilities to increase their comprehension of text through generative processes. A few of the generative methods are reminiscent of well-known attention focusing strategies (discussed later in this review). A major difference between generative processes and attention strategies, however, is that in generative processes the learner encodes new material by relating his or her own knowledge to the information to be learned. Again it is important to remember that learning is not a passive event, but an active process.

Through appropriate training, students can be taught to employ generative processes which increase their learning ability and comprehension. For example, Marshall and Glock (1978) and Willows (1974) discovered that a major difference between students with good versus poor reading comprehension scores was their ability to avoid distractions stemming from

irrelevant surface characteristics in text. Training students to attend to relevant text ideas was a successful generative strategy. In related studies, Malamuth (Note 1) was able to increase poor readers' comprehension scores by teaching them self-management techniques for controlling their attention. When the student makes the passage relevant to his or her own personal experience, and expends effort and attention in comprehending a passage, learning increases. In a related use of strategies, Doctorow, Wittrock, and Marks (1978) found that having subjects generate summaries sizably increased comprehension and recall for passage information.

Other researchers have investigated generative processes. Dee-Lucas and DiVesta (1980) found the generation of topic sentences to be useful for increasing comprehension. They also found that generative processes should be student originated, as opposed to teacher imposed. In the study, Dee-Lucas and DiVesta discovered that while student-generated topic sentences increased overall comprehension and knowledge structure recall for a passage, teacher generated sentences increased memory of factual details.

Frase and Schwartz (1975) noted that teaching children to generate and ask questions of themselves, or of each other, enhanced their recall and comprehension. As part of the same study, constructing objectives, practicing rehearsal strategies, and utilizing self-directed study skills were also enhancers of recall. Even such logical skills as note-taking are generative comprehension processes which increase learning (Peper & Mayer, 1978).

Training students to generate relationships between parts of the text and between the text and personal experience and knowledge increases recall abilities and learning. The major point to be made here is that this success-inducing, learning process is not emphasized by traditionally utilized tests of intelligence or achievement. Yet generative processes seem to be involved in scholastic achievement.

IMAGERY

The use of mental imagery to increase learning and memory is perhaps one of the oldest cognitive strategies known. Aristotle, Cicero, and later Thomas Acquinas all taught and utilized mental imagery strategies to maximize encoding and recall. In modern times, Paivio (1971) discussed the importance of imagery in instructional psychology. Paivio hypothesized that there are at least three imagery-based techniques which can enhance recall and comprehension of text. The first method employs instructions to form mental images during encoding. For example, Levin (1973) studied poor readers at the elementary school level. Students receiving instruction and training to form mental images of a story outperformed a non-imaginal strategy used by a control group of subjects. In related studies, Bull and Wittrock (1973) had some subjects draw pictures of words, while other children either wrote definitions or traced images supplied by the experimenters. Students who generated their own images outscored the others.

Second, Paivio (1971) stressed the use of highly imaginable, concrete words in prose to aid in the formation of mental images. Wittrock

and Goldberg (1975) found that abstract words, as well as their definitions, are less effectively remembered when contrasted with the more easily imaged concrete words.

The third imagery strategy was the use of pictures in text. Lesgold, Levin, Shimron, and Guttman (1975), and later Bender and Levin (1978) all showed that pictures of relevant concepts or objects serve to increase recall of text read by subjects. Bull and Wittrock's (1973) study also supports this strategy, and adds the element of student involvement in generating the accompanying images.

The use of images in verbal instruction sometimes facilitates comprehension of complex concepts in elementary school. In 1963 Wittrock completed a study in which elementary school children participated in two to four weeks of instruction on the topics of molecules, gases, liquids, solids, evaporation, and condensation. According to Piaget these topics are not likely to be comprehended unless a child is at the concrete operational level (age 7). However, Wittrock used illustrations and drawings exemplifying the objects and the concepts. His results showed that after a year, two-thirds of the students successfully recalled the information taught about the complex principles covered. In a similarly aimed study, Bray, Justice, Ferguson, and Simon (1977) showed that the ability to effectively utilize imagery strategies depends upon the cognitive level of the child.

When Paivio (1971) wrote his treatise on imagery, he hypothesized that human memory stores consist of two separate but coordinated systems --

imaginal and semantic. Studies of imagery have supported that hypothesis by showing that there is a relationship between verbal ability and imagery efficiency. In an excellent review on the topic, Rohwer (1970) concluded that one's ability to benefit from images or pictures depends upon verbal ability.

One interesting facet of Rohwer's assertion is that between nursery school and third or fourth grade verbal ability often precedes imagery ability. Dilley and Paivio (1968) found that the capacity to benefit from pictorial or imaginal strategies develops later than verbal ability. Hence, children of nursery school or kindergarten age are less able to effectively utilize imagery strategies than children in later elementary school years (Rohwer, Note 2). However, with age the visual, imaginal mode comes to be preferred over and more effective than the verbal processes (Rohwer, 1970).

Finally, age seems to be the determinant of the developmental trend, not experience (Levin & Pressley, 1978). This implies that as children mature, their ability grows to successfully employ imagery techniques for increasing their mental capacity.

It is clear that little if any emphasis has been placed on measuring imagery ability for predicting academic success. Certainly traditional measures have not often assessed this cognitive process, yet achievement is sometimes associated with imaginability. There may be an improvement in the measurement and prediction of scholastic success if cognitive processes such as imagery were more systematically included in ability testing.

ATTENTION

Attention is the initating, sustaining, and directing of activity. It is important to educators because one attends to information which one desires to learn or remember. Although information can be encoded unintentionally, we encode the major part of what we learn by paying attention.

Several pedagogical strategies to increase attention have been studied. One of the more substantial strategies for increasing attention involves the use of questions inserted into text. Adjunct questions have different effects depending upon (1) whether they are inserted before or after relevant text, and (2) whether they require factual or conceptual responses. Generally, questions inserted prior to relevant text (prequestions) facilitate verbatum, factual learning, while questions placed after relevant text (post questions) facilitate more global or conceptual learning (Boker, 1974; Swenson & Kulhavy, 1974).

