

# Investigation of reliability, validity and normality Persian version of the California Critical Thinking Skills Test; Form B (CCTST)

Khalili H.<sup>1</sup> MSc; Hossein Zadeh M.<sup>2</sup> MSc;

<sup>1</sup>Member of Faculty in Semnan University of Medical science, Nursing Faculty

<sup>2</sup>Member of Faculty in Shahid beheshti University of Medical science, Nursing Faculty

## ABSTRACT

**Background:** To evaluate the effectiveness of the present educational programs in terms of students' achieving problem solving, decision making and critical thinking skills, reliable, valid and standard instrument are needed.

**Purposes:** To Investigate the Reliability, validity and Norm of CCTST Form.B. The California Critical Thinking Skills Test contain 34 multi-choice questions with a correct answer in the five Critical Thinking (CT) cognitive skills domain.

**Methods:** The translated CCTST Form.B were given to 405 BSN nursing students of Nursing Faculties located in Tehran (Tehran, Iran and Shahid Beheshti Universities) that were selected in the through random sampling. In order to determine the face and content validity the test was translated and edited by Persian and English language professor and researchers. it was also confirmed by judgments of a panel of medical education experts and psychology professor's. CCTST reliability was determined with internal consistency and use of KR-20. The construct validity of the test was investigated with factor analysis and internal consistency and group difference.

**Results:** The test coefficient for reliability was 0.62. Factor Analysis indicated that CCTST has been formed from 5 factor (element) namely: Analysis, Evaluation, Inference, Inductive and Deductive Reasoning. Internal consistency method shows that All subscales have been high and positive correlation with total test score. Group difference method between nursing and philosophy students (n=50) indicated that there is meaningful difference between nursing and philosophy students scores ( $t=-4.95, p=0.0001$ ). Scores percentile norm also show that percentile of fifty scores related to 11 raw score and 95, 5 percentiles are related to 17 and 6 raw score ordinary.

**Conclusions:** The Results revealed that the questions test is sufficiently reliable as a research tool, and all subscales measure a single construct (Critical Thinking) and are able to distinguished the persons with different level's CT.

**Keywords:** Critical Thinking, Nursing Education, Nursing Students, Reliability, validity, Normality, CCTST

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## Introduction

One of the important aims of health related education is training of graduates who are able to give good services to patient and healthy people in the society and clinical centers(1).

In most instances, the traditional education in the universities, presents a combination of information and concepts to the students, but it doesn't contribute to development of critical thinking skills required for effective and meaningful learning (3 and 4). Nikravan Mofrad(5) believes that nurses not only need to acquire facts and skills, but they also should be able to make decisions in high-risk clinical situations.

In educational institutes which main focus is on providing students with facts, at best student gain knowledge and other aspect of learning such as critical thinking, decision making are inevitable. To address these issue, teacher should provide the student with learning opportunities that let students have an active role in their learning (3 and 7). To do so the instructor should stimulate the students to critically think on the arising question (7, 8, and 9).

Emphasizing the importance of above mentioned skills, National League of Nursing in U.S.A has determined the development of critical thinking skills as an essential part of nursing education (10, 11, and 12).

In Iran due to growing attention paid to higher education especially medical education, methods of teaching and learning has been placed in the center of constant focus in recent years. Educational experts suggest that developing problem solving, decision making and critical

Semnan University of Medical science, 5-Kilometers of Damghan Road, Semnan, Iran  
Tel: 231 3330014-6 Fax: 231 3330014  
Email: khalili\_h@yahoo.com

thinking skills are of outmost importance and emphasize that universities should prepare the ground for reaching these objectives (3,4, and 13). To evaluate the effectiveness of the present educational programs in terms of students' achieving problem solving, decision making and critical thinking skills, reliable, valid and standard instrument are needed.

So we decided to adopt CCTST – form B, which is based on the APA Delphi consensus conceptualization of critical thinking in 1989/90, for use in Iran. Original version of CCTST\_ Form B was developed by Facione .A and Facione .C in California in 1991/92. The Theoretical basis of CCTST is on the APA Delphi consensus conceptualization of critical thinking. 34 items contained in the CCTST are drawn from a pool of 200 items developed in a 20-year research program aimed at validity and reliably testing CT. Items selected for inclusion in the CCTST cover the domain of the five CT cognitive skills identified by the Delphi experts: interpretation, analysis, evaluation, explanation, and inference. Each is a multiple choice item designed to be scored dichotomously, with one correct answer and three or four distracters

