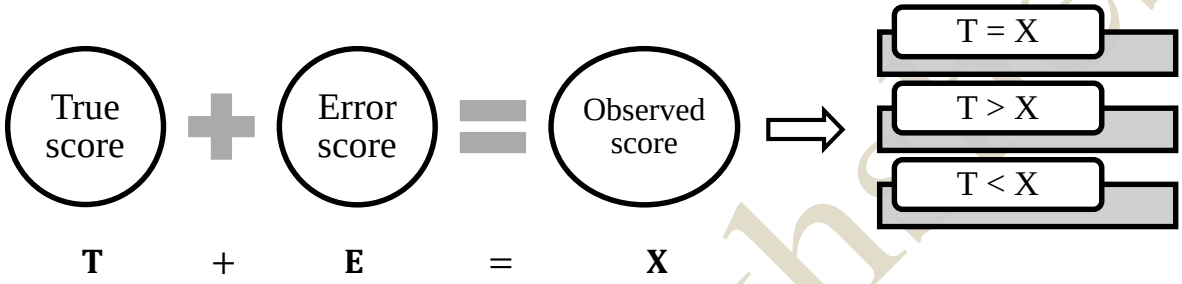
CHAPTER SIX: CHARACTERISTICS OF A GOOD TEST

1. RELIABILITY

The notion of *consistency of one's score with respect to one's average score over repeated administrations* is the central concept of reliability.

2. CLASSICAL TRUE SCORE THEORY (CTS)

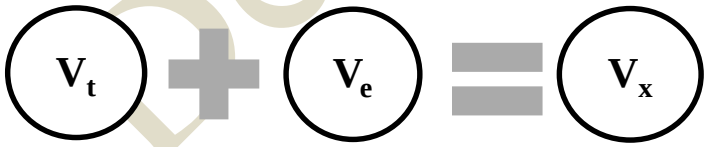
An **observed score** an examinee obtains on a test comprises two factors or components: a **true score** and an **error score**. The relationship between the observed and true score can be illustrated as follows:



We don't speak of the reliability of a measure for 'an individual' – reliability is a characteristic of a measure that is taken 'across individuals':

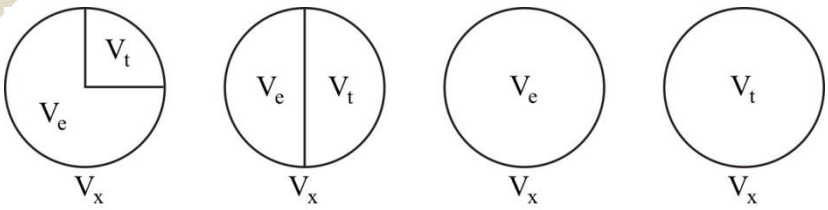
(a) **meaningful variance** → those creating variance related to *the purposes of the test* or *subject matter area being tested* → predictable, systematic →contributes to reliability

(b) **error variance** → those generating variance due to *other extraneous sources* → Error variation → unpredictable, unsystematic



Reliability → the ratio of the variance of true scores to the variance of observed scores:

$$r = \frac{V_t}{V_x}$$



3. STANDARD ERROR OF MEASUREMENT

The formula for calculating SEM is relatively simple:

$$SEM = S_x\sqrt{1-r}$$

where **S_x** = the standard deviation of the test
r = reliability of the test

Example: If the standard deviation of a test were 15 and its reliability were estimated as 0.84, then what would be standard error of measurement?

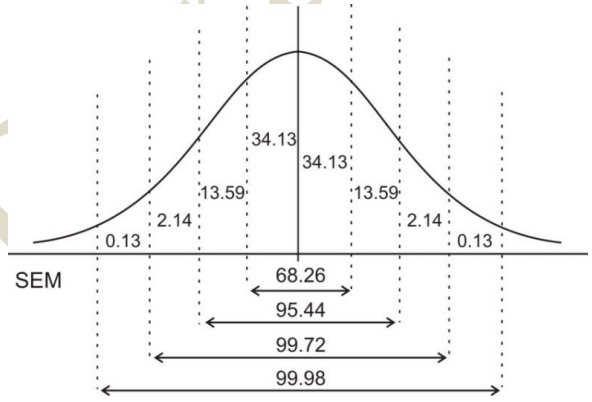
$$SEM = S_x\sqrt{1-r} = 15 \times \sqrt{1-0.84} = 15 \times \sqrt{0.16} = 15 \times 0.4 = 6$$

Example: When the test has no measurement error, then reliability would be ---------.