Wittrock and Lumsdaine (1977) maintained that adjunct questions operate as attention-focusing devices. Inserted questions tend to direct learners to attend to relevant material while drawing their attention away from irrelevant material. Encoding of factual information is facilitated by prequestions because they cue the learner to attend to the relevant information. Post questions, on the other hand, serve to direct the learner's attention to the general gist or topic already covered, to the avoidance of detail. Andre (1979) explained that adjunct questions facilitate learning if the subject is not already motivated to attend to the material. Highly attentive subjects are not helped by the questions, while

poorly motivated students experience increased attention and knowledge acquisition.

Another important selective attentional device which is related to adjunct questions is behavioral objectives (Duell, 1974). As with inserted questions, objectives increase learning whether they are given before or after the text (Kaplan & Simmons, 1974). Again, these types of inserted attention devices serve to increase learning by directing subjects' selective attention to relevant material.

It is of interest to study the selective attention phenomenon in mentally retarded children. Recent research such as Krupski's (1980) has shown that retarded children differ from normal children in their ability to experience and maintain voluntary sustained attention. Krupski did not find a difference between normal and retarded children on arousal (involuntary attention), orienting short-term attention, or for low demand, sustained voluntary attention (Krupski, 1975). In short, mentally retarded children reacted normally to warning signals, but not to signals to act.

The difference Krupski found between normal and mentally retarded children is explainable through selective attention and attribution models. The retarded children are more easily distracted and are less easily directed voluntarily to selectively attend to relevant materials for sustained periods of time (Krupski, 1979). It appears that retarded children do not experience normal developmental changes in cognition which cause children to increase their ability to concentrate their attention to tasks and selectively to attend to relevant stimuli (Hallahan & Reeve, 1980).

For most children, the ability to attend selectively could be increased by two logical strategies. As previously mentioned, inserted questions could be utilized to focus attention (Swenson & Kulhavy, 1974; Andre, 1979). Also, remedial attention strategies can be taught to children (Paris, Lindauer, & Cox, 1977). Basically, the strategies rest on the premise of selective attention. Good readers seem automatically to focus their attention on the underlying meanings within text, while poor readers focus on surface structures (Willows, 1974). Training children to see beyond surface structures should, therefore, increase reading potential. Paris, Lindauer, and Cox (1977) trained children to construct stories about text they read by inferential techniques. These stories significantly increased selective attention and, as a result, both comprehension and recall improved.

Hyperactive or hyperkenetic children also suffer in learning tasks due to their inability to sustain selective attention. Brenner and Stern (1976) claim that hyperactive children are actually no more aroused than normal children. Instead, hyperactive children attend to task-irrelevant stimuli more actively than they do to task-relevant stimuli. Selective attention is reduced due to idiosyncratic, task-irrelevant distractibility. Stimulant drugs administered to hyperkinetic subjects work by increasing selective attention (Connors, 1976), not by reducing general activity (cf. Rosenthal & Allen, 1978). It is interesting that in recent research hyperactivity has been used as a diagnostic category rather than an irreversible or permanent characteristic of children (Porges & Smith, 1980).

Several researchers have recently linked hyperactivity and selective attention strategies to attribution models. By the use of self-verbalizations, modeling, self-monitoring, and self-reinforcement children have been taught to control their impulsive behaviors and to attend to task-relevant matters (Camp, 1980; Douglas, Parry, Martin, & Garson, 1976; Malamuth, 1979; Whalen & Henker, 1980).

Attention is a factor in educational success. Children who lack appropriate attention directing skills, such as mentally retarded or hyperkinetic children, also show correspondingly low achievement rates in school. However, identifying and remediating this nonintellectual process deficiency can result in increased academic performance and normal school experiences.

In short, if one could measure attention as an individual process or capability, then predicting academic success would be far more accurate and informative than simply assessing intellectual products.

COGNITIVE STYLES

The ability to learn in classroom situations and the ability to score on achievement tasks depend upon cognitive style. Among the most researched cognitive styles are field-dependence-independence and impulsivity-reflectivity, which we will relate to learning and achievement.

Basically, field-dependent people and field-independent people differ in the degree to which their perception of an event depends upon its context and framework. A field-dependent person generally accepts the organization of information in the form in which it is presented. Items within a framework or field are <u>not</u> perceived as discrete or independent of

the totality, but rather are perceived in relation to their context or the frame of reference provided. A field-independent person, on the other hand, separates the discrete elements within the field, and provides a framework or context for perceiving them. In a recent meta-analysis, Linn and Kyllonen (1981) found that the two major dimensions which the test of field independence tasks assess are (1) the cognitive restructuring ability, and (2) strategy selection in unfamiliar situations.

Many academic tasks require the development of analytic abilities. One who can perceive parts independently from the whole can analyze discrete relationships, a skill which is critical in schoolwork, including reading and mathematics (c.f. Ehri & Muzio, 1974; Kagan, 1965; Kagan, Rosman, Day, Albert, & Phillips, 1964; Witkin, Moore, Goodenough, & Cox, 1977). Several studies have shown that field-independent children and young adults score significantly higher on school achievement tests than do field-dependents. In a review of the relevant research, Witkin, Moore, Goodenough, and Cox (1977) recounted the gender differences, occupational diversities, and achievement results which correlate with cognitive style. Acquisition of analytic skills for field-dependent students is possible but difficult, and requires more than repeated exposure to classroom imposed, logical situations.

A second cognitive strategy, reflectivity-impulsivity, has also been well researched. Given a problem, a reflective child will study it, carefully attempt to determine the relevant clues, and then respond. Given the same problem, impulsive students, in contrast, choose their response almost immediately without laboring over the details the way reflective.

children would. As with the field-dependent-independent students, achievement is highly related to the reflective versus impulsive nature of a child. Impulsive children do more poorly on reading tests beginning in first grade (Kagan, 1965). On vocabulary, reading comprehension, spelling, grammar, and language, and even on mathematics, reflective children achieve higher than their impulsive peers throughout the school experience (Robinson & Gray, 1974). Reflective students are more analytical and process information more efficiently and systematically in problem-solving situations (McKinney, 1975).

