

Assessment of Reasoning Abilities

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In response to concerns about the basic skills proficiencies of students entering college, the New Jersey Board of Higher Education established the Basic Skills Assessment Program in 1977. The program has two major mandates: to assess the basic skills of all first-year students entering public colleges in the state and to evaluate the character and effectiveness of these colleges' remedial programs. To carry out these requirements, the Board created a Basic Skills Council composed of faculty members representing all sectors of higher education.

The Council addressed the first mandate by creating its own test, the New Jersey College Basic Skills Placement Test (NJCBSPT). In developing this test, the Council attempted to measure critical thinking skills both by creating a separate section called logical relationships and by designing questions on the verbal and math sections to require understanding and thinking. The Council dropped the logical relationships section after four years because it was found to be too highly correlated with reading comprehension to be an accurate measure of a separate category of skills.

The second approach, involving the kinds of questions asked, was more subtle and continues to be incorporated into the test. The essay section, for example, requires an expository rather than a narrative essay. Students are asked to take a position on a broad topic and defend it with reasons. Their

papers are scored with an holistic scoring system that assesses the important attributes of logic and organization as well as the more traditional factors of syntax, grammar, punctuation, capitalization, and spelling. Similarly, the reading section requires comprehension and inference; and the math section demands that students understand concepts.

In 1982, concerned that thinking/reasoning needed more attention, the Basic Skills Council created a Task Force on Thinking with three charges:

1. Define the kinds of thinking competencies entering first-year college students should be able to demonstrate.
2. Explore the measurement of these thinking competencies.
3. Make recommendations for the improvement of thinking/reasoning skills.

Defining Thinking Competencies

Early in its deliberations the Task Force decided that the list of reasoning competencies published by the

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College Board (1981) through its Project EQuality was an appropriate set of guidelines for describing critical thinking. These included:

1. The ability to identify and formulate problems, as well as the ability to propose and evaluate ways to solve them.

2. The ability to recognize and use inductive and deductive reasoning and to recognize fallacies in reasoning.

3. The ability to draw reasonable conclusions from information found in various sources, whether written, spoken, tabular, or graphic, and to defend one's conclusions rationally.

4. The ability to comprehend, develop, and use concepts and generalizations.

5. The ability to distinguish between fact and opinion.

At the same time, however, the Task Force also concluded that this list of competencies did not completely describe the nature of thinking/reasoning. They developed a taxonomy of competencies needed for a more complete definition of thinking. The Task Force decided the two lists (the College Board list and its own—see New Jersey Task Force Taxonomy of Thinking Skills) were necessary so that both the broad and the specific nature of these skills could be examined, bearing in mind that neither taxonomy was exclusive nor exhaustive and that no hierarchical order existed.

Exploring Measurement of Thinking Competencies

Having a framework from which to operate in measurement and ultimately in teaching, the Task Force moved on to its second charge: exploring ways of measuring thinking/reasoning. Many members were familiar with existing tests of thinking; they decided to take a closer look at those tests. Watson-Glaser, New Jersey Test of Reasoning Skills, Whimbey Analytical Skills Inventory, Cognitive Abilities Test, Cornell Critical Thinking Test (Level X) and the discarded logical relationships section of the NJCBSPT were examined with regard to their *cleanliness* (a term the Task Force used to refer to items or tests where it was reasonably clear that what was being measured was the student's ability to reason, not his or her ability to read or write). Each of the tests was compared

Tests of Thinking

TEST, AUTHOR(S), SOURCE	NUMBER AND KINDS OF ITEMS
New Jersey Test of Reasoning Skills Virginia Shipman IAPC—Test Division Montclair State College Upper Montclair, NJ 07043	50 items, untimed Conversion Standardization General Reasoning Assuming Induction Good Reasons Syllogism Contradiction Hypothetical Reasoning Causal Relationships Etc.
Whimbey Analytical Skills Inventory Arthur Whimbey Franklin Institute Press Box 2266 Philadelphia, PA 19103	38 items, untimed Differences and Similarities Following Directions Solving Problems Analogical Reasoning Mathematical Analogies Trends/Patterns Sorting Etc.
Cornell Critical Thinking Test, Level X Robert Ennis and Jason Millman University of Illinois Press, 1982 Box 5081, Station A Champaign, IL 61820	76 items (5 sample), timed or untimed Hypotheses Deduction Reliability of Authorities Assumptions Relevance
Cognitive Abilities Test, Form 3 (Level H) Robert Thorndike, Elizabeth Hagen, and Irving Lorge Riverside Publishing Co. 8420 Bryn Mawr Ave. Chicago, IL 60631	25 items per section, timed VERBAL Similarities Sentence Sense Classification Analogies QUANTITATIVE Relating Seriation NONVERBAL Classification Synthesis Analogies
Watson-Glaser, Forms A and B Goodwin Watson and Edward M. Glaser Psychological Corporation 757 Third Ave. New York, NY 10017	80 items, timed or untimed Inference Assumptions Deduction Interpretation Evaluation of Arguments

