



Dimensions

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TECHNOLOGY

IRT Sets The



Standard

While most of us involved in professional credentialing programs understand the need to use legally defensible models for the establishment of minimum passing scores, many regulatory programs are governed by laws or regulations that require a candidate to achieve a specific number of items correct, or a specific percent score, in order to be licensed. Usually, such a mandated minimum passing score is determined arbitrarily and is completely unrelated to any demonstrated level of necessary competence. The arbitrary nature of setting a minimum passing score in this

manner is only one of the problems associated with such situations. Another major flaw is the inability to create equivalent forms in terms of difficulty. If two examination forms developed for such a program are statistically equated, it is likely that each form will have a slightly different, though equivalent, minimum passing score. Accordingly, if examinations of different levels of difficulty are administered in such a program, pass rates will vary from form to form even though the candidates taking each form may be similar in ability.

Various methodologies have been proposed to control form difficulty differences, such as selecting items with similar p-values (a measure of difficulty). Despite the best efforts of test developers,

methodologies such as these are highly imperfect, largely because candidate ability is not consistent from group to group and form to form. Thus, matching p-values becomes a meaningless exercise since the p-values have different meanings in response to differences in candidate group ability. This, in turn, leads to greater than normal fluctuations in pass rates, which are understandably undesirable.

The way that problem is traditionally solved is by statistically equating test forms to each other, using a classical common item linear equating method. This method involves adjustments to the raw cut score from test form to test form (to account for the differences in difficulty levels) and then conversion of these raw

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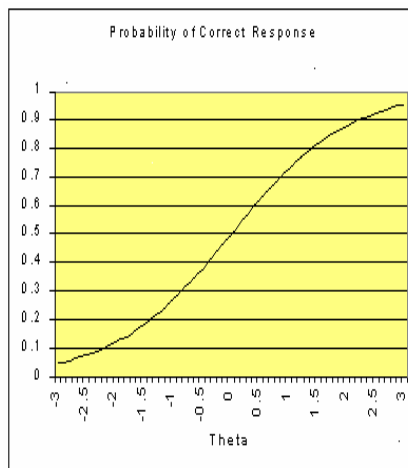
scores onto a reporting scale. The percentage correct model does not allow for raw score adjustments, nor does it allow for the necessary conversion of scores into “points” (because the scores must be presented in percentages).

SMT has developed an innovative solution to this problem of reporting percentage correct scores called the *IRT Convergence Model*. The *IRT Convergence Model* is based on the use of Item Response Theory (IRT). IRT is a latent trait model of the relationship between an examinee’s level on the trait being measured by a test and the examinee’s response to a given test item. IRT allows for the construction of pre-equated tests forms, which is made possible by the calibration of the item banks. That is, a test form is equated prior to and not after the test form is administered.

The *IRT Convergence Model* allows the test developer to utilize a powerful and precise method for ensuring the equivalency of test forms and controlling test form difficulty levels. The model is also psychometrically sound, consistent with industry standards, and, thus, is highly defensible in the event of a legal challenge. By virtue of being able to equate prior to the administration of the test, this model allows issuance of on-site scores without impacting the quality of the data analysis or

scoring process in programs where appropriate.

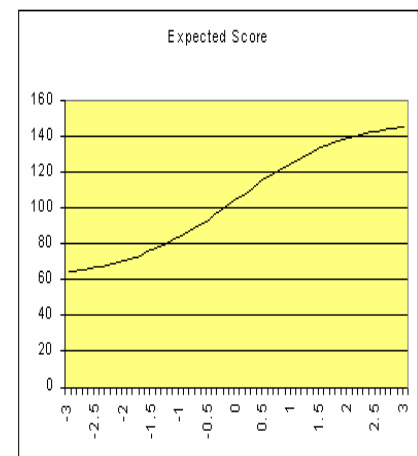
The following paragraphs contain a brief description of the *IRT Convergence Model* and an explanation of how it is used in an environment where a minimum passing score has been specified in law or regulation. Consider an examination consisting of 150 items with a passing requirement of 70% or 105 items correct. IRT is a model of how examinations and examination questions function based on the relationship between candidates probabilities of success and the level of ability of the candidates. Below is an Item Characteristic Curve (ICC), which relates the probability of a correct response for the item or question (Y-axis) to the overall ability or proficiency to be assessed (X-axis).