The most common test of reflectivity-impulsivity is the Matching Familiar Figures Test (MFFT) (Kagan, Pearson, & Welch, 1966). Messer (1970) used the MFFT to show that high impulsivity is often used as a criterion for not promoting first grade boys with normal IQ scores. More data from Neimark (1974) and Pascual-Leone (1973) led Heatherington and Parke (1979) to conclude that achievement deficits in impulsives are indeed not due to insufficiencies in intelligence, but to the nature of the task and to the subjects' information processing strategies. As a consequence, several successful cognitive style modification treatments have raised impulsive student scores to parity with reflective students by teaching task relevant attention strategies (Bartis & Ford, 1977; Zelniker & Oppenheimer, 1976).

The common label of "cognitive style" may lead to confusion in studying the various style constructs which have been isolated. Denny (1974) distinguished the two styles discussed in this review as conceptual style for field-dependence-independence, and cognitive tempo for

reflectivity-impulsivity. He detected that both styles were highly correlated with elementary school reading but that a third dimension of "attentional style" was a better predictor of achievement.

Cognitive styles apparently represent distinct internal processes which mediate school achievement related abilities. Treatment or training in these underlying processes promises to raise test scores and scholastic achievement for students whose strategies do not match up with current educational system demands.

MOTIVATION

J.W. Atkinson (1957, 1964) developed a theory of achievement motivation applicable to scholastic situations. Atkinson's motive to achieve is the sum of three tendencies: (1) the tendency to seek success, (2) the tendency to avoid failure, and (3) the tendency to comply with norms or to seek approval. Atkinson used H.A. Murray's Thematic Apperception Test (TAT) to assess the strength of the tendency to seek success, which he labelled the "need to achieve (nAch)." Atkinson and his colleagues repeatedly found a high correlation among college males between nAch and indices of scholastic success such as grades (J.W. Atkinson, 1958, 1964, 1966; Atkinson & Feather, 1966; Klinger, 1966), implying that the motivation to achieve is one of the processes underlying achievement in school.

Mehrabian (1968) also found that measures of motivation predicted academic performance. He measured motivation to succeed and motivation to avoid failure. With undergraduate subjects, he found a relation between need achievement and scholastic achievement. High

scholastic achievers have a high nAch, while low achievers have a high need to avoid failure.

Crandall, Katkovsky, and Crandall (1965) theorized that achievement motivation would be influenced by a person's perception of the control he/she has over reinforcements in scholastic situations. For example, if students believe that success in school occurs because of their own effort, then motivation to succeed will be high. On the other hand, if they believe that forces external to themselves control success, then motivation to avoid failure will be high. Crandall et al.(1965) devised the Intellectual Achievement Responsibility Scale (IAR) to measure internal vs external "locus of control." With children from grades 3-12, Crandall et al.(1965) found that locus of control scores correlate with intelligence and social class, and that females more than males attributed success and failure to internal causes. They also found that self-responsibility was well established by the time a child reaches the third grade.

Rotter (1966) proposed that people differ in locus of control because of their different perceptions of the causes of achievement. He found that the attribution of success or failure correlated with intelligence scores, TAT scores, and achievement test results for early elementary school through college undergraduate students. Schultz and Pomerantz (1974) also found that the motive-to-succeed versus the motive-to-avoid-failure could be assessed with Rotter's scale and was related to internal vs external attributions.

Since the research by Crandall et al., and by Rotter, the relationship of locus of control to achievement has been reported repeatedly (Lao, 1970;

McGhee & Crandall, 1968; Nord, Connelly, & Daignault, 1974). Gozali, Cleary, Walster, and Gozali (1973) used the Rotter scale with undergraduates and found that "sense of control" predicted achievement, as opposed to ability. Frymier and his colleagues (Frymier, Norris, Henning, Henning, & West, 1975) used the Junior Index of Motivation (JIM) in a longitudinal study with children in junior high school. Their results showed that motivation in junior high predicted senior high school and college GPA's better than did ability or achievement measures. Also, their measure of motivation predicted which students would attend college, and differentiated low from high achievers. Nowicki and Strickland (1973) developed another meaningful index of locus of control in adults and in children. With their measure, they found that achievement scores were more highly correlated with locus of control than with traditional measures of intelligence. Reid and Croucher (1980) recently supported this finding. The conclusion is clearly that locus of control is a process which underlies achievement even more definitely than do measures of ability or intellect.

Another study of attribution and achievement involved the effects of teaching strategies and classroom structure. Using Rotter's scale, Parent, Forward, Canter, and Mohling (1975) discovered that an internal locus of control enhanced achievement in low discipline, unstructured classrooms, whereas an external locus of control enhanced achievement in the more structured, higher discipline setting. Daniels and Stevens (1976) support these findings. They found that internally motivated college students outperformed externally motivated students when the grade given

was based on a coursework contract, while externally motivated students did better than internally motivated students in the more traditional teacher controlled work environment.

Several researchers have analyzed Rotter's scale to determine the characteristics it measures. Collins (1974) used a factor analytic approach to isolate four major factors that Rotter's index measures. The first factor, "belief in a difficult world," was most closely associated with an external locus of control. Second, "belief in an unpredictable (undeterministic) world" was more related to an internal orientation. Third, "belief in a just world" was more indicative of the internal locus of control. Fourth, "belief in a politically responsive world" was chosen equally by either locus. Luginbuhl, Crowe, and Kahan (1975) found that Rotter's scale isolated four causal attributions for test outcomes: ability, effort, task difficulty, and luck.

In the late 1970's Weiner developed an attribution theory of motivation (Weiner, 1977, 1979). He proposed a multi-dimensional model to account for the variance among attributions used by people. In 1972, Weiner, Heckhausen, Meyer, and Cook presented a two-dimensional model of causal ascriptions for achievement. Locus of control -- internal or external -- constituted one dimension, and stability -- fixed vs. variable -- comprised the second dimension. Stability referred to the perceived fluctuation over time of the cause of success or failure.

Figure 1 illustrates the four perceived determinants of achievement.

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Stability	Locus of Control	
	Internal	External
Fixed	Ability	Task Difficulty
Variable	Effort	Luck

Figure 1. Perceived Determinants of Achievement (Weiner et al., 1977)

Ability, generally a constant factor, is categorized as the fixed internal locus of control; one either has or doesn't have the ability to succeed in an endeavor. Second, the variable factor of internally controlled causes is effort, which is either high or low according to situational determinants. Third, task difficulty is external because it is beyond the control of the subject, and fixed because it does not change from one moment to the next. Finally, if the student has no control over the outcome of a task, and the attribution of the outcome to any given cause is variable, then luck is the perceived determinant of success or failure.

