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PSYCHOLOGY *of* CLASSROOM LEARNING

An Encyclopedia

ERIC M. ANDERMAN, *Editor in Chief*
LYNLEY H. ANDERMAN, *Co-editor*

Attention to prevention would suggest (a) remove the aversive noise by using lights that do not produce the negative hum, and (b) teach the child a communication skill that she can use to tell adults when she is in distress (without engaging in aversive histrionics). Changing the lights removes the aversiveness of the room and hence the function of screaming, throwing, and hitting—removal from the situation—no longer is relevant. Teaching her an alternative communication skill that produces the same effect (removal from aversive noise) gives her a socially appropriate (and more efficient) strategy for achieving the maintaining function.

The message from this example is that applied behavior analysis has matured beyond just the manipulation of positive and negative consequences. Both the research being done in the early 2000s, and the clinical applications of the technology, focus extensively on (a) the events that set the occasion (or prompt) problem behavior, and (b) alternative skills that can be taught to make problem behaviors unnecessary. In essence applied behavior analysis is being used to apply the principles of human behavior to the design of effective school, work, play, and home environments. This is an exciting development in that applied behavior analysis is being used as a technology to create situations that prevent problems as well as a technology to address problems when they develop.

The field of applied behavior analysis remains promising, but under-utilized in U.S. society. The contributions that basic principles of behavior can make to improve living and learning opportunities far outstrip current applications. The early decades of the twenty-first century are anticipated to show elaboration and scaling of these contributions. For the first years of the 2000s, however, (a) research in applied behavior analysis can be expected to improve the on-going understanding of how the environment affects human behavior, and (b) any clinical application of applied behavior analysis can be expected to (1) be based in application of basic behavioral principles, (2) include an initial functional behavioral assessment or functional analysis to identify the consequences maintaining the target behavior(s), (3) employ behavioral interventions that combine manipulation of prevention variables (e.g. antecedent stimuli and instruction on new skills) in addition to consequences, and (4) include measurement of behavior over time to assess effects.

SEE ALSO *Classroom Management.*

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Robert H. Horner
Cynthia M. Anderson

APTITUDE TESTS

Perhaps no other construct in psychology or education has elicited as much debate as the question of what constitutes mental ability, how one might go about measuring it, and even how the resulting tests should be labeled. Most tests of mental ability include in their title some reference to intelligence (i.e., IQ) or aptitude. At the same time, some authors are moving away from the use of either of these terms for fear of the negative connotations they often elicit regarding their historically incorrect associations with invariant hereditability. An example would be the change in how the SAT is known. That "the *Scholastic Aptitude Test* became the *Scholastic Assessment Test*, and later simply the *SAT*" (Hogan, 2003, p. 279) is an example of an organization's move away from these highly charged terms.

Beyond labels, different theories of mental abilities focus on different aspects of and emphases on mechanisms and processes. There is no universal agreement or clear consensus as to which human processes are responsible for giving rise to intelligent behavior. It is, however, fair to say that most definitions and theories of mental ability include the use of the term *capacity* in one or more ways. For example, the capacity to learn, process information, learn from experience, adapt to one's environment, and think abstractly. Tests of mental ability are designed to quantify a variety of cognitive processes that underlie individual capacity.

INTELLIGENCE AND APTITUDE

Differentiation of mental ability in terms of intelligence and aptitude is often very subtle and difficult to disentangle. The problem is further complicated by the fact that scientists and test authors often use the terms synonymously, frequently making a separation between the two concepts a matter of semantics. However, examination of the content and purported uses of tests that include either intelligence or aptitude in their title allows for some differentiation between the two terms. Examples of intelligence and aptitude tests are presented in many major psychological measurement and testing texts such as Anastasi and Urbina (1997) and Kaplan and Saccuzzo (2005). Perhaps the most obvious difference relates to the purposes of their intended use. Both are primarily useful for predicting future outcomes or gauging potential for success. Whereas intelligence tests are typically used for predicting classroom or scholastic achievements, aptitude tests tend to be used more for gauging occupational success (e.g., informing job selections and military placements). Another distinguishing feature is that tests that in title purport to measure aptitude tend to be group administered, whereas those tests that advertise themselves as measuring intelligence are more often individually administered.