### What is critical thinking

Before The Delphi project there was no clear consensus on definition of critical thinking (CT), although the concepts advanced by Ennis, Paul, and others were prominent and influential. A consensus was reached on the concept of CT in 1990 by a panel of experts drawn from throughout the United States and Canada. these experts characterize CT as the Process of Purposeful, Self-Regulatory Judgment. Critical thinking, so defined, is the cognitive engine, which drives problem solving and decision-making. This process is not a linear or step – by – step process, CTs flexibility permits one to use CT in judging the soundness of the evidence being presented, the criteria or standards of judgment being appealed to, the relevance of the contextual elements being described, or the validity of the methods of inquiry being used. Using our critical thinking ability we are able to consider novel and complex problems in order to determine what we should do or what we should believe. Effective interventions in main cognitive skills of critical thinking should cover areas of interpretation, analysis, evaluation, inference, explanation and self – regulation.)

### Materials and Methods

To investigate reliability, content validity, construct validity, and norms of Persian version of CCTST a stratified random sample (n=405) of the nursing students (BSN) who were studying in 1998-99 in Tehran, Iran, Shahid Beheshti Universities' nursing schools, with an age range of 19-34( mean ,22.5) were given the Persian version of the test (Form B) which had 34 multi – choice questions each with one correct answer covering 5 fields of cognitive skills of critical thinking (analysis, evaluation, inference, inductive and deductive reasoning

In order to determine the face validity, test were translated by researchers and two English teachers and was edited by a faculty member of Persian language. The content validity of test evaluated through collecting 12 experts' judgements (medical teachers and psychology faculty members).

Internal consistency were calculated (Kuder – Richardson-20) for assessing reliability. The construct validity was determined through factor analysis, internal consistency and group differences. The statistical analysis was made with the spss version 10.

### Results

**Reliability:** The results indicate that KR-20 for total scale with 34 items was 0.62. Five subscales have inadequate reliability estimates ranging from 0.62 for analysis to 0.67 for inductive reasoning. These coefficients are within the acceptable range for scales, which measure the thinking ability in an individual. Facione and Facione (1993) note that a KR-20 range of 0.65 to 0.75 for this type of instrument is acceptable.

#### Validity:

**Content validity:** After making the modification which the experts deemed necessary regarding altering foreign names to Persian content validity was confirmed by the consensus of the expert panel.

**Construct validity:** construct validity of test was determined by factor analysis, internal consistency and group differences. First, a principal component factor analysis with varimax rotation was conducted on the 34 items of the Persian version of CCTST and the resulting solution was compared with the basic conceptual framework. Factor

components used in factor analysis of the test were, evaluation, analysis, and inference. Critical thinking traditionally is classified into two type: inductive, deductive.

The results indicate that the Persian version of CCTST includes 5 subscales in 5 fields of cognitive skills of critical thinking (analysis, evaluation, inference, inductive and deductive reasoning).

Subscale analysis showed a positive high level of correlation between total test score and the component (analysis,  $r = 0.61$ ; evaluation,  $r = 0.71$ ; inference,  $r = 0.88$ ; inductive reasoning,  $r = 0.73$ ; and deductive reasoning,  $r = 0.74$ ). Also subscales had positive and significant correlation with each other. In investigating the group differences in order to determine construct validity, the mean scores of nursing students compared with philosophy students ( $N=50$ ), who were randomly selected from Tehran and Shahid Beheshti faculties of human sciences, showed that there was a significant difference between mean scores of nursing (11.68) and philosophy (14.24) students in this test ( $t = -4.95$ ,  $p = 0.0001$ ) [table 2].

Because no significant difference was observed between mean scores of two sex (male and female) for norm scores, a percentile norm was calculated for the whole group. The results showed that frequency distribution of scores has a normal distribution in the population ( $X = 11.68$ ,  $M=12$ ,  $SD=3.25$ ,  $SK=0.21$ ,  $CUR = 0.09$ ). Percentile norm of scores also indicates that percentiles of 50, 5, 95 are related to 11, 6, and 17 raw scores, respectively [ table 1,3 ].

**TABLE 1.** Statistical Analysis of CCTST Norm Sample

Mean	11.68
Median	12
Mode	12
Std Dev	3.25
Range	18
Minimum	3
Maximum	21
Cases	405

**TABLE 2.** Statistical Analysis of Total Scores In-Group Differences

Course	Mean	Std Dev
Nursing	11.68	3.25
Philosophy	14.28	4.23
t Test	$t=-4.