By 1979, Weiner added a third dimension called "controllability." Modelled after Heider (1958) and Rosenbaum (1972), controllability refers to the subject's control of outcomes. Locus of control was renamed "locus of causality," meaning the perceived cause of an outcome. Stability was retained and defined as previously stated. Figure 2 illustrates the 2 locus X 2 stability X 2 controllability design Weiner formulated to account for causal attributions.

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insert figure 2 about here

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Another recently developed aspect of attribution theory involves self-serving biases in causal ascriptions. Miller and Ross (1975) proposed that perceived causes of behavior could be simplified by describing attributions as defense mechanisms. Bradley (1978) showed that while attributions are self-serving in the sense that they offer people a vent

	Internal		External	
Controllability	Stable	Unstable	Stable	Unstable
Uncontrollable	Ability	Mood	Task difficulty	Luck
Controllable	Typical effort	Immediate effort	Teacher bias	Unusual help from others

Figure 2. Causes of Success and Failure in Achievement, Classified According to Locus of Control, Stability, and Controllability. (Weiner, 1979)

for the frustrations of failure or for the pride of success, causal ascriptions cannot be categorized as defensive mechanisms. Attributing failure to one's own lack of ability or effort, or attributing success to luck, implies that self-serving does not presuppose defensiveness.

Recent research has yielded evidence supporting an attributional model of motivation and its connection with achievement. Arkin and Maruyana (1979) found that successful college students often attributed their success to internal, stable factors and also felt that internal, stable factors were the most important for the successes of other people. Unsuccessful students, in contrast, blamed failures on external and unstable factors, which they felt were the most important factors for others to consider when undertaking the same tasks. In a meta-analysis of 40 achievement motivation studies involving 50 students from grades 1-12, Uguruglu and Walbert (1979) concluded that general motivation, academic motivation, achievement motivation, and locus of control were analogous to each other, and that all predicted school achievement.

Several researchers have discussed relations between motivation and achievement in schools. Stipek and Weisz (1981) comprehensively reviewed motivation, perceived personal control, and academic achievement. Nicholls (1979) discussed the role that motivation plays in education. Johnson and Croft (1975) discussed how personalized instruction can produce equal achievement for internal and external attribution subjects.

Research to date has served to establish a relationship between an affective variable, causal attribution, and scholastic achievement.

Perhaps it is premature to use this relationship for predicting school success. However, if achievement is mediated by affective processes, such as attribution, as strongly as data show, then such a relationship should be exploited. Testing might include the measurement of attribution in an effort to predict and understand scholastic progress more accurately.

SELF-CONCEPT

Empirical efforts to determine the degree of predictive relationship between self-concept and school achievement began with the development of reliable and versatile measures of self-concept. In 1959, Coopersmith devised the Self-Esteem Inventory (SEI), an index of self-concept. Using the SEI, Morse (1964) concluded that lower self esteem children from grades 1-6 achieve lower than do higher self esteem pupils. More recently, Primavera, Simon, and Primavera (1974) verified that school achievement is predicted by SEI scores. The Primavera et al. results, however, suggested that only females demonstrate the relationship between achievement and self-concept. In 1975, Simon and Simon did not find a sex bias in SEI results. They did find that the inventory correlated with academic achievement scores, and with both verbal and nonverbal IQ scores.

Other researchers have used indices of self-image to relate achievement to beliefs of self-worth or self-adequacy. In a longitudinal study, Wattenberg and Clifford (1964) found that self-concept measured in kindergarten predicts reading achievement two-and-a-half years later. Quasi-longitudinal experiments by Chang and by Ellerman have reaffirmed Wattenberg and Clifford's results. Chang (1976) concluded that self-concept predicts achievement in both reading and math (p.9) from

fourth through sixth grades. In 1980, Ellerman studied Australian children from first through seventh grades. He found that self-concept predicted achievement. He also found that younger children had higher self-esteem scores, as did male subjects across grades. Joe (1971) maintains that high achievers demonstrate higher self-concept scores despite the measurement tool employed.

Self-concept is not always an all-encompassing phenomenon. One may have a positive self-concept and still experience feelings of inadequacy in a given task or area of specialization. In 1964, Brookover, Thomas, and Paterson discovered that a measure of area specific self-concept more accurately predicts student achievement and GPA potentials than does a measure of general self-concept. Korman (1970) correlated achievement with three types of self-esteem: chronic or general, task-specific, and socially influenced. All three classes of self-image predicted academic success for undergraduates, but task specific self-concept was the best predictor of the three measures. Jones and Grieneeks (1970) measured self-expectations, degree of identity development, and general self-concept of ability. They found that all three predicted GPA, but that self-expectation was the best predictor for undergraduates. Self-esteem, then, is a construct which involves processes highly related to and predictive of school achivement.

In a review of the research in locus of control up to 1971, Joe described profiles of both internally and externally motivated learners. Externals, he explained, were lower achievers with lower self-esteem. Internals demonstrated higher achievement and higher self-esteem.

Weiner (1979) claimed from his review of research that locus of causality is associated with the esteem-related emotions. Atkinson (1957, 1964) supported the correlation between self-esteem and motivation found by Joe and Weiner. Atkinson discovered that low achievers in school were preoccupied either with unrealistically high or unproductively low goals in life. High achievers, on the other hand, were more oriented toward realistically attainable but challenging objectives. No effort was made to ascertain whether self-concept or aspirations and achievements were antecedent to the other.

Measuring self-esteem and locus of control, Fish and Karabenick (1971) confirmed Atkinson's (1964) findings regarding undergraduate subjects; high self-esteem was associated with internal locus of control, and low self-concept with external locus of control. Cohen and Lefkowitz (1977) included measures of chronic and task-specific self-image along with measures of locus of control. They found that the latter two predict task performance for high school seniors better than measures of general self-concept. In a study with subjects from grades 6-8, Prawat (1976) measured achievement motivation, locus of control, and self-esteem. Prawat concluded that the three constructs are stable and significantly intercorrelated across the three grades.

Bridgeman and Shipman (1978) measured achievement motivation and general self-esteem for third grade subjects, and found that the two constructs were significantly related. Both of them predicted school achievement. Jordan (1981) concluded that the relation of self-image with motivation was generalizable to Black adolescents.