Beyond these differences related to use and administration, there are often only slight differences in the content of the measures. Most aptitude tests are comprised of large doses of content devoted to the measurement of cognitive ability constructs that would typically be found on an intelligence test (e.g., verbal ability, perceptual ability). Historically, aptitude tests were differentiated from intelligence tests by providing a broader assessment of abilities than the single IQ score afforded by intelligence tests. However, later developments resulted in an explosion of cognitive theories and accompanying IQ batteries that provide a much broader assessment of individual strengths and weaknesses, causing this line of distinction to become increasingly blurred. These same theories also provide the foundation underlying tests of aptitude. In addition, although aptitude tests may contain portions that are more obviously (i.e., as indicated by subtest labels) achievement related, many intelligence tests require acquired knowledge on the part of the examinee. These issues are addressed in greater detail below.

Popular Aptitude Battery Subtests (and their Linkages to CHC Constructs)

Differential Aptitude Tests - Fifth Edition (DAT) and the Differential Aptitude Tests - Computerized Adaptive Edition (DAT Adaptive)

Verbal Reasoning (Gc), Numerical Reasoning (Gq), Abstract Reasoning (Gf), Perceptual Speed and Accuracy (Gt), Mechanical Reasoning (Gv), Space Relations (Gv), Spelling (Grw), Language Usage (Grw)

General Aptitude Test Battery (GATB)

General Learning Ability (Gf), Verbal Aptitude (Gc), Numerical Aptitude (Gq), Spatial Aptitude (Gv), Form Perception (Gv), Clerical Perception (Gv), Motor Coordination (Gp), Finger Dexterity (Gp), Manual Dexterity (Gp)

Multidimensional Aptitude Battery (MAB)

Information (Gc), Comprehension (Gc), Arithmetic (Gf), Similarities (Gc), Vocabulary (Gc), Digit Symbol (Gs), Picture Completion (Gv), Spatial (Gv), Picture Arrangement (Gv), Object Assembly (Gv)

Occupational Aptitude Survey and InterestSchedule - Third Edition (OASIS - 3)

General Ability (Gf), Verbal Aptitude (Gc), Numerical Aptitude (Gq), Spatial Aptitude (Gv), Perceptual Aptitude (Gv), Manual Dexterity (Gp)

Note: Gf = Fluid Intelligence, Gq = Quantitative Knowledge, Gc = Crystallized Intelligence, Grw = Reading and Writing, Gv = Visual Processing, Gs = Processing Speed, Gt = Reaction Time, and Gp = Psychomotor Abilities.

Table 1 ILLUSTRATION BY GGS INFORMATION SERVICES. CENGAGE LEARNING, GALE.

HISTORY OF MEASURING MENTAL ABILITY

The first attempt at measuring mental ability can be traced back to the early 1800s and the work of Sir Francis Galton (1822–1911). Galton's first attempts at measuring mental ability were met with criticism and largely failed to stand the test of time. This was most likely the result of his failure formally to understand and define the construct he was attempting to measure. Further, Galton's measures were primarily physical and sensory rather than mental or cognitive in nature. Modern theories of mental ability can be traced back to the mid to late 1800s and the theoretical work of Alfred Binet (1857–1911), Victor Henri (1872–1940), and Theodore Simon (1872–1961). Binet's early theories were operationalized in the Binet-Simon Intelligence Scale (1905), an instrument that was largely successful in identifying children with mental retardation. Success of the Binet-Simon Scales of Intelligence led to their translation and adaptation for use in the United States, and ultimately led to the first Stanford-Binet Intelligence Scale (Terman, 1916). Soon to follow were the group administered Army Alpha and Army Beta tests of mental ability. The former consisted of 10 scales designed for use with examinees proficient and literate in English, and the latter seven scales designed for use with those unfamiliar with or lacking proficiency in English literacy.

The eventual declassification of the Army Alpha-Beta scales led to a proliferation of commercially available tests through the mid 1900s, including the first Scholastic Aptitude Test (SAT; 1926). Wasserman and Tulsky

(2005) give a more detailed historical account of the origins of cognitive assessment.

Many of the historical attempts at measuring cognitive ability were often criticized for lacking a strong underlying theoretical basis. In addition, the primary benefit of these measures was largely in the prediction of academic outcomes and in the identification of children in need of special services. Despite the importance of these objectives, educators often sought ways in which the results of cognitive assessments could inform instructional practices. These attempts, however, largely failed to obtain empirical support. Several contemporary theories of human abilities have been proposed that hold greater promise for informing instructional interventions. The advantage of mapping test designs onto models of cognitive development that are both theoretically meaningful and empirically supported is that the assessment results hold greater promise for academic interventions that can be more directly applied to optimize student success in the classroom.