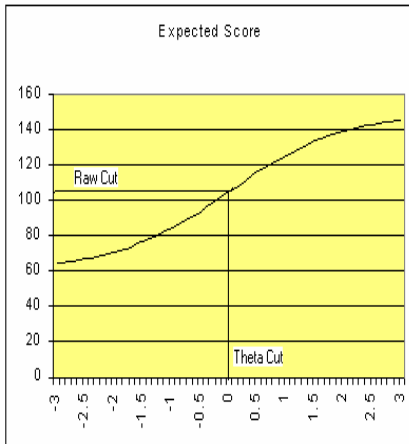
Each test item has a unique characteristic curve. ICCs are displaced to the right for more difficult items and shifted to the left for easier items. ICCs also rise

more steeply for items with greater discrimination.

Just as each examination item has a ICC, each examination itself has what is referred to as a Test Characteristic Curve (TCC). The TCC is simply the curve which represents the sum of all ICCs for the items on an examination. Below is a graph of the TCC.



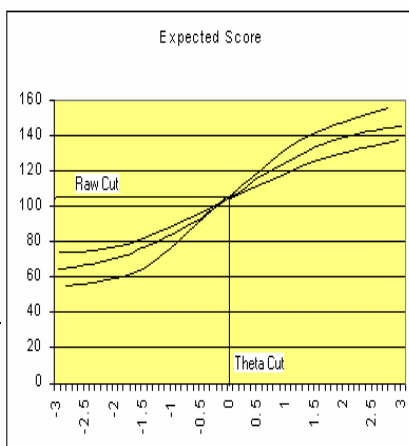
This graph shows a range of candidate scores from about 62 to 145 over the range of candidate proficiency characterized by a scale which runs from -3 to +3. The graph on the following page shows this same TCC with the minimum passing score (or cut score) of 105 questions correct and shows the relationship of that score to the performance scale:



This graph shows that a proficiency level of .05 represents the level of proficiency necessary to pass the examination with a score of 105. Since all items and candidates have been placed on this same scale of proficiency, a minimum passing score of .05 for any future examination will represent the same level of proficiency.

Using this standard, all future fluctuations in pass rate will be due to differences in the capabilities of the groups of candidates taking the examination.

Since it is necessary that the standard of 105 also be preserved to be consistent with regulations for the examination, future examinations will need to be constructed so that the TCC for each form



passes through the point in the graph above .05 and across from 105. The graph below shows the TCC and two additional TCCs for prospective forms.

All three TCCs pass through this prescribed point and, therefore, candidates taking all three examinations will be judged by the same pass-fail performance standard, both in terms of the candidate proficiency scale as well as in terms of the number correct on the examination.

This new innovative model developed by SMT enables testing programs to stay in compliance with specific legal mandates related with the scoring of examinations while at the same time maintaining a scale which requires the same level of candidate proficiency to pass the examination for each form. Under this model, fluctuations in pass-rates are due to differences in candidate ability alone.

TESTING ISSUES

Standard Setting Software Removes Subjectivity from Cut Score Process

Schroeder Measurement Technologies, Inc. is constantly looking for software based solutions to the various problems that are encountered in our industry. Our motto 'Solutions through Innovation' is the driving force of our company, especially in our research and development department. Below is an article describing our latest innovation, SMT-Cut+.

SMT – Cut+

Setting a passing standard or cut score on a credentialing examination is often a difficult, expensive, and very subjective process. Schroeder Measurement Technologies, Inc. (SMT) has developed software, SMT-Cut+, that incorporates the use of Item Response Theory (IRT) into the standard setting process and removes a large percentage of the subjectivity through the use of group/rater consistency across items. SMT-Cut+ also increases the efficiency of the process by reducing the number of items required in order to set the passing

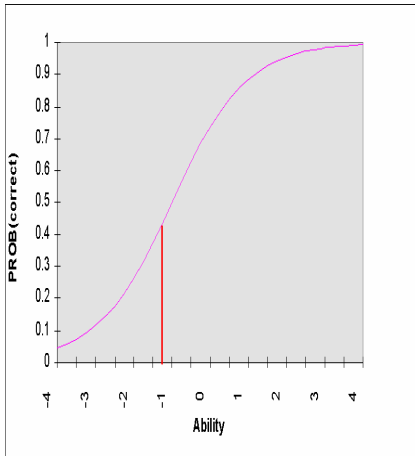
standard. This new software will save valuable time and money while at the same time reducing the subjectivity of the process.