Self-concept and achievement motivation were assessed in reading, language (English), and mathematics classes separately by Cole (1974), using measures developed by Cicirelli et al. (1971). Motivation and self-affect correlated with each other, and both predicted academic achievement for third graders in each of the three areas.

Stenner and Katzenmeyer (1976) examined the relation via regression analyses and discovered that 22 percent of all variation in reading scores was accounted for by self-esteem alone. In sum, research indicates that measures of motivation and self-concept can predict school achievement (Shavelson, Hubner, & Stanton, 1976).

Self-esteem also seems to be related to academic achievement, perhaps as a manifestation of locus of control attributions. High self-image children generally will experience internal attributions and high achievement, while students with low self-esteem will attribute scholastic outcomes to froces external to self and find less success in school environments. Measuring attribution with some emphasis on the self-concept processes should provide informative and useful feedback for predicting future success and remediating some learning problems.

TEST ANXIETY

Although anxiety in general is related to poor achievement (cf. Spielberger, 1972), the scholastic situation most closely associated with induced anxiety, despite age or years of school experience, is test-taking. Seymour Sarason and George Mandler (1952) used The Test Anxiety Questionnaire (TAQ) to relate test anxiety to achievement outcomes. They discovered that test anxiety correlated significantly with

aptitude scores in mathematics and Scholastic Aptitude Test (SAT) scores. They also found that TAQ scores predicted future GPA's more accurately than concurrent GPA could. I.G. Sarason (1959) used the TAQ to confirm that anxiety scores are significantly related to IQ (Stanford Binet) and achievement outcomes.

The Children's Manifest Anxiety Scale (CMAS) is a primary grade version of Taylor's (1953) Adult Manifest Anxiety Scale (Castaneda, McCandless, & Palermo, 1956). The CMAS consists of two parts. One part measures situational anxiety, while a second portion measures personality-based anxiety. A similar notion of transitional versus constant or chronic anxiety also appears in the research of Zuckerman and his colleagues (Zuckerman, 1960; Zuckerman & Lubin, 1965) who developed the Affective Adjective Checklist (AACL). The AACL offers two improvements in anxiety measurement. First, subjects are not forced to respond to a long list of questions or statements; the AACL allows a subject to choose adjectives from a list to best describe relevant feelings. Second, the measure assesses anxiety for a situation, a day, or an extended period of time.

Speilberger (1972), also differentiated between trait and state anxiety. State anxiety (A-state) is a transitional emotional reaction to a given situation, such as a specific test or tests in general. Trait anxiety (A-Trait) is a general constant, chronic condition not specific to testing conditions. Spielberger's research showed that A-Trait is built up by A-State experiences over time. When threat is perceived, stress is incurred and anxiety results. Upon renewal of the threat-inducing situation the anxiety is re-experienced and aggravated.

Based on some of Spielberger's results, Gaudry (1977) conducted a series of studies designed to show that both state and trait anxiety are the product of failure experiences. By manipulating the successful or unsuccessful outcome on an experimental pretest, Gaudry was able to control A-State. As expected, success on the pretest reduced test anxiety and failure increased test anxiety.

Explanations of the outcomes of test anxiety research based on the effects which failure and success experience have on self-concept led Nicholls (1976) to conclude that test anxiety scales are actually measuring self-evaluation rather than anxiety. However, although the correlation between anxiety and self-esteem is often statistically significant (e.g., Fish & Karabenick, 1971; Lewis & Adank, 1975; Patty & Safford, 1977; Weiner & Potepan, 1970), the multivariate nature of both affects make any cause-effect or antecedent-outcome relationships difficult to determine.

The Test Anxiety Questionnaire has been used extensively to measure anxiety in schools. Liebert and Morris (1967) proposed that the TAQ actually measured two separate qualities (subconstructs) of text anxiety, a cognitive component labelled "Worry" and a component of "Emotionality" (cf. Morris & Liebert, 1970). Worry is primarily a chronic cognitive concern dealing with the perception of potential failure or success in achievement attempts. Emotionality is an acute autonomic reaction associated with stressful situations. Liebert and Morris explained that although performance on the worry portion of the TAQ was inversely related to performance expectancy on a test (as expected), emotionality scores showed no such relationship. Although later studies by Spiegler, Morris,

and Liebert (1968), however, did reveal a relation between TAQ Emotionality scores and anxiety, Deffenbacher concluded (1977, 1978) that Worry is indeed the element of anxiety which causes test performances to fluctuate, but only for highly emotive subjects. Also, he found that high Worry and high Emotionality are separate phenomena that the TAQ combines into one factor score.

Spielberger (1972) and Gaudry (1977) made it clear that anxiety is closely associated with variables such as past failure and success experiences. The findings of Nicholls (1976) linked self-esteem with the outcomes of test experiences and their corresponding anxiety. I. G. Sarason had long before shown that test anxiety correlated moderately with achievement need for males (Sarason, 1961) and with achievement and intelligence test results for verbal and quantitative domains (Sarason, 1963).

Alpert and Haber (1960) demonstrated that scores on their Achievement Anxiety Test (AAT) predicted manifest anxiety (Taylor, 1953) and test anxiety (TAQ), as well as exam scores, course grades, and GPA's. Allen, Gait and Cherney (1974) determined that locus of control was highly associated with test anxiety and corresponding test performance, final grades, and academic outcomes in general. Lewis and Adank (1975) discovered that anxiety scores correlated with IQ, achievement outcomes, and self-esteem in self-contained elementary classrooms. As early as 1970, Kestenbaum and Weiner had uncovered a highly correlated relationship between achievement motivation and test anxiety. Weiner and Potepan (1970) found that an increase in anxiety (TAQ), as a test occasion came nearer, correlated with achievement need scores (IAR). The relation was more predictive of test success for males than for females.