Ross Test of Higher Cognitive Processes	105 items, timed
John D. Ross and Catherine M. Ross	Analogies Deduction Missing Premises Abstract Relations Sequential Synthesis Questioning Relevance Analysis of Attributes
Academic Therapy Publications, 1976 20 Commercial Blvd. Novato, CA 94947	

The New Jersey Task Force Taxonomy of Thinking Skills

Compiled by Matthew Lipman, Paul Jacobs, and Jerry Coleman

Mental Acts

associating
assuming
pretending
supposing
guessing
speculating
wishing
surmising
conceding
remembering
choosing
judging
deciding
comparing
contrasting
and so on

Cognitive States

knowing that one knows
knowing that one doesn't know
comparing, wishing, and hoping
realizing one understands
and so on

Combinations of Mental Acts and Cognitive States

doubting
knowing
wondering
understanding
and so on

Reasoning Skills

concept formation
sorting
grouping
classifying
defining
grading
seriation
using criteria
exemplifying
generalizing
recognizing relationships
distinguishing dissimilarities
logical
existential
discovering similarities
resemblance of terms
identity of terms
resemblance of relationships
understanding systems
applying criteria to reasoning
consistency
validity
completeness
truth (definitional)
inferring
formal
immediate
ordinal (relational)
categorical syllogistic
conditional
informal
generating logical alternatives
utilizing matrices
utilizing contradictories
understanding perspectives and frames of reference
constructing arguments
formulating questions
providing reasons
assumption-finding
relating premises to conclusions
standardizing sentences

Inquiry Skills

observing
narrating
describing
explaining
estimating
formulating problems
forming hypotheses
measuring
predicting
designing experiments
verifying
inductive reasoning
methodical doubting
reciprocally adjusting
means and ends
seeking comprehensive-ness
distinguishing among
causal, contingent, and
correlated relationships
formulating conclusions
looking for relevant evidence
and so on

with both the definition and the taxonomy developed by the Task Force to determine which aspects of thinking were apparently measured by each test.

Three of the above tests were chosen for further research: New Jersey Test of Reasoning skills because of its simple language and its balance of inductive and deductive logic; Whimbey Analytical Skills Inventory because of its array of skills; and Cornell Critical Thinking Test (Level X) because of its story format and sequential nature.

Testing the Tests

The Task Force decided that simply to examine the content (or face) validity of the instruments was insufficient to determine their validity. They were concerned about the limited information available on the reliability, norms, and other statistical data of these tests when administered to large numbers of first-year college students. To address these concerns, the Task Force administered the three selected tests in serial fashion to more than 2,200 freshmen in eight colleges across the state. Students identified as needing remediation were included in the sample, as were students deemed ready for college level courses. As part

of the regular college testing program, all of these students had already completed the New Jersey Basic Skills test. Therefore, the Task Force could study the relationships, if any, between each of the thinking tests and the basic skills scores in reading, writing, and mathematics.

In addition, the Task Force employed test-item regression analysis (Dass and Pine, 1981), which allows microscopic examination of individual test items to determine item and test effectiveness, classifications of items within a taxonomy, and the relationship between thinking test items and basic skills.

Results

The Task Force is still analyzing the results. A complete report on test validity and reliability, with information about the applicability of these tests to New Jersey freshmen, should be available soon. Preliminary findings include:

1. Many entering students are functioning below the level of formal reasoning as measured by the three selected tests. (Precise numbers are not ready for publication.)
2. Each test contains items that do not appear to be productive. Some

items are ambiguous; some do not relate to the total score; some do not discriminate well between those who reason well and those who do not (as measured by the total score); some appear to be more related to mathematics or vocabulary than to reasoning.

3. Strong positive correlations existed between each thinking test and all five sections of the Basic Skills test. These are illustrated in Figure 1.

Discussion

The Task Force on Thinking continues to study the abundant data. Analyzing the items, classifying them, and attempting to determine which type of item works best is part of this continuing effort. Future analysis will include the relationships between thinking tests and basic skills tests from the vantage points both of the total score and of individual items. Whether to add reasoning items to the Basic Skills test or simply to score it so as to yield a "thinking" score is an important question. Better understanding of what thinking is and how it relates to basic skills is an additional area of inquiry. And we have not even begun to systematically consider the implications for teaching. □

References

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- Ennis, Robert H., and Millman, Jason. "Cornell Critical Thinking Test, Level X, 3rd ed." Champaign: Illinois Thinking Project, 1982.
- Shipman, Virginia. "New Jersey Test of Reasoning Skills, Form A." Totowa, N.J.: Totowa Board of Education, 1983.
- Whimbey, Arthur, and Lockhead, Jack. *Problem Solving and Comprehension*. 3rd ed. Franklin Institute Press, 1982.

Figure 1. Correlations Between Three Thinking Tests and Various Sections of the New Jersey College Basic Skills Placement Test.

Name of Test	New Jersey College Basic Skills Placement Test				
	Reading Comprehension	Sentence Sense	Computation	Elementary Algebra	Essay
Cornell Critical Thinking Test N = 512	.68	.62	.49	.40	.44
Whimbey Analytical Skills Inventory N = 513	.76	.75	.76	.70	.56
New Jersey Test of Reasoning N = 643	.82	.81	.67	.59	.69

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