Assessment and Education: Access and Achievement

CSE Technical Report 435

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July 1997

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The work reported herein was supported in part under the Educational Research and Development Centers Program, PR/Award Number R305B60002 to the National Center for Research on Evaluation, Standards, and Student Testing, as administered by the Office of Educational Research and Improvement, U.S. Department of Education, and in part by the National Research Center on Student Learning at the Learning Research and Development Center funded by the Office of Educational Research and Improvement (OERI) of the U.S. Department of Education.

ASSESSMENT AND EDUCATION:

ACCESS AND ACHIEVEMENT[1]

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In these remarks, I address the two broad uses of testing and assessment in education. One is selecting for and facilitating access to education; the second is the assessment of learning outcomes, i.e., the level and nature of competence achieved. I consider these two functions and discuss their present condition, anachronistic dysfunctional uses, and research directions for the future. Overall, I attempt to place research familiar to many in a framework that emphasizes the interaction between assessment, learning, and instruction that I believe is necessary for the future.

The first function, access to education, is historically coordinated with work on individual differences in human intelligence and extends the concept of testing developed by Binet some generations ago as measurement of the ability or aptitude to profit from schooling. Technical practices for access to education in the United States developed largely around the management of instruction through selection and the use of methods for the classification and differential placement of individuals. Modern psychometric theory grew up primarily in this context of use. In contrast, the second function, the assessment of achievement, proceeded with less developed underlying theory. An implicit behavioral psychological theory was involved, which could not adequately describe complex processes of thinking, reasoning, and problem solving that characterize high levels of competence.

If we are now to move ahead with the modern development of assessment for learning and teaching, it is important to examine the shortcomings and dysfunctional aspects of current methods. We need to ask how testing and assessment are institutionalized in educational systems today, and how current practice reflects the attempts of past generations to meet the conditions

[1] This article is based on a paper presented at the 1996 Annual Meeting of the American Educational Research Association, New York City.

of other times with consequent undesirable practices. To make progress, we also need to ask what new goals for learning and what modern understanding of the development of cognition must be considered in improved uses of assessment for both access to educational opportunity and to display and assess outcomes.

Consider *access to educational opportunity*. A selective system is no longer the prevalent educational demand on assessment (even though the choice to be selective or not remains). More effort is being placed on helping students succeed. The selective emphasis placed too much burden for learning on the condition of the student and too little burden on the possibilities of innovative and adaptive teaching and instruction. Fortunately, much current research and innovation is beginning to investigate these possibilities. The requirement is to design adaptive and helping educational communities in which we devise means for providing equitable educational opportunities.

This shift in emphasis poses problems and demands in the use of tests for monitoring access to education because the tests used to make assignment decisions have generally not been designed to guide specific educational practices. Today, teaching needs information on individuals that is oriented toward instructional optimization rather than prediction. For this purpose, the test and the instructional process need to become more integral events. Scholars have put their minds to this problem and their efforts, along with those of teachers and schools, are being implemented with ingenuity and disregard for past conceptions.

However, studies have reminded us of the institutional use of selection-placement testing in schools in ways that are decoupled from the learning process. Tests are used to place students into instructional practices to provide differential opportunities, but little effect has been shown in either (a) increasing the educational achievement of the learner, or (b) in an appreciation of the interaction between the capabilities of the learner and the learning environment required.

Studies of selecting students for mathematics instruction have illustrated the situation. Students assigned to lower tracks tend to receive less actual instruction (and more drill and practice of lower level knowledge) than students assigned to middle or higher tracks (Oakes, 1985). Rather than

allowing students access to instruction that maximizes educational outcomes, this practice results in excluding students from fruitful educational experiences, and from the development of capabilities for learning in environments where relevant knowledge and ability are exercised (Shepard, 1991).

The main point here is that assessment for placement as a component of the system separate from the learning environment precludes consideration of efforts to appropriately redesign instruction. The possible positive contributions of selection assessment to enable teachers to adapt instruction to the learner's needs is overshadowed by the use of testing to maintain the organizational structure and continuity and present level of efficiency (Cronbach, 1984). The lack of classroom adaptability also limits environmental designs that are optimal for even the fastest students.

