Requirements for Adaptive Testing

Nathan A. Thompson, PhD

Whitepaper

ASSESSMENT SYSTEMS

6053 Hudson Road, Suite 345
St. Paul, MN 55125 USA

Computerized adaptive testing (CAT) is recognized as the **next generation of tests**. CAT works by tailoring both the difficulty and number of items to an examinee. This provides a wide range of benefits including cutting testing time in half. Many organizations hear of these benefits and desire to move to a CAT system without investigating the implications or requirements of CAT. This paper describes the pieces that an organization must have available before building CAT exams.

A CAT is not easy to build. It requires extensive psychometric expertise, specially-designed software, and large pilot samples. However, the benefits of CAT make it worthwhile, leading to a positive return on investment!

What is CAT?

CAT works by adapting a test to each examinee, item by item, based on their responses. A correct response leads to a more difficult item, while an incorrect response leads to an easier item. These decisions are not made arbitrarily; they are based on complex calculations from **item response theory (IRT)**, the modern paradigm for designing and analyzing tests. More information on IRT is presented in a separate white paper.

Obviously, in addition to CAT-specific requirements the test should also follow general requirements for IRT (unidimensionality, unspeeded, model fit) and good measurement in general (detailed blueprints, no bias, etc.).

Prerequisites to building a CAT

1. Items (questions) can be scored objectively in real time: Because the CAT will score each item before selecting the next item, the item must be scorable in real time. Questions that are graded at a later time (essays) are not feasible.

2. Resources to develop large banks of items: CATs typically need banks at least 3 times your intended test length (though often no more than is needed for multiple traditional test forms); simulations can help you explore needs.

3. Large pilot samples: IRT requires at least 100-1000 examinees to serve as a pilot sample for each test (depends on IRT model – more powerful and complex models require larger samples).

4. Psychometricians: Expertise from a PhD psychometrician is necessary to perform complex IRT analysis and appropriate CAT simulation research.

5. Analytical software: Special software is necessary for IRT calibration (*Xcalibre*) and CAT simulations (*CATSim*). General statistical software programs produce very poor estimates (IRT), or are completely incapable (simulations).

6. IRT item banker: Your item banking system must obviously be capable of storing IRT parameters and designing CATs.

7. CAT delivery system: Test delivery system capable of fully adaptive testing based on IRT, with appropriate termination criteria and item selection algorithms at the very least.

What to outsource?

Some of these requirements are better supplied by the testing organization; the first three are almost always, though item writing can be outsourced if it does not require specific expertise. Items for an advanced medical field can only be written by experts in that field.

A growing number of organizations have psychometrician on staff, leading to an increase in sophistication of tests and the development process. However, if your organization does not have a psychometrician with CAT experience, it can easily be outsourced.

The software side of the CAT project is best purchased, as the costs and complexity are prohibitive for all but the largest organizations.

How FastTest can help implement

Our expertise in the latter four components (psychometric expertise and software) is **unequaled in the industry**. Contact us to learn how our in-house experts can optimize the advantages of CAT to make your testing program more efficient.

First, a test delivery system must be established that is capable of fully adaptive tests based on IRT. *FastTest* is the **only content-free system for online testing that provides fully adaptive CAT**. Other content-free systems might claim to provide adaptive capabilities, but are based on crude approximations such as fixed branching.

Additionally, a psychometrician is necessary to perform the quantitative analysis and extensive research needed for CAT. **Publishing a CAT without such an expert will likely make it inefficient, indefensible, or both, seriously hampering validity**. *FastTest* can also provide this essential expertise, from our team of experienced Ph.D. psychometricians, and at reasonable rates.

About FastTest

FastTest is a comprehensive web-based system for the entire test development cycle:

- Item banking
- Item review
- Test assembly
- Standard setting
- Test delivery (computer or paper)
- Adaptive testing (CAT)
- Score reporting
- Results management
- Back-end reporting
- Psychometric analysis.

While comprehensive, it is flexible and scalable enough to be applied to testing organizations of all types and sizes. Customized, hosted systems are also available.

For more information, visit www.assess.com or contact sales@assess.com.