THEORIES AND MODELS OF COGNITIVE ABILITY

New and revised theories of cognitive ability, which are strongly rooted in the more empirically researched paradigm of information processing, have paved the way for new instruments and revisions of past traditions. Broadly, information processing theories are concerned with the cognitive processes involved in performing various tasks. Most contemporary theories operate within this paradigm, differing largely in terms of the number of processes believed to be involved, how the processes are related to one another, and the level of detail required for a proper assessment of children's strengths and weaknesses that are useful for informing interventions and predicting future success. Examples of operational models of mental ability that derive roots within the information processing paradigm include the Planning, Attention, Simultaneous, and Successive (PASS) theory (Naglieri & Das, 1990); the Gf-Gc theory (Horn & Cattell, 1966); Carroll's 1993 three-stratum theory; and the Cattell-Horn-Carroll (CHC) theory of cognitive abilities.

Although no single representation of the structure of cognitive ability is universally accepted among researchers, the CHC model appears to be drawing the most attention in terms of academic research and its influence on the development and revision of cognitive tests. (Interested readers may consult McGrew's 2005 study for a fascinating discussion of the birth of the CHC model.) The CHC model integrates the Gf-Gc (Cattell & Horn) and three-stratum (Carroll) models. Gf-Gc originates from the earliest model of the theory that consisted of only two abilities: fluid (inductive and deductive) reasoning (Gf) and crystallized intelligence (Gc) largely characterized by knowledge acquired through acculturation. Evolutions of both the original Gf-Gc model and Carroll's three-stratum theory have occurred over time.

The CHC model is characterized by several broad-band abilities, including fluid intelligence (Gf), quantitative knowledge (Gq), crystallized intelligence (Gc), reading and writing (Grw), short-term memory (Gsm), visual processing (Gv), long-term storage and retrieval (Glr), processing speed (Gs), reaction time (Gt), and psychomotor abilities (Gp). Underlying each of these broad-band abilities are numerous narrow abilities that are useful for operationalizing the multidimensional aspects of the broad-band ability constructs. For example, fluid intelligence (broad-band ability) is influenced by several narrow abilities including general sequential reasoning, induction, quantitative reasoning, Piagetian reasoning, and speed of reasoning. Interested readers may consult Alfonso, Flanagan, and Radwan (2005); and McGrew and Flanagan (1998) for a more detailed description of the CHC model.

MEASUREMENT INSTRUMENTS

Recent decades have witnessed a swelling of cognitive tests on the market. The majority of these new or recently revised instruments are rooted within the CHC model of cognitive ability and measure, to varying degrees, at least some of the broad-band and narrow-band abilities represented in the CHC model. Examples of such instruments that are appropriate for use with children and adolescents in school settings include Kaufman Adolescent and Adult Intelligence Test (KAIT; Kaufman & Kaufman, 1993), Kaufman Assessment Battery for Children, second edition (KABC-II; Kaufman & Kaufman, 2004), Reynolds Intellectual Assessment Scales (RIAS; Reynolds & Kamphaus, 2003), Stanford-Binet Intelligence Scales, fifth edition (SB-5; Roid, 2003), Wechsler Intelligence Scale for Children, fourth edition (WISC-IV; Wechsler, 2003), Wechsler Preschool and Primary Scale of Intelligence, third edition (WPPSI-III; Wechsler, 2002), Wechsler Adult Intelligence Scale, third edition (WAIS-III; Wechsler, 1997), Wide Range Intelligence Test (WRIT; Glutting, Adams, & Sheslow, 2002), and Woodcock-Johnson III Tests of Cognitive Abilities (WJ-III; Woodcock, McGrew, & Mather, 2001). The 2005 study by Alfonso and colleagues contains descriptions of the specific CHC model components and influences embedded within these psychodiagnostic measures.