The best explanation for these findings lies in attribution theory. Achievement need and test anxiety correlated with attribution. Internals (locus of control) showed a higher correlation between anxiety and need to succeed, while externals showed a correlation between anxiety and need to avoid failure. This explanation was investigated by Patty and Safford (1977). In a study of motivation to succeed versus motivation to avoid failure, in which state and trait anxiety were examined along with performance, an important sex difference emerged. Females were shown to be oriented toward succeeding and there was a direct correlation between the magnitude of motivation to succeed and test anxiety scores. Both motivation to succeed and test anxiety correlated with trait anxiety for the females. Together, anxiety scores predicted low performance. In contrast with females, males were more motivated by the need to avoid failure, which was correlated with anxiety and performance. The implication is that females experienced more trait anxiety geared toward success, while males experienced more task-specific, state anxiety focused on avoiding failure experiences. These findings verify previous research by I. G. Sarason (1961).

In a study involving locus of control and anxiety measures, Feather (1967) found that externally motivated college students experienced more debilitating anxiety than internals. The large magnitude of the effect suggested that the perfomance deficits were actually caused by the anxiety. The possibility of anxiety causing school failures, a self-perpetuating, spiralling phenomenon, has led several researchers to examine treatments for its reduction. Miechenbaum (1972) used a cognitive

awareness technique successfully to reduce anxiety. The techniques involved making subjects aware of their test-anxious behaviors, thoughts, self-verbalizations, and self-instructions. Through systematic de-sensitization with images of a coping self, test anxiety was reduced to parity with normally achieving peers. A similar treatment was successfully employed by Golfried, Linehan, and Smith (1978).

Other approaches have involved the use of anxiety-reducing instructions. Deffenbacher and Deitz (1978) successfully reduced both Worry and Emotionality in highly anxious children. Kirkland and Hollandsworth (1980) showed that test anxiety is a manifestation of poor test-taking skills. By teaching the requisite skills and increasing test situational confidence, the effects of anxiety were overcome. In a more novel treatment, Smith (1971) simply inserted humorous items in the test. On the humor-amended test, highly anxious subjects outperformed high anxiety students in the control group.

In several studies by Hill and colleagues (Hill, 1972; Hill & Eaton, 1977; Williams & Hill, Note 3), anxiety was triggered by the implications and parameters of the testing occasion. Williams and Hill (Note 3) showed that highly anxious pupils actually outscored low and middle anxious children when the test purpose was explained in a non-threatening manner. Instructions telling students that (1) the test was difficult and it was not expected that all items would be answered correctly (Expectancy-Reassurance), or (2) that the teacher just wanted to explore how children solve problems (Normative), were both anxiety facilitating conditions. In contrast, (3) standard test situations or diagnostic

instructions caused anxious subjects to be outscored, as is the more common result.

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Hill and Eaton (1977) revealed that by removing time limitations the effects of anxiety were minimized and performances were increased. In contrast, with a time limit that precluded subjects from responding to more than two-thirds of the test items, highly anxious fifth and sixth graders made three times as many errors and cheated twice as often as did low anxiety children. Hill (Note 4) concluded that the deficits which high anxiety children show in achievement are NOT due to learning difficulties, but rather to test situation, test taking, and motivational factors.

For a comprehensive review of measurement and treatment of test anxiety, see Tryon (1980). Relating the results of research on test anxiety to self-esteem and attribution findings implies that all three may actually be measuring one common or closely related underlying achievement process. As will be shown later in this paper, the intercorrelates among these three factors make them nearly indivisible. Nicholl's (1976) self-evaluation theory may provide the best interfacing for the close association of self-esteem and anxiety. Combined with the findings on the relation between anxiety and locus of attribution (Patty & Safford, 1977), it is probable that one process may provide the best explanatory and remedial starting point for any discussion of achievement deficits which are attributable to underlying process variables.

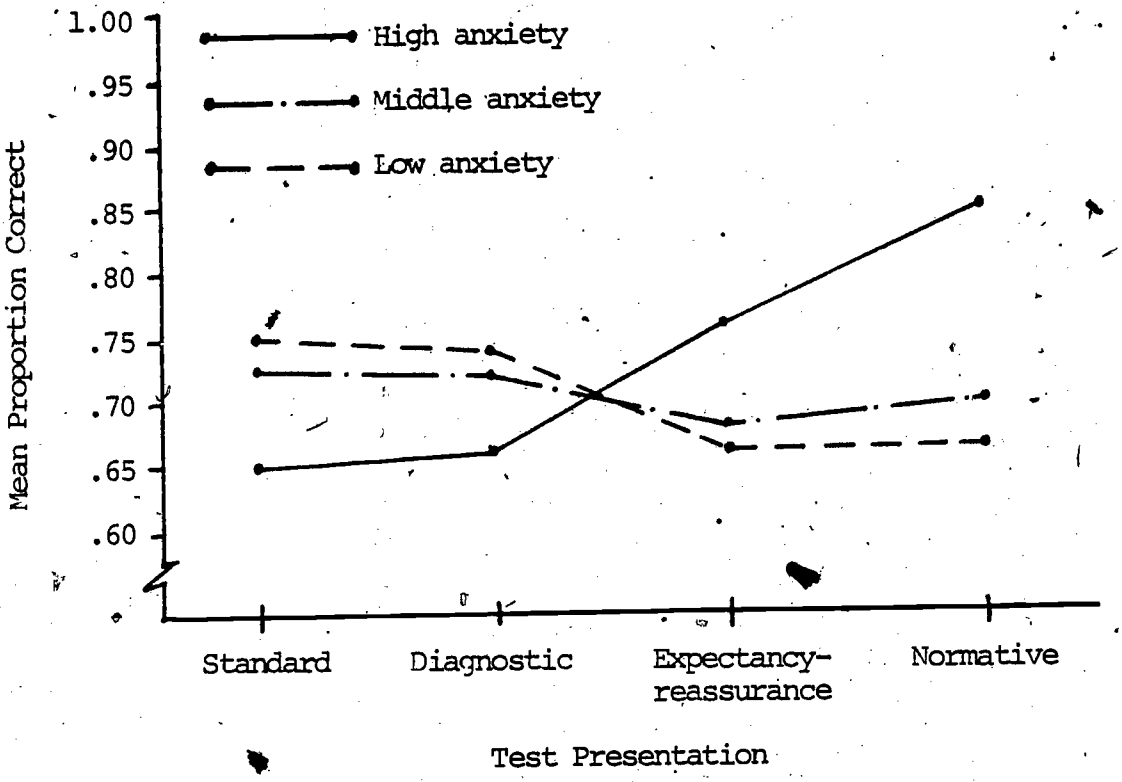

Figure 3. Children's Performance under Various Test Presentation Conditions. (Williams & Hill, Note 4)

In summary, test anxiety is associated with school success. The assessment of test anxiety should yield information concerning intellectual product deficits which can be remediated.