So, traditional techniques of selection testing can encourage the deterministic philosophy of early modes of education. Today, we are compelled to ask how assessment can enable us to consider educational environments that can be optimized for the growth of student potential. The requirement and research problem is to design a helping educational society that can be "judged in terms of its ability to facilitate constructive adaptations of educational programs for individuals" (Thorndike, 1975).

Consider a *research agenda* for this purpose—to facilitate the design of adaptive learning environments. There are developments in the modern study of cognition and learning that are relevant here and offer a significant agenda for research and application. I consider several areas of study here: (a) identifying prior knowledge, (b) utilizing diverse intelligences brought to learning, and (c) enabling self-regulatory abilities.

Prior Knowledge and Foundations for Learning

The first area for research is study of the foundations of ability and competence, on the basis of which learning can proceed. I illustrate this area with the study of young children but note that the paradigm is applicable to the knowledge of students at many ages. Research on cognitive development has uncovered the kinds of reasoning and forms of knowledge that are present in young children. For example, the study of children's intuitive knowledge in mathematics has identified substantial knowledge about quantity relations

that can serve as a foundation for meaningful instruction on understanding numbers and arithmetic. Children come to school with qualitative knowledge about amounts of physical material and relations among these amounts, such as more or less, lots and little, increase and decrease, and the part-whole nature of material (i.e., that material comes apart and goes together).

Children understand these ideas even though they cannot yet use numbers to describe these relations. But they also know principles and procedures for counting sets of objects. These principles enable them to match number names with objects in a set, to order the number names, and to use the principle of cardinality (i.e., that the last number in a counting sequence names the quantity in the whole set). Assessment of this prior knowledge of both physical material and counting principles provides a foundation for learning to use numbers and for manipulating and describing relations between amounts (Gelman & Gallistel, 1978; Resnick, Bill, Lesgold, & Leer, 1991).

A central issue here for the utility of such assessment is the design of supportive environments in which students can use their current abilities to take advantage of and also construct opportunities to learn. Much instructionally relevant developmental research focuses on children's prior knowledge and abilities to organize and coordinate information, make inferences, and discover strategies for problem solving and learning.[2]

Cultural experience and community participation. I turn now to the significance of prior knowledge as it is broadened by cognitive-anthropological research on cultural practices. This work has brought necessary attention to the high levels of performance that result from the demands of problem solving in everyday life. Outside of formal schooling, individuals develop competence in solving verbal and quantitative problems that arise in community participation.[3] Participation in social practice is a fundamental

[2] Research in developmental psychology has described the relationships between children's prior knowledge and such cognitive activities as accessing memory (Chi, 1978), organizing and coordinating information (Scardamalia & Bereiter, 1993), making inferences (Carey, 1985), Gobbo & Chi, 1986), discovering new strategies (Siegler & Jenkins, 1989), and categorizing objects (Smith, 1989).

[3] See, for example: Carraher, Carraher, and Schliemann, 1985; Lave, Murtaugh, and de la Rocha, 1984; Lave, 1988; Saxe, 1990; Scribner, 1984; Stigler and Baranes, 1988.

form of learning, and its relevance to a learning theory of instruction needs to be considered (Greeno, 1991; Lave & Wenger, 1991).

This line of research has been carried out in a range of settings and cultures, and has focused on the community-specific or everyday intelligences that are developed in particular contexts of activity. These studies have identified the highly competent strategies used by people in their everyday life and work that become a base for future learning. These forms of expertise are very efficient and sophisticated in their settings of use, but they may be less readily applicable to the objectives of formal schooling. However, if we consider adaptive environments for formal schooling, then an important research area is how these competences can become a basis for the further education and training that society offers.

Related to this context of research, Sternberg, Wagner, Williams, and Horvath (1995) have made the distinction between formal academic knowledge, i.e., the knowledge assessed by common intelligence and aptitude tests, and tacit knowledge that is related to practical action. Their studies indicate that tacit knowledge forms of intelligence develop in a variety of social contexts such as successful business activities and academic productivity. These forms of intelligence are related to future success and to continued education and training. In research particularly related to schooling, Gardner, Krechevsky, Sternberg, and Okagaki (1994) studied tacit knowledge in school performance and developed a program on practical intelligence for schools that attempts to identify and enhance the kind of tacit knowledge that is instrumental to school success.