Through the years many methodologies have been created to determine a passing score on a credentialing examination (Please see Nedelsky (1954), Angoff (1971), Jaeger (1978), Ebel (1979), etc.). All models, however, contain an element of subjectivity as an experienced Subject Matter Expert (SME) attempts to determine the response pattern of those candidates of minimal competency (note: the term minimal competency often has a negative connotation and is sometimes referred to as *just* an acceptable level of competency.). The subjective nature of the standard setting process is a known and accepted element of the practice.

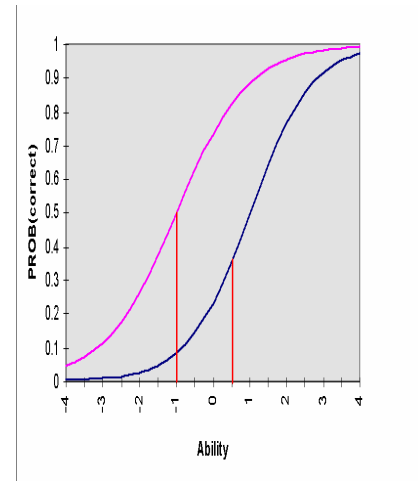
The most common method of standard setting is the modified Angoff method, in which, SMEs determine the probability of a minimally competent candidate achieving a correct response for each item on an examination. This model allows SMEs to rate a hard item on the examination with a high probability of a successful response by a minimally competent candidate and an easy item with a low probability of a successful response. The modified Angoff method provides the SMEs with very little information in which to base their probability estimates. With the incorporation

of IRT statistics in the SMT-Cut+ software, the performance of an item across all competency levels can be viewed. Please see the following graph.

SMT-Cut+ displays the Item



Characteristic Curve (ICC) as well as the line depicting the probability of correctness (group average for all SMEs) for the item and its corresponding competency level. Each competency level (values from -4 to +4) corresponds to a score on the examination. After viewing multiple items, the consistency of the competency estimates can be viewed and evaluated. If in fact a hard item on the examination is estimated with a high probability of a successful response by a minimally competent candidate or an easy item with a low probability of a successful response, it would be very obvious from the graphic display of those items. At which time the items would be re-evaluated. Please see the following graph.

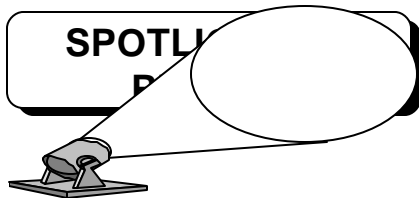


SMT-Cut+ can also improve the consistency of a single SME's estimates across multiple items. By increasing the consistency of each individual SME, the overall reliability of the estimates for the examination increases.

The software also allows the estimate of competency for the entire examination form to be completed in a shorter amount of time. Once the estimates are consistent across a large grouping of items (i.e. 30% to 50% of the examination items), the process is complete and a cut score can be established.

Through the use of SMT-Cut+, Schroeder Measurement Technologies has turned a difficult, expensive, and very subjective process into one that is simplified, reasonably priced, and very objective.

MIS Director: Steve Schimsky



Our spotlight in this issue of dimensions shines on Steve Schimsky who serves as the Director of Management Information Systems (MIS). Mr. Schimsky received his Bachelor degree in Computer Science from Stockton State College in Pomona, New Jersey. His intelligence and skill provides us with the innovative software and programs that contribute eminently to the success of the development and delivery of our high-quality examination resources.