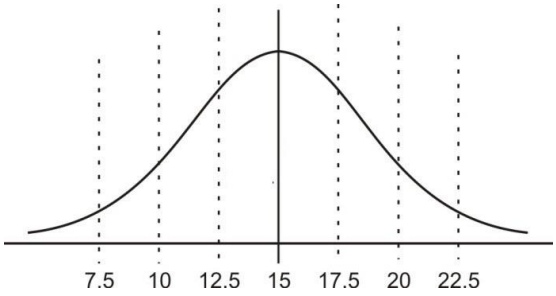
$$SEM = S_x\sqrt{1-r} \to 0 = S_x \times \sqrt{1-r} \to 0 = \sqrt{1-r} \to r = 1$$

💣 **Note:** There is a negative relationship between standard error of measurement and reliability.

Conceptually → SEM provides a concrete estimate in test score values of the amount of unreliable score variation in a set of scores
Practically → SEM is used to determine a band around a student's observed score within which that student's true score would probably fall



Example: If the SEM of a set of scores is 2.5 we can be sure that a student's true score who obtained 15 would fluctuate 68% of times between ---------



4. APPROACHES TO ESTIMATING RELIABILITY

4.1. Stability (Test-retest Method)

Administering a given test twice and then calculating the correlation between the two sets of scores, using Pearson product-moment correlation coefficient.

- **Note:** consistency of scores *over time* or *temporal stability*.

Drawbacks:

- Two administrations
- Human being abilities are most likely to change from one administration to another.
- **Practice effect:** after the first test, testees would naturally have a better performance on the second administeration

4.2. Equivalence (Parallel-forms Method)

Two similar forms of the same test are administered to a group of examinees just once → Using Pearson product moment formula, reliability is calculated.

Parallel forms:

He usually …… tennis every day.
a) plays b) play c) playing
My brother often …… a cup of tea every morning.
a) drinking b) drinks c) drink

Drawbacks:

- Constructing two parallel forms
- **Ordering effect** ≠ counterbalanced test design

	Time 1	**Time 2**
Half I	Form A	Form B
Half II	Form B	Form A

4.3. Internal Consistency

Uses information internal available in one administration of a single test. Assumptions:

a) test scores are **unidimensional** → the parts or items of a test are homogeneous
b) the items or parts of a test are **locally independent**

4.3.1. Split-half Methods

A single test is administered to a group of examinees → the test is divided into two equal halves

Spearman Brown estimate

The correlation (Pearson product-moment) between the two halves is an estimate of the test score reliability → *Spearman-Brown prophecy* formula:

$$r_{total} = \frac{2(r_{half})}{1 + (r_{half})}$$

Example: The reliability of half of a grammar test is calculated to be 0.35. By applying the Spearman Brown's prophecy formula, the total reliability would be ---------

$$r_{total} = \frac{2r_{half}}{1 + r_{half}} = \frac{2 \times .35}{1 + .35} = \frac{0.7}{1.35} = 0.51$$

Assumptions:

- The two halves are equivalent, i.e. they have equal means and variances
- The two halves are experimentally independent of each other

Guttman estimate

It does not assume equivalence of the halves; it does not require computing a correlation between them:

$$\propto = 2\left(1 - \frac{S^2_{odd} + S^2_{even}}{S^2_{total}}\right)$$

4.3.2. Item variance methods

KR-21 Method

Developed by Kuder and Richardson.

$$(KR - 21)r = \left(\frac{K}{K - 1}\right)\left(1 - \frac{\bar{X}(K - \bar{X})}{KV}\right)$$

where: **K** = the number of the items in a test

Assumptions:

- items are of equal difficulty
- items are scored dichotomously (no weighting scheme)

- **Note:** called **rational equivalence**
- **Note:** the easiest and most frequently used method of internal consistency
- **Note:** an underestimate index of reliability

KR-20 Method

Avoids the problem of underestimating reliability:

$$KR - 20 = \left(\frac{K}{K - 1}\right)\left(1 - \frac{\sum pq}{S^2_t}\right)$$

where: **pq** (**item variance**) = $IF\ (1 - IF)$

Assumption:

- items are scored correct/incorrect (i.e., dichotomously or binary)

💣 **Note:** most accurate and flexible internal consistency method

Cronbach alpha method

Used with weighted items where examinees may receive partial credit:

$$\alpha = \left(\frac{K}{K-1}\right)\left(1 - \frac{\sum S_i^2}{S_t^2}\right)$$

where: $\mathbf{S_i^2}$ = item variances for each individual item

	Assumption		Effect if assumption is violated	
	Equivalence	**Independence**	**Equivalence**	**Independence**
Spearman-Brown	Yes	Yes	Underestimate	Overestimate
Guttman	-	Yes	-	Overestimate
Kuder-Richardson	Yes	Yes	Underestimate	Overestimate