Multiple intelligences. In pursuing this topic of prior abilities influencing learning, we cannot leave out the well-known line of research that is the study of “multiple intelligences” (Gardner, 1983). The work of Gardner emphasizes capabilities in particular areas of performance (e.g., language and music, spatial representations in art and design, and sensitivity in personal relationships) that can be assessed and developed as students learn and that are a basis for learning and achievement. These various intelligences provide a foundation for adaptive education toward optimizing life-relevant competences. The performance assessment can be used as learning feedback for individuals themselves and also for encouragement by the community.

Self-regulatory capabilities. Another area of prior knowledge and skill that is influencing conceptions of learning and instruction, especially as learning has come to be viewed as constructive activity, is the study of *self-regulatory capabilities.* For some time, there has been great awareness of the regulatory abilities that children and adults use to perform a task, solve a problem, or comprehend a situation. These regulatory activities enable the self-monitoring and executive control of one's performance (Brown, 1978). They include such strategies as predicting outcomes, planning ahead, apportioning one's time, explaining to one's self in order to improve understanding, noting failures to comprehend, and activating background knowledge. Although such skills may be apparent in good learners, other individuals may need to be taught to exercise these capabilities. Regulatory and monitoring activities thus become important candidates for assessment and incorporation into theories of learning and practices of instruction. A significant question for research is how these skills are acquired and how specific or general they are to performance in various domains of knowledge.

So, on the issue of access to education, we see research support for going beyond selective practices toward adaptive education. We are now offered the possibility of repairing the dysfunctional aspects of testing and learning that resulted from applications of our prior psychological knowledge and practice to older social goals. We can rethink concepts developed in other times that do not meet new challenges. Guided by our understanding of cognition, we need to carry out programs of research that will assess the development of talents and abilities as a basis for designing environments for learning.

Achievement Testing and the Nature of Competence (Cognitive Validity)

I turn now to the outcomes of education: assessing achievement and the nature of attained competence. Here we have seen dysfunctional aspects in terms of the overreliance on norm-referenced measures, and the constraints on assessment that allow only weak measures of higher order, authentic performance at the end of and during a program of instruction.

Many years ago, I was forced to coin the term "criterion-referenced measurement." It emerged from work I was pursuing to develop procedures for assessing the outcomes of learning. I was envisioning assessments (tests we called them) of proficiency that could refer to progressive states of acquired

achievement (Glaser & Klaus, 1962; Glaser, 1963). The weak link at that time was our capability to analyze and describe human performance. We had available concepts and techniques from behavioral analysis that could specify behavioral objectives but failed to identify the structures of knowledge, strategic processes, problem solving competencies, and the characteristics of expertise that present knowledge and learning theory now enable us to consider in the description of human development and achievement.

That time was described by Lee Cronbach in 1970 when he wrote "the design and construction of achievement test items have been given almost no scholarly attention . . . demands for content validity have suddenly become insistent, thanks to demands for genuine diagnosis and mastery testing, for national assessment and local accountability, for data that describe learners rather than rank them . . . [however] the art of test construction so far has not coped very well with these demands" (pp. 509-511). Cronbach went on to say that some important ideas had been generated, such as criterion-referenced testing, items as samples of operationally defined content universes, and the analysis of information-processing requirements of tasks, but that much work lay ahead to clarify these ideas and turn them into useful procedures.

Certainly, 20 years later we have made some progress along these lines and have gone even further with cognitive theories that might underlie the technology of assessment. The assessment of achievement is now being integrally tied to the nature of learning. The relevant learning theory can be conceived of as a developmental psychology of performance changes—the changes that occur as knowledge and complex cognitive strategies are acquired. Achievement measurement should be designed to assess these performance changes and identify attainment at various levels of acquisition, emphasizing not only content considerations but also structural and process considerations that are involved in sources of difficulty and in facilitators of the growth of competence (Messick, 1984).