It is notable that the same CHC ability constructs that serve as templates for the development of tests that feature "intelligence" in their titles also factor prominently into measures of "aptitude." Table 1 lists several popular aptitude batteries along with the subtests that comprise them. It is also shown that each of the components of these batteries aligns with one of the broad or narrow constructs of the CHC model. As described in an earlier section of this entry, this illustrates the substantial overlap in the constructs typically assessed by labeled tests of intelligence and aptitude. Similarly, although aptitude tests may contain portions that are more obviously (i.e., as indicated by subtest labels) achievement related, many intelligence tests also require acquired knowledge on the part of the examinee. The popular Wechsler Intelligence Scale for Children, for example, contains several subtests that assess previously learned material (e.g., vocabulary, information).

IMPLICATIONS FOR LEARNING

The prediction of academic achievement and future occupational success remains a common practice in education as a means for guiding decisions related to student selection, diagnosis, and placement. Historically, interest in the prediction of academic achievement emerged from a variety of sources. One of these sources was the need for institutions of higher education to select students who demonstrated academic potential (Laven, 1965). A second source was from interest in the early diagnosis of students likely to suffer from academic failure, so that remedial interventions could be provided in a timely fashion (Keogh & Becker, 1973).

A variety of variables have been linked to school achievement, including cognitive ability, academic skills/readiness, language abilities, motor skills, behavioral-emotional functioning, achievement motivation, peer relationships, and student-teacher relationships (Tramontana, Hooper, & Selzer, 1988). As a result, it is important to note that any assessment of children's potential strengths and/or weaknesses should consider multiple inputs and sources. Nonetheless, evaluations of children's capacity to learn as measured by many tests of cognitive ability remain at the forefront of developing hypotheses about potential learning problems.

Psychodiagnostic tests have a rich history of accounting for meaningful levels of achievement variance (Bracken & Walker, 1997; Brody, 2002; Flanagan, Andrews & Genshaft, 1997; Grigorenko & Sternberg, 1997; Jensen, 1988; McDermott, 1984). In fact, it is often said that one of the most important applications of such tests is their ability to predict student achievement and future outcomes (Brown, Reynolds, & Whitaker, 1999; Weiss & Prifitera, 1995). From this perspective, cognitive tests can be considered useful for identifying children who are at risk for academic failure.

At the same time, there has been movement in the field to inform users of alternative ways in which aptitude tests can be more directly tied to individual educational treatment plans. A few examples of the many ways in which aptitude test results can be used to guide individual instruction, enhance academic success, and suggest useful accommodations are provided below, and interested readers may consult Mather and Wendling's 2005 study for more details. Drawing from this source, the following examples illustrate how cognitive assessment results can be useful for guiding instruction and enhancing the learning of children. The examples are not contained within any one of the many available aptitude tests listed above, rather, they are general processes involved in different ways to student learning. As noted above, most of these contemporary tests have been constructed to tap into some aspect of the information processing system responsible for learning. As a result, these processes are largely measured in one way or another by most contemporary tests of intellectual processing.

Early language development is dependent upon children's phonological processing capacity. Children with identified deficits in phonological processing often benefit from direct instruction emphasizing linkages between phonemes and graphemes. The ability to retain and recall information over long periods of time is an important component of cognitive functioning. Children with identified long-term retrieval problems are likely to benefit from additional practice when learning new material. Including dynamic visual instruction diagrams or organizers will benefit children struggling with visual-spatial thinking, and children with processing speed deficits will often require more concise definitions of required tasks and longer periods of time to complete them.

It is important to note, however, that children at risk may have more than one type of aptitude deficit, and may also possess one or more strengths. As a result, it is important that educators take into consideration how these processes may be operating in concert. In addition, it is important to emphasize that while aptitude tests hold much promise for helping to understand the needs of children, no single test score should be used as the sole basis for decisions. A complete understanding of the potential influences of learning problems involves multiple inputs from multiple sources. It is equally important to remember that while aptitude tests explain a good portion of the variance in student achievements, they are in no way self-determining of academic success. Children's motivation, personality, classroom environment, self-image, peer relationships, student-teacher relationships, teacher instructional effectiveness, and so on also contribute to student success.

SEE ALSO *Accountability; High Stakes Testing; Intelligence: An Overview.*

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Timothy R. Konold
Gary L. Canivez

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SEE *Attributional Retraining.*

ARGUMENTATION

Argumentation is a form of discourse in which individuals take a position, justify that position with claims and evidence, and address possible counterarguments. In school settings, argumentation may involve contrasting alternative hypotheses in a lab, questioning the sources used to construct an historical account, or revising a