ATTITUDE

Among the more frequently attributed causes for failure or success is students' attitude. Teachers, counselors, and parents alike blame mediocre achievement on attitudinal deficits. Research has supported this assertion.

In 1969, Lunn developed a scale for measuring attitudes in junior high school children. Using students from 9 to 11 years old, Lunn demonstrated that his ten attitudinal subscales significantly correlated with achievement scores in English, mathematics, essay writing, and verbal and nonverbal reasoning. In a similar attempt, Neall, Gill, and Tismer (1970) confirmed the relation of attitude with achievement for sixth graders in social studies, mathematics, and reading.

Recently, some of the research on attitudes and achievement in schools has concentrated on attitudes toward mathematics. An example of the findings is the longitudinal research of Antonnen (1969) who found significant correlations between elementary and secondary math attitude scores and scores on the Iowa Test of Basic Skills, the Iowa Test of Educational Development, and Mathematics GPAs. In other words, students' attitudes toward math in elementary school predicted both attitudes and achievement six years later.

Aiken (1970, 1976) has written two comprehensive reviews of research in attitudes towards mathematics. From his findings, it becomes clear that

a mathematics phobia is caused by a complex interaction of a network of variables. Teacher characteristics, course content, instructional methods and material, and even parents' and peers' perceptions of math affect mathematics attitudes (Aiken, 1976). Lunn (1969) found that attitudes in general are the product of self-image, social adjustment, and feelings about the importance of doing well. In other words, attitudes are the manifestations of achievement-causing variables, such as self-concept, both general and task-specific motivation, and anxiety (i.e., Aiken, 1970, 1976; Cicirelli, Granger, Schemmel, Cooper, Helms, Holthouse, & Nehls, 1971; Gilbert, 1977; Schofield & Start, 1977).

The interactive effects of anxiety, achievement motivation, and achievement on attitudes were explored by Peterson (1977) with ninth graders. She found that no single factor predicted achievement alone, but that their interactions did predict achievement in school. This effect was true for attitudes toward self, toward the teacher, the subject matter, and the instructional methods.

Maier and Seligman (1976) discussed the intercorrelated, almost circular relation of the effects of motivation, cognitive abilitites, self-concept, and anxiety on attitudes of helplessness. Weiner (1972, 1979) related attitude to motivation, especially in terms of learned helplessness. In general, low achievers with external attributional tendencies feel that they have little control over achievement. Since the efforts of poor achievers cannot influence outcomes, these students adopt an attitude of futility, of "learned helplessness." Abramson, Seligman, and Teasdale (1978) found that helplessness is either acute or chronic, and

is not necessarily generalized to all tasks. Abramson et al. explained that the distinction between general or task-specific helplessness directly affects self-concept and motivation for future endeavors.

Brown and Holtzman (1955; Holtzman, Brown, & Farquhar, 1954) developed the Survey of Study Habits and Attitudes (SSHA) Questionnaire for predicting academic success. They detected that for high school or college students study habits are highly correlated with attitudes. The two constructs together predict GPA and achievement better than do standardized aptitude measures. Khan (1969) used a similar SSHA (McGuire, Hindsman, King, & Jennings, 1961) to support the findings that through counselling the affective variables (i.e., attitude and correlates) could be altered to increase achievement.

In summary, attitudes toward scholastic situations and tasks are the product of complex interactions of other affective cognitive processes. Motivation, self-concept, anxiety, and attitudes are affective processess that can be used to try to increase school achievement. Future tests should include batteries for measuring attitudes and attitudinal factors which may be causing unrealistically low scores on intellectual tests.

MULTIPLE PREDICTORS OF ACHIEVEMENT

This section presents several representative studies which investigated the predictability of achievement based on multiple variables, at least some of which are cognitive process variables.

McGuire, Hindsman, King, and Jennings (1961) predicted school achievement using multiple variables. With junior high school students, McGuire, et al. attempted to identify the critical dimensions of talented

behavior and academic success. Their model predicted that academic performance was the product of a linear combination of the following factors: (1) Potential, which includes cognitive structure, perceptual strategies, and psychomotor skills; (2) Personality variables which govern expectations, including motivation and attitude; (3) Outside Influences and pressures from peers and parents, as per selective reinforcement, avoidance or acceptance; (4) Sex-Role Identification; and (5) Cultural context or location or the pattern of educational experiences in general.

Based on 120 measures obtained in this massive project on human talent, a series of factor analyses and regressions were performed. Eight factors emerged as predictors of academic success, each discussed below.

Factor A - Cognitive Approach. This factor is associated most with cognitive style and attention, analytic and reasoning skills, as discussed in this review. The factor also covers verbal facility and word fluency, more intellectually determined abilities.

Factor B - Divergent Thinking. The variables which loaded on this factor are best summarized as creativity correlates. The tests involved items with no single conclusion or answer, as is characteristic of creativity inventories.

Factor C - Achievement Motivation. This factor involved achievement motivation, including attitudes toward school and education, and scholastic motivation. Interestingly, students high on this factor were more anxious yet positively oriented to societal obligations, as would be expected based on the study of motivation and anxiety in this review.

Factor D - Peer Stimulus Value. Persons high on this factor were active, accepted, and showed higher self-concept and self-confidence. The factor involved children who react positively to peer pressures.

Factor E - Age-Mate Avoidance. This factor contrasts somewhat with Factor D. Students here are antisocial, impulsive, and avoided by peers. Although Factors D and E seem to present a bipolar relation, they were independent of each other.

Factor F - Anxious Emotionality. Anxiety was described in this review as anxiety to avoid failure versus anxiety to succeed and also as task-specific anxiety versus general anxiety. Factor F was specific to boys, a finding which agrees with Patty and Safford's (1977) conclusion that males are often driven by anxiety to avoid failure rather than to succeed. Also, Weiner and Potepan (1970) showed that on the Individual Achievement Responsibility (Crandall et al., 1965) measure of achievement motivation males scored higher than females and showed a higher task-specific anxiety level due to the drive to avoid failure.