Of key significance here is the growing information on the nature of *human memory and the structure of knowledge.* A fundamental consideration that should underlie assessment theory is the fact that our understanding of memory has moved beyond theories of simple associations toward descriptions of structures that represent knowledge and meaning. We conceive of integrated representations of knowledge, such as schemata and mental

models, that account for complex levels of cognition and understanding. This construct of coherent structures of information and the nature of organized knowledge needs to drive modern techniques of assessment. As you know, residual older conceptions of association learning have too often resulted in testing multiple-choice, fragmented information that does not encourage inference and reasoning. Both in teaching and assessment, we are faced with the challenge of developing and assessing the nature of the structure and coherence of acquired knowledge.

The Development of Competence and Expertise as a Basis for Assessment

The organized structures of knowledge that I have just mentioned lead to the significance of studies of competence and expertise for considering fundamental dimensions of the progressive development of achievement. My theme here is that understanding of the cognitive growth of knowledge can underlie the theoretical base for assessment and for systematic description of the results of learning. Let me list a representative sample of the properties and characteristics of developing achievement that has been generated by research on expert-novice differences (Glaser, 1990). I mention four possible constructs for dimensions of assessment:

1. **Structured, principled knowledge.** As competence is attained, elements of knowledge become well integrated so that proficient individuals store coherent chunks of information in memory. In assessment, when solving problems the expert rapidly accesses the underlying meaningful patterns and principles inherent in these structures whereas the novice will perceive primarily the surface features of a problem.

2. **Proceduralized knowledge.** With experience and practice in a domain, the factual declarative knowledge of the beginner becomes bound to conditions of applicability and procedures for use. In assessment, experts and novices may be equally competent at recalling a principle or a rule, but novices less frequently recognize where such knowledge applies or how to implement it.

3. **Effective problem representation.** This is an important characteristic of competence. Experts often spend extended time in initial analysis of a problem. In this early phase, the experts qualitatively assess the nature of the problem and build a mental model or representation from which they can make inferences and add constraints that reduce and organize the problem space.

Novices quickly generate a superficial model that drives their performance. Assessment of this dimension might take place at initial problem presentation, with little need for further assessment time.

4. **Self-regulatory skills.** As well as prior abilities, these are also important outcomes of learning. With extensive experience, experts develop critical self-regulatory or metacognitive skills that control their performance in particular areas of knowledge. As I have already indicated, they learn to monitor their problem solving by predicting the difficulty of problems, allocating time appropriately, noting their errors or failures to comprehend, and checking questionable solutions. These skills are less available in novices at early stages of achievement, and their development can be assessed and taught if necessary.

In general, the growing understanding of such characteristics of competence provides a knowledge base that can be considered in theories of learning and assessment. These properties of proficiency focus attention on progressive outcomes of acquiring knowledge in the course of learning. They provide a framework for judging what can be called the "cognitive validity" of innovative assessments (Baxter & Glaser, in press) and for the techniques of "on-line" assessment (Martin & VanLehn, 1995; Mislevy & Gitomer, 1996; Tatsuoka, 1990).

Testing and Learning as an Interactive Endeavor

Finally, I cannot leave the topics of learning, instruction, and assessment without reemphasizing the importance of their interaction. We are aware that we think too much in terms of the two worlds of teaching and testing, and we must become more sensitive to the integral nature of the two. Active research on this matter is ongoing, and it is useful to consider features for research and innovation that will encourage this integration. I rely here on discussions by Frederiksen and Collins (1989), Linn, Baker, and Dunbar (1991), Mislevy (in press), Snow and Lohman (1989), and Silver and Lane (1993). The writings of these individuals describe possible features for the reform of achievement assessment. The general principle is that testing and assessment will have a certain naturalness in learning and teaching as a display of competence and of the attainment of standards for achievement. Overall, the assessments used

in schooling can include characteristics that are integrated to instruction such as the following:

1. **Access to educational opportunity.** As I have emphasized, in order to lessen the exclusionary aspects of testing, assessments should be designed to survey possibilities for student growth. Integrated programs of assessment and instruction should enable teachers to recognize and support learners' strengths so that they can achieve in more powerful curricula.

