

Implementation of Computerized Adaptive Assessments

What is a Computerized Adaptive Assessment?

Computerized adaptive testing (CAT), which was first developed four decades ago¹, begins with a large pool of questions and then selects individual questions for test takers, depending on their responses as they progress. As the test taker answers questions correctly, the questions become more difficult. As the test taker answers incorrectly, the questions become less difficult. CAT requires the following components: a pool of questions to draw from, calibrated to a common measurement scale; a mechanism to select questions on the basis of students' responses; a process to score students' responses; a process to terminate the test; and reports that relate students' scores to their instructional needs.

Limitations

Even with the increased sophistication of today's CAT programs, there are some limitations to these programs and their functions.

- ◆ The primary limitation to CAT is ensuring that schools have the network infrastructure to successfully implement a web-based adaptive testing model. A related issue is providing all students with the required devices to take an adaptive test, such as laptops or tablets.
- ◆ Students cannot skip questions or perform a post-test review. Conventional tests allow a student to return to a question later after completing other items, while CAT requires the test questions to be answered as they appear.
- ◆ Item bank size limits application of CAT. The number of test questions required to cover all the skills taught in school over a range of difficulty limits CAT use to entities with substantial resources. Large effort is required to maintain a CAT item bank and keep the item content fresh and up-to-date as well as secure.

¹ Weiss, D. J., & Betz, N. E. (1973). Ability measurement: Conventional or adaptive? (Research Report 73-1). Minneapolis, MN: University of Minnesota, Department of Psychology; Weiss, D. J., & Kingsbury, G. G. (1984). Applications of computerized adaptive testing to educational problems. *Journal of Educational Measurement*, 31, 361-375.

Benefits

In a computer-based fixed-form test, students will complete a fixed number of test questions. Each student may or may not see the same questions, and the item order can be randomized to discourage cheating. These computer-based tests share some benefits with CAT, including immediate scoring and paper resource savings. Adaptive testing offers additional benefits compared to computer-based fixed-form tests. The following four elements of CAT provide context to the discussion of the advantages of CAT over other testing methods.

- ◆ **Item selection that adapts to performance:** With CAT, it is possible to use feedback from previous responses to select new items. This means that the CAT will become easier if a student is struggling and more difficult if a student is performing well.
- ◆ **Improved efficiency:** Adaptive testing makes it possible to administer questions near a student's ability level and provides more information about student performance compared to other testing methods. This improves the precision of measurement and reduces the number of questions that a student must answer. Students need less time in front of a computer to complete the test, and teachers have more time for instruction. The end result is a test that is both shorter and more accurate than other, more conventional tests.
- ◆ **Test security and item bank maintenance:** The matching of items to students results in different item content being seen by different students and reduces the risk of cheating in the classroom. The reduced test length for CAT also reduces item exposure and risks of students being coached on frequently seen items.
- ◆ **Results delivered immediately:** Another advantage of CAT is the immediate calculation of ability level and feedback for both students and teachers. Additionally, when CAT is used for formative assessment, a student's past performance can be used as a starting point for subsequent exams, to measure growth and to target instruction to areas of student need.

Computerized Adaptive Testing in Practice

- ◆ Implementing CAT involves significant education of students, parents, and teachers.
- ◆ Large investment in technology may be required, to ensure that schools will have enough devices and bandwidth for CAT.
- ◆ Significant item development is required. For example, for a 40-question test, an adaptive test bank might contain 800 items.
- ◆ Existing training will need to be updated for teachers to serve as test administrators.
- ◆ CAT enables educators to shape teaching strategies, classroom by classroom and student by student, using data from the adaptive assessments. These data can be especially effective for instruction when aligned to curriculum and state standards.
- ◆ CAT data, along with information from other assessments, play an integral role in instructional decision-making.
- ◆ School administrators must provide teachers with time to examine student data and to collaboratively build responsive instructional strategies.
- ◆ Data may allow for teachers to group students similarly, or at intentionally mixed-levels, for appropriate interventions.

- ◆ Teachers are able to look at the strands within CAT to see where students are performing the best and the worst comparatively, which can help with instructional design.
- ◆ School staff can use CAT data to encourage students to take greater ownership of their learning, and CAT data can be part of the shared instructional vocabulary of students, teachers, and parents.

Policy Questions to Consider

- ◆ Will all schools have the technological infrastructure to support CAT?
- ◆ Will the cost of the new assessments exceed current expenditures? If so, how will the state or the district pay for these new assessments?
- ◆ Will all schools use both CAT formats for summative and formative assessments?
- ◆ How will CAT data be used to inform instruction and policymaking?
- ◆ How will new teachers, principals, and administrators be trained to use and understand CAT?
- ◆ How will experienced teachers, principals, and administrators be trained to use and understand CAT?
- ◆ How will the assessments affect compliance with Every Student Succeeds Act accountability provisions?



CSAI Update is produced by the The Center on Standards and Assessment Implementation (CSAI). CSAI, a collaboration between WestEd and CRESST, provides state education agencies (SEAs) and Regional Comprehensive Centers (RCCs) with research support, technical assistance, tools, and other resources to help inform decisions about standards, assessment, and accountability. Visit www.csai-online.org for more information.



WestEd is a nonpartisan, nonprofit research, development, and service agency that partners with education and other communities throughout the United States and abroad to promote excellence, achieve equity, and improve learning for children, youth, and adults. WestEd has more than a dozen offices nationwide, from Massachusetts, Vermont and Georgia, to Illinois, Arizona and California, with headquarters in San Francisco.

For more information, visit WestEd.org; call 415.565.3000 or, toll-free, (877) 4-WestEd; or write: WestEd / 730 Harrison Street / San Francisco, CA 94107-1242.