



Better Score Precision with Item Response Theory

Item Response Theory (IRT) provides a powerful paradigm for developing, analyzing, and scoring assessments of knowledge, skills and abilities. Superior in many ways to classical methods, IRT focuses on test items, allowing for a model-centric assessment of item performance as well as how the assessment overall performs *for each level of ability*. It also provides increased scale stability over time by linking item parameters of tests taken in different years, and more effective methods for test building. Additionally, IRT connects items and persons onto the same scale, which allows for the development of a Computerized Adaptive Tests (CAT). This issue will discuss the basics of IRT, definitions, advantages of using IRT and how *FastTEST Web*[™] (FTW) implements IRT.

See page 2 for more information on IRT.

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FastTEST Web's Mission

FastTEST Web's mission is to provide a cost-effective solution for web-based test development and delivery at a professional level, namely with full support for item response theory (IRT) and computerized adaptive testing (CAT).

FTW Benefits

- Advanced psychometrics
 - IRT and classical test theory
 - Computerized adaptive testing (CAT)
 - Modified-Angoff module
- Secure-lockdown online delivery
- Innovative software
- Test development services
- Detailed psychometric analysis
- Controlled security with roles and content access
- Geographic independence
- Flexible and easy to use interface
- Custom solutions to meet your needs
- Free trial – [click here!](#)

Welcome

In this issue of the FTW Newsletter, Item Response Theory (IRT) is discussed, what FTW offers, FTW's new features and those to come in the near future, and upcoming events. FTW will be present at the following conferences this Fall, please be sure to stop by our booth!

CLEAR: September 8-10 booth #32

NCTA: September 21-24

IACAT: October 3-5

ICE: November 8-11 booth #402

I invite you to check out *FastTEST Web* at www.fasttestweb.com and sign up for a free 30- day trial to review all of *FastTEST Web's* capabilities. Follow us on Facebook and Twitter for updates. Questions about our functionality and customization, or wish to purchase? Please contact me at sales@fasttestweb.com.

Thank you,

Kimberly

Kimberly Bennett, Director of Sales & Marketing, *FastTEST Web*

Better Score Precision with Item Response Theory

While basic concepts of IRT were suggested prior to 1950, IRT was developed in the 1950s and '60s, though due to computational complexity, it did not become widely used until high-powered personal computers became widespread. Today, IRT is recognized as the dominant test theory, applied worldwide in a range of testing applications, including education, employment, psychology, admissions, and marketing. Well-known tests that use IRT for CAT include the Graduate Record Examination® (GRE) and the Graduate Management Admission Test® (GMAT). Psychologists also use IRT to measure cognitive and personality traits with instruments such as the Myers-Briggs Type Indicator (MBTI). FTW can help your organization apply the same cutting-edge IRT technology.

IRT can have several variations (models) depending on your testing needs. The three primary models are the one-parameter logistic model (1PL or Rasch: uses the b parameter only), two-parameter logistical model (2PL: uses a and b), and three-parameter logistical model (3PL: uses all three a , b , and c). Items can be either dichotomous (having one correct answer, which would include multiple-choice and true/false items) or polytomous (such as a Likert item or partial credit scoring).

IRT Item Parameters

- a is the discrimination and reflects the slope of the item response function (IRF). This ranges from 0.0 to infinity in theory but 0.2 to 2.0 in practice.
- b is the difficulty of the item and can be conceptualized as the z-score of a person for which the item is appropriate. As it is similar to the z-scale, the range is typically -3 to 3, with 0.0 being average.
- c is a lower asymptote, and has been associated with the effect of guessing

Advantages of IRT

- Items and examinees are measured on the same scale
- Greater sensitivity in scoring—uses the entire response pattern
- Better characterization of error and precision
- Easily can transition into a CAT design
- Greater scale stability with more powerful linking and equating

FastTEST Web & IRT

FTW is ideal for IRT, supporting all three dichotomous models. Test assembly has been designed to efficiently leverage the benefits of IRT; search for items with specific parameters (in addition to other requirements), evaluate item information and response functions before adding items, and then assess important test-level functions (see right) before publishing. Then easily publish tests in an adaptive format. Please [visit our IRT page](#) to learn more about the benefits!

IRT requires expertise. Fortunately, ASC's internationally recognized Ph.D psychometricians are available to assist you with the expertise needed to implement IRT, item banking, and test development. Contact us today (sales@fasttestweb.com) to learn how FTW can make your testing process more powerful and efficient.

New to IRT? We recommend the following resources.