2. **The display of competence.** Knowledge and skills should be measured so that the processes and products of learning are openly displayed. This requires fewer instances of indirect measurement procedures that use formats for multiple choice or controlled scoring. The criteria of performance by which students are judged will be transparent so that these criteria can motivate and direct learning.

3. **Self-assessment.** Assessment will involve the teaching of self-assessment. Because assessment and instruction are integrally related, instructional situations will provide coaching and practice in ways that help students reflect on their performance. Such occasions for assessment enable students to set incremental standards by which they can judge their own achievement and develop self-direction for attaining higher performance levels.

4. **Socially situated assessment.** The conditions of assessment can require performance in a social setting in which students contribute to a task and assist others. This has the advantage of encouraging students to develop and question their definitions of competence. Students can observe how others reason and receive feedback on their own efforts. In this context, not only can performance be assessed but also the facility with which a student adapts to help and guidance.

5. **Instructional effectiveness.** Assessments can be judged in terms of their effectiveness in informing teachers to devote time to certain concepts and content and cognitive skills in the curriculum. Outcomes of assessment can be interpreted in terms of how they influence instruction and in terms of the information they provide for the development of classroomπ activities that relate to learning goals.

Final Comment

To conclude, assessments in education of the abilities and achievements of learners must be designed and used in ways that take account of present knowledge of human learning and the goals of modern society. Reaching these aspirations will be impossible if we continue to carry the ballast of practices that were designed for a time gone by. New perspectives are now offered on the nature of knowledge and abilities that are brought to learning and on the nature of competent achievement that results from instruction. The innovative merger of learning, instruction, and assessment can now drive the design of educational environments that support and respect human cognitive ability.

References

Baxter, G. P., & Glaser, R. (in press). *Cognitive complexity of science performance assessments: Theory and method*. Los Angeles: UCLA Graduate School of Education & Information Studies, Center for Research on Evaluation, Standards, and Student Testing.

Brown, A. L. (1978). Knowing when, where, and how to remember: A problem of metacognition. In R. Glaser (Ed.), *Advances in instructional psychology* (Vol. 1, pp. 77-165). Hillsdale, NJ: Lawrence Erlbaum Associates.

Carey, S. (1985). *Conceptual change in childhood*. Cambridge, MA: MIT Press.

Carraher, T. N., Carraher, D. W., & Schliemann, A. D. (1985). Mathematics in the street and in school. *British Journal of Developmental Psychology, 3*, 21-29.

Chi, M. T. H. (1978). Knowledge structure and memory development. In R. S. Siegler (Ed.), *Children's thinking: What develops?* (pp. 73-96). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cronbach, L. J. (1970). [Review of *On the Theory of Achievement Test Items*]. *Psychometrika, 35*, 509-511.

Cronbach, L. J. (1984). *Essentials of psychological testing* (4th ed.). New York: Harper & Row.

Frederiksen, J. R., & Collins, A. (1989). A system's approach to educational testing. *Educational Researcher, 18*(9), 27-32.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.

Gardner, H., Krechevsky, M., Sternberg, R. J., & Okagaki, L. (1994). Intelligence in context: Enhancing students' practical intelligence for school. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice*. Cambridge, MA: MIT Press/Bradford Books.

Gelman, R., & Gallistel, C. R. (1978). *The child's understanding of numbers*. Cambridge, MA: Harvard University Press.

Glaser, R. (1963). Instructional technology and the measurement of learning outcomes: Some questions. *American Psychologist, 18*, 519-521.

Glaser, R. (1990). Expertise. In M. W. Eysenck, A. Ellis, & E. Hunt (Eds.), *The Blackwell Dictionary of Cognitive Psychology* (pp. 139-142). Oxford, England: Basil Blackwell.

Glaser, R., & Klaus, D. J. (1962). Proficiency measurement: Assessing human performance. In R. M. Gagne (Ed.), *Psychological principles in system development* (pp. 419-474). New York: Holt, Rinehart & Winston.

