

What is the definition of the Kuder-Richardson Formula 20 and can you provide an example of its application?

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The Kuder-Richardson Formula 20 is a statistical measure used to assess the internal consistency or reliability of a test or survey. It is calculated by taking the total number of items in the test, subtracting the sum of the variances of each item, and dividing by the total number of items minus one. This formula yields a coefficient ranging from 0 to 1, with higher values indicating higher internal consistency.

An example of its application would be in evaluating a multiple-choice exam. If the Kuder-Richardson Formula 20 yields a coefficient of 0.8, it indicates that the exam has a high level of internal consistency, meaning that the questions are measuring the same underlying construct. This can give confidence in the accuracy of the exam results and the validity of the test. The Kuder-Richardson Formula 20 is commonly used in educational and psychological research to assess the reliability of various measures.

Kuder-Richardson Formula 20 (Definition & Example)

The Kuder-Richardson Formula 20, often abbreviated KR-20, is used to measure the reliability of a test in which each question only has two answers: right or wrong.

The Kuder-Richardson Formula 20 is as follows:

$$KR-20 = (k / (k-1)) * (1 - \sum p_j q_j / \sigma^2)$$

where:

k: Total number of questions
p_j: Proportion of individuals who answered question j correctly
q_j: Proportion of individuals who answered question j incorrectly
σ²: Variance of scores for all individuals who

took the test

The value for KR-20 ranges from 0 to 1, with higher values indicating higher reliability.

The following example shows how to calculate the value for KR-20 in practice.

Example: Calculating Kuder-Richardson Formula 20

Suppose we administer a test with 7 questions to 10 students.

The results of the test are listed below in Excel, with 1 indicating a correct answer and 0 indicating an incorrect answer:

	A	B	C	D	E	F	G	H	I	J
1	Student	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total Correct	
2	1	0	1	1	0	1	1	1	5	
3	2	1	1	1	1	0	0	0	4	
4	3	1	1	1	1	0	1	1	6	
5	4	1	1	0	0	1	1	0	4	
6	5	0	1	1	1	1	0	1	5	
7	6	1	0	1	0	1	1	0	4	
8	7	1	1	0	0	0	0	0	2	
9	8	1	1	0	1	0	1	0	4	
10	9	0	0	1	1	0	0	0	2	
11	10	1	1	1	0	1	0	1	5	
12										
13										
14										
15										
16										
17										
18										
19										

The following screenshot shows how to calculate the KR-20 value for this test:

	A	B	C	D	E	F	G	H	I
1	Student	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total Correct
2	1	0	1	1	0	1	1	1	5
3	2	1	1	1	1	0	0	0	4
4	3	1	1	1	1	0	1	1	6
5	4	1	1	0	0	1	1	0	4
6	5	0	1	1	1	1	0	1	5
7	6	1	0	1	0	1	1	0	4
8	7	1	1	0	0	0	0	0	2
9	8	1	1	0	1	0	1	0	4
10	9	0	0	1	1	0	0	0	2
11	10	1	1	1	0	1	0	1	5
12									
13	p	0.7	0.8	0.7	0.5	0.5	0.5	0.4	
14	q	0.3	0.2	0.3	0.5	0.5	0.5	0.6	
15	pq	0.21	0.16	0.21	0.25	0.25	0.25	0.24	
16									
17	k	7.0000							
18	Σpq	1.5700							
19	σ²	1.6556							
20	KR-20	0.0603							
21									
22									
23									

Here are the formulas used in various cells:

B13: =SUM(B2:B11) / 10
B14: =1-B13
B15: =B13*B14
B17: =COUNTA(B1:H1)
B18: =SUM(B15:H15)
B19: =VAR.S(I2:I11)
B20: =(B17/(B17-1))*(1-B18/B19)

The KR-20 value turns out to be 0.0603.

Since this value is extremely low, this indicates that the test has low reliability.

Additional Resources

The following tutorials provide explanations of terms commonly used when assessing the validity of tests and questionnaires:

ARABPSYCHOLOGY.COM