Rudner, L. (December 2001), Item Response Theory. Retrieved July 28, 2011, from <http://echo.edres.org:8080/irt/>

Hambleton, R. & Jones, R. (1993), An NCME Instructional Module on: Comparison of Classical Test Theory and Item Response Theory and Their Applications to Test Development. Retrieved on July 28, 2011 from <http://www.ncme.org/pubs/items/24.pdf>

IRT Assumptions

1. Unidimensionality - item has one dimension and is a stable measured trait, and is not affected by item dependence (the item is not influenced by other items on the test)
2. Data fits an IRT Model – scoring is appropriate and reliable
3. You have sufficient sample size and [psychometric expertise](#)

IRT Sample Size

To effectively analyze data with IRT, the following sample sizes need to be met for the three primary IRT models ([Yoes, 1995](#)).

- 1PL: 100
- 2PL: 300
- 3PL: 500-1,000

Q: What types of graphs does FTW offer for IRT?

1. *Item Response Function* (IRF): models the probability of an examinee answering a question correctly
2. *Item Information Function* (IIF): shows how well each ability level is measured by the item
3. *Test response function* (TRF): sum of IRFs, used to assemble strong tests
4. *Test information function* (TIF): sum of IIFs, used for test assembly
5. *Conditional standard error of measurement* (CSEM): essential for building and evaluating tests
6. And more! [Sign up for the free trial to see.](#)



New Features on *FastTEST Web*

These features will be available by Sept. 1, 2011

- Rating Scale Matrix items: allows multiple Likert-type items to be presented on the same screen, sharing a common rating scale (e.g., Strongly Disagree to Strongly Agree)
- Item Review Module: Display items purely for review with associated scales; allows reviewers to rate on difficulty, cognitive level, etc. – Ideal for Modified-Angoff studies!

The features below are scheduled to be released during Fall 2011

- Deliver multiple tests in a single session, and combine the scores with advanced composite scoring
- Content balancing for computerized adaptive testing (CAT): distribute items by percentages to increase content validity
- A static link for examinees to take low-stakes exams or surveys, rather than logging in with a secure key
- Testlets: two or more items per page, such as a reading passage with three questions

FastTEST Web is jointly owned and operated by ASC & 4ROI

About ASC

ASC brings over 30 years of experience and the expertise of four Ph.D. psychometricians.

ASC also provides software tools for a full range of psychometric analyses and processes, empowering organizations to produce more reliable tests while also streamlining the business and operations of test development and psychometrics. The full catalog of software is available in the ASC web store at www.assess.com.

About 4ROI

4ROI is a leader in the development and administration of efficient internet-based assessments and accredited certification tools. 4ROI builds assessment tools for clients to use as their own or to sell to others, as well as offering a range of brand assessments. 4ROI supports business, educational, and governmental service providers by conceptualizing, implementing, and commercializing online assessment systems and certification programs. 4ROI has built over 500 assessment systems for clients ranging from Fortune 100 organizations to single-person consulting firms, and delivers these assessments throughout the United States as well as internationally. To learn more about 4ROI, please visit www.4ROI.com.

FastTEST Web Uniqueness:

FastTEST Web has the unique capability to include Item Response Theory (1PL, 2PL or 3PL), Classical Test Theory, and User Defined statistics within its system. For example, users can create fields to hold IRT fit statistics. The item creator may enter in the statistics item-by-item directly, or import the statistics in a few quick and easy steps.

In addition to serving as an extensive repository for item metadata, FTW has been designed to allow users to search for items with specific statistics, as well as other information such as keywords or dates. FTW then provides several methods to evaluate test quality before publishing, including estimated mean, standard deviation, conditional standard error, and reliability. This makes test assembly much more efficient and defensible.

Best of all, FTW remains affordable – as little as \$0.25 per test. Contact sales@fasttestweb.com for a quote.



Free FTW Trial

Want to find out more about how FTW is your complete online testing solution? Sign up for a free trial at www.fasttestweb.com.

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Upcoming Events

FTW will be at the CLEAR conference in Pittsburgh (Sept. 8-10, booth #32), the NCTA conference in San Diego (Sept. 21-24), and at the ICE Conference in New Orleans (Nov. 8-11). Please stop by our booth if you are attending these conferences. We will also be presenting at the IACAT conference in Pacific Grove, California (Oct. 3-5).

Late Summer/Fall 2011 Conferences

119th APA Annual Convention, Aug. 4-7, <http://www.apa.org/convention/index.aspx>

CLEAR, Sept. 8-10, <http://www.clearhq.org> --VISIT US, booth #32!--

National College Testing Association, Sept. 21-24, <http://www.ncta-testing.org> --VISIT US!--

International Association of Computerized Adaptive Testing, Oct. 3-5, <http://www.iacat.org/> --VISIT US!--

IAEA, Oct. 23-28, <http://www.iaea.info/>

53rd IMTA conference, Oct. 31-Nov. 3, <http://www.imta.info/Conference/FirstAnnouncement.aspx>

ICE, Nov. 8-11, <http://www.credentialingexcellence.org> --VISIT US, booth #402!--

Association for Educational Assessment Europe conference, Nov. 10-12, <http://www.aea-europe.net/>

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