Factor G - Anti-social Variables. Also specific to boys, this factor is most closely associated with the negative aspects of attitudes toward social situations in school, which correlated with resisted authoritarianism and educational settings in general. This factor may also be related to the fear of failure presented by school situations (Patty & Safford, 1977).

Factor H - Sensitivity Dependency. This factor was specific to girls. Socialization and sex-role identification may be the cause of this tendency toward sensitivity and willingness to submit to authority.

Another possible explanation of this sex difference may also be that females are more motivated by the need to succeed. This need to succeed would potentially create a more conventional approach to education, while the males' need to avoid failure might be more evidenced by a need to rebel and to "beat the system."

In 1969, Kahn attempted to isolate affective correlates which predicted academic achievement. Employing factor analysis and canonical correlation techniques, he found high interrelations between attitudes, study habits, motivation, achievement needs, and achievement anxiety. These relationships are supportive of the multivariate prediction of achievement implied in this review.

Kahn detected some gender differences. However, overall achievement in reading, mathematics, language, social studies, science, and problem-solving tasks were predictable by achievement need, achievement anxiety, and academic interest (motivation and attitude). Sex differences favoring males showed achievement scores were also predicted by attitudes toward teachers and academic motivation.

A variety of eight scales for measuring personality traits was used in an attempt by Mehrabian (1969) to characterize students with a high achieving tendency. The measures included an achievement motivation scale (Mehrabian, 1968), Task Orientation Scale (Bass, 1967), Sociability Scale (Guilford & Zimmerman, 1949), Social Love and Affection Scale (Liverant, 1958), Neuroticism Scale (Eysenck & Eysenck, 1963), Dogmatism Scale (Rokeach, 1960), Social Desirability Scale (Crowne & Marlow, 1960), and a scale of Venturesomeness versus Shyness (Cattell & Eber, 1957). The

results of Mehrabian's multivariate study in achievement yielded the following characterization of high achievers as opposed to low achievers: less test anxious, less dogmatic (more flexible), less neurotic (less anxious, less compulsive or impulsive) and less conforming (more original and creative). These characteristics also support conclusions drawn in previous portions of this review.

In 1972, Cattell, Barton and Dielman gave 311 sixth and seventh graders a battery of three tests in an effort to isolate the best combination of predictors of school achievement: 16PF (personality), Motivation Analysis Test, and Culture Fair IQ test (ability). Four standardized achievement tests were administered three months later -- mathematics, science, social studies, and reading, all Educational Testing Services measures. The results of the Cattell, et al. study showed that achievement correlated significantly with the following motivation variables: fear and anxiety, pugnacity (anti-social attitudes), self-concept and narcissism, attitudes toward school, and attitudes about home. Personality variables which correlated with achievement included warm-heartedness, emotional stability, self-assurance, conscientiousness, and self-sentiment. Interestingly, achievement in math was uniquely associated with adventurousness (creativity), tough-mindedness, and individualism. IQ predicted achievement, also.

Cattell, et al. concluded that the three combined measures account for 50 percent of all variance associated with achievement, with an R^2 of from .61 to .69 for math, and .69 to .76 for reading. Certainly, this effort should be considered as a significant step toward better prediction

of school achievement success based on properties of processes which undergird intellect. Motivational variables alone accounted for 20 percent of the variance in achievement scores over and above personality and ability measures in reading, and 10 to 15 percent in the other areas. Personality variables accounted for between 15 and 23 percent of variance.

A quasi-longitudinal study of the relationship of academic achievement to personality characteristics was published by Kifer in 1975. He used four personality measures : Parental Reinforcement Questionnaire (Dave, 1963); Self-Esteem Inventory (Coopersmith, 1967); the Brookover, Thomas, and Paterson (1964) measure of self-concept of ability; and Crandal et al. (1965) Individual Achievement Responsibility motivation index. He found that one of the two major contributing factors to academic success is the home and home-based reinforcement for academic achievement. The other major contributor to scholastic outcomes is a history of prior successful academic attainments. These latter successes have the greatest influence on personal characteristics related to school success.

The studies of multiple predictors of achievement success have several variables in common. Among these are the major factors treated in this review, namely motivation, achievement need, self-concept, anxiety, and attitudes. It is interesting to note that the strength (R^2) of personality variables for predicting achievement outcomes often exceeds that of the IQ measures themselves (cf. Cattell, Barton, & Dielman, 1972).

SUMMARY

The traditional reliance on scores from intelligence tests and achievement measures has discouraged the measurement of underlying,

mediating process variables such as those covered in this review. This situation persists even in light of the volume of evidence which has established strong relationships between cognitive and affective processes and scholastic success. We maintain that to increase the predictive validity of tests, and the utility of their score outcomes, cognitive and affective process measures should be added to tests meant to predict school achievement.

The purpose of this review, however, is not simply to caution or to advise test development institutions, but to communicate ideas to test users as well. The most significant value of the emphasis on process variables for assessment may not lie in the prediction of future academic success, or in the measurement of existing achievement levels. The greatest potential gain in moving toward this new approach of testing may well lie in the usefulness of the test results. Our contention is as follows:

Intelligence measures yield data concerning momentary states of knowledge or ability. These static descriptions are interpreted as descriptions of student potential. Yet the evidence accumulated in this review shows that the affective and cognitive processes which underly these intelligence scores are dynamic in nature, and that they can be taught and improved.

While feedback from measures of intelligence, ability, and achievement tests may lead to remediation of some academic deficiencies or weaknesses, it may also result in superficial treatments based on the assessment of subject-specific symptoms. Scores from cognitive and affective measures, on the other hand, reflect problems which may be undermining scholastic

potential. Treatments and therapies based on process scores have the unique possibility of resolving underlying deficits which may be limiting student potential in areas previously undiagnosed.

The future of the measurement and prediction of student potential goes beyond the development of new tests of intelligence. Potential of individuals is based on the underlying attributes and processes which mediate performance and are only diffusedly reflected through traditional test scores. To predict potential scholastic success, as well as to provide remedial information to increase that potential, the testing movement will need to refocus its emphasis upon cognitive and affective processes. Although we do not suppose that this approach represents a panacea, we do maintain that it is essential, logical, and has been too long waiting.

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