Mr. Schimsky is a recognized expert in field of examination development related software. In addition to his current position, he has previously served as the Director of MIS for the National Assessment Institute (NAI) and as the Director of MIS for Applied Measurement Services (AMS).



*MIS Director
Steve Schimsky*

Mr. Schimsky's superior proficiency in computers is of extreme value to SMT. He applies his excellence to three major responsibilities, as well as many other important duties he performs at SMT. These major responsibilities include creating all of our software, securing all data through the use of back-up procedures, and ensuring that all systems, software and hardware are functioning properly.

His greatest accomplishments, according to Mr. Schimsky, include SMT-Bank for Windows, which stores the items or questions for each SMT contract, produces all examinations and runs all programs pertinent to test development processes and Candidate Processing which regulates testing administration such as scheduling testing dates, creating pass/fail letters for candidates, and processing applications. When asked how he creates such innovative, extraordinary programs he simply replied, "I like to

be on the cutting edge of information technology."

POINT OF INTEREST

For your general information, SMT has moved to a new location in Dunedin, Florida. The purpose of this move was to provide SMT with ample room for expansion and to benefit SMT employees with more workspace. Please be advised that our telephone number has also changed. You can note this new information at the beginning and at the end of this newsletter.

For details about SMT, our product and service offerings or to discuss your testing program, please contact :

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SMT NOW OFFERS CRT

SMT has established a strategic relationship with the ***LaserGrade Computer Testing Network*** to provide the highest standard in computer based testing.

“Computerized testing is our expertise. It’s the only thing we do.” It’s this dedication that has gained ***LaserGrade*** a reputation of providing unsurpassed levels of **reliability, test security** and **customer service** to their testing agencies, test sites and test applicants. It is also this same dedication that is the foundation of the ***SMT – LaserGrade*** partnership.

The relationship between ***SMT and LaserGrade*** brings numerous features to the examination process

- SMT’s experience and innovation in connection with the test development and other research and development functions
- SMT’s statistical and psychometric expertise in IRT
- LaserGrade’s high-tech, secured testing sites throughout the U.S. and Canada
- LaserGrade’s candidate registration via toll free hotline or Internet and eligibility screening
- Complete security to protect the integrity of the examinations
- Statistical data for each question and test type
- Test proctors must complete strict training course and pass a certification test prior to administering examinations

We are very excited about the ***SMT – LaserGrade*** relationship. Both organizations are highly committed to providing superior quality to all clients. ***LaserGrade*** will compliment ***SMT’s*** focus on cutting edge techniques to enhance and improve the testing process.

FOR ADDITIONAL INFORMATION REGARDING THE SMT – LASERGRADE CONNECTION

Matt Wenger, Vice President

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LaserGrade

Your best choice in computerized testing

Since 1995, **LaserGrade** has established a reputation for hi-tech, high standards and high quality in all aspects of computerized testing. Their steady growth has resulted in a network of hundreds of test sites across the nation, along with an increasing number of international sites.

LaserGrade offers various registration options for test applicants:

- Controlled registration, at the customer's request, via Internet access to **LaserGrade's** reservations database,
- Test applicants may call the national reservations hotline OR
- On-site registration

Test facilities are centrally located for the business community, furnished with amenities and equipped with leading edge technology (Pentium computers with SVGA color monitors). Test site schedules are designed to accommodate individual needs and hours of operation are not limited to weekdays, business hours.

Test security is **LaserGrade's** primary concern. All test questions and associated data reside on their central computer and is password protected on several levels. **LaserGrade** modem servers will **only** accept calls from authorized **LaserGrade** test site computers. The applicant data and test questions are downloaded to the local test site and are encrypted, compressed then password protected. All sensitive data is encrypted with a custom encryption routine that was conceived and written by **LaserGrade**. It is only when the sensitive data is read into active RAM that it is decrypted, and then only one question at a time. The correct answer to the test question only resides in the encrypted data. Any data that is of a secure nature and needs to reside on the local testing station is encrypted in this manner.

Professional organizations that utilize computer-based licensure and credentialing exams expect and deserve to work with a test administration company that is reliable, secure, and involved in all aspects of the testing process...

LASERGRADE IS THE BEST CHOICE