Gobbo, C., & Chi, M. (1986). How knowledge is structured and used by expert and novice children. *Cognitive Development, 1*, 221-237.

Greeno, J. G. (1991). Number sense as situated knowing in a conceptual domain. *Journal for Research in Mathematics Education, 22*, 1-49.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life*. Cambridge, MA: Cambridge University Press.

Lave, J., Murtaugh, M., & de la Rocha, O. (1984). The dialectic of arithmetic in grocery shopping. In B. Rogoff & J. Lave (Eds.), *Everyday cognition* (pp. 67-94). Cambridge, MA: Harvard University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, MA: Cambridge University Press.

Linn, R. L., Baker, E. L., & Dunbar, S. B. (1991). Complex, performance-based assessment: Expectation and validation criteria. *Educational Researcher, 20*(8), 15-21.

Martin, J., & VanLehn, K. (1995). Student assessment using Bayesian nets. *International Journal of Human-Computer Studies*, 42, 575-591.

Messick, S. (1984). The psychology of educational measurement. *Journal of Educational Measurement, 21*(3), 215-237.

Mislevy, R. J. (in press). Foundations of a new test theory. In N. Frederiksen, R. J. Mislevy, & I. Bejar (Eds.), *Test theory for a new generation of tests*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Mislevy, R. J., & Gitomer, D. H. (1996). The role of probability-based inference in an intelligent tutoring system. *User Modeling and User-Adapted Interaction, 5*, 253-272 .

Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven, CT: Yale University Press.

Resnick, L. B., Bill, V. L., Lesgold, S. B., & Leer, M. N. (1991). Thinking in arithmetic class. In B. Means, C. Chelemer, & M. S. Knapp (Eds.), *Teaching advanced skills to at-risk students: Views from research and practice* (pp. 27-67). San Francisco, CA: Jossey-Bass.

Saxe, G. B. (1990). *Culture and cognitive development: Studies in mathematical understanding*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Scardamalia, M., & Bereiter, C. (in press). Schools as knowledge-building communities. In S. Strauss (Ed.), *Human development* (Vol. 4). Norwood, NJ: Ablex.

Scribner, S. (1984). Studying working intelligence. In B. Rogoff & J. Lave (Eds.), *Everyday cognition* (pp. 9-40). Cambridge, MA: Harvard University Press.

Shepard, L. A. (1991). Negative policies for dealing with diversity: When does assessment and diagnosis turn into sorting and segregation? In E. H. Hiebert (Ed.), *Literacy for a diverse society: Perspectives, practices, and policies* (pp. 279-298). New York: Teachers College Press.

Siegler, R. S., & Jenkins, E. (1989). *How children discover new strategies*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Silver, E. A., & Lane, S. (1993). Assessment in the context of mathematics instruction reform: The design of assessment in the QUASAR project. In M. Niss (Ed.), *Assessment in mathematics education and its effects* (pp. 59-70). London: Kluwer.

Smith, L. B. (1989). From global similarities to kinds of similarities: The construction of dimensions in development. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning* (pp. 146-178). Cambridge: Cambridge University Press.

Snow, R. E., & Lohman, D. F. (1989). Implications of cognitive psychology for educational measurement, In R. Linn (Ed.), *Educational measurement* (3rd ed., pp. 263-331). New York: Macmillan.

Sternberg, R. J., Wagner, R. K., Williams, W. M., & Horvath, J. A. (1995). Testing common sense. *American Psychologist, 50*(11), 912-926.

Stigler, J. W., & Baranes, R. (1988). Culture and mathematics learning. In E. Z. Rothkopf (Ed.), *Review of research in education* (Vol. 15, pp. 263-306). Washington, DC: American Educational Research Association.

Tatsuoka, K. K. (1990). Toward an integration of item-response theory and cognitive error diagnoses. In N. Frederiksen, R. Glaser, A. M. Lesgold, & M. G. Shafto (Eds.), *Diagnostic monitoring of skill and knowledge acquisition* (pp. 453-488). Hillsdale, NJ: Lawrence Erlbaum Associates.

Thorndike, R. L. (1975). Mr. Binet's test 70 years later. *Educational Researcher, 4,* 3-7.