5. FACTORS INFLUENCING RELIABILITY

5.1. The Effect of Testees

- Psychological and physiological conditions
- Testees' Homogeneity
- Guessing: Educated guess vs. wild guess
- Test-wiseness → a test taker's capacity to utilize the characteristics and formats of the test and the test taking situation to guess the correct answer

5.2. The Effect of Test Factors

- Homogeneity of the items
- The speed with which the test is performed
- Ambiguity of instructions and items
- Discriminability
- Number of items

$$r_k = \frac{kr_1}{1 + (k-1)r_1}$$

$\mathbf{r_k}$ = the test when adjusted to k times its original length

$\mathbf{r_1}$ = the observed reliability of the test with its present length

$\mathbf{k} = \frac{\text{تعداد ثانویه سوالات}}{\text{تعداد اولیه سوالات}}$

5.3. The Effect of Administration Factor

- The influence of the environment
- Quality and test timing

5.4. The Influence of Scoring Factors

The concern here is **rater reliability** in case of subjective items:

- **Intra-rater (**or **Mark/remark) reliability** → Error due to the fluctuations of a *single scorer in scoring items twice* → unclear scoring criteria, fatigue, bias toward particular good and bad students, or simple carelessness
- **Inter-rater reliability** → Error due to the fluctuations of *different scorers scoring a single test* → lack of adherence to scoring criteria, inexperience, inattention, or even preconceived biases.

To avoid the effect of scoring:

- Provide a detailed scoring key
- Identify candidates by number, not name
- Train scorers
- Employ multiple, independent scoring
- Agree acceptable responses and appropriate scores at outset of scoring

6. VALIDITY

Reliability: How much of an individual's test performance is due to measurement error, or to factors other than the language ability we want to measure? → minimizing the effects of these factors
Validity: How much of an individual's test performance is due to the language ability we want to measure? → maximizing the effects of these abilities

Validity → the extent to which a test measures what it is supposed to measure.

6.1. Content Validity

Degree of correspondence between the test content and the content of the materials to be tested:

- Subject matter = the topics
- Instructional objectives = degree of learning that students are supposed to achieve

NRT → the extent to which a test contains a representative sample of the larger universe it is supposed to represent

Main issue is *sampling* → *appropriateness* of the test sample

It provides subjective information → to reduce subjectivity:

- Have the test reviewed by more than one expert
- Transfer the detailed definition onto a table of specification

6.2. Face Validity

The way the test looks to the examinees, test administrators, educators, and the like → this is not validity in the technical sense

- a well-constructed, expected format with familiar tasks,
- a test that is clearly doable within the allotted time limit,
- items that are clear and uncomplicated,
- directions that are crystal clear,
- task that relate to their course work (content validity), and
- a difficulty level that presents a reasonable challenge,
- no surprises in the test.

6.3. Criterion-related validity

Investigates the correspondence between the scores obtained from the newly-developed test and the scores obtained from some independent outside criteria → Pearson product-moment correlation

- **Concurrent validity:** a particular trait is administered *concurrently* with another well-known test
- **Predictive validity:** the two tests are administered with *some time interval*.

💣 **Note:** also known as **empirical** or **statistical validity**
💣 **Note:** content of the criterion measure must be on the same domain as that of the new test

6.4. Construct Validity

A test has construct validity to the extent to which the psychological reality of a trait or construct (like language proficiency) can be established = If a test has construct validity, it is capable of measuring certain specific characteristics in accordance with a theory of language behavior and learning

The major problem with psychological constructs is that testers cannot take a construct out of a student's brain and show that a test is in fact measuring it. Experiment:

multitrait-multimethod studies
factor analytic techniques
structural equation modeling
think-aloud protocol
differential-groups studies
intervention studies

7. FACTORS INFLUENCING VALIDITY

- Directions
- Difficulty levels of the test
- Sample truncation
- Structure of items
- Arrangement of items and correct responses

8. PRACTICALITY

Have to do with physically putting tests into place in a program

- Ease of Test Administration
- Ease of Test Scoring
- Ease of Interpretation and Application
- Ease of Test Construction
- The Cost Issue

9. RELIABILITY VS. VALIDITY

Reliability is a mathematical concept = when a test shows a certain degree of reliability, it will produce, to the same degree, consistent scores
Validity is a relative term = it depends on the purpose of the test = it is test-dependent

- If a test is reliable, it may or may not be valid.
- If a test demonstrates a certain degree of validity, it is to some extent reliable.

9. EXTRA POINTS

Coaching effect → the effect on test scores of 'teaching to the test'. Coaching can be defined as short term instruction in test *wiseness* and in answering questions similar to those appearing on the target examination
Test comprise effect → the acquisition of prior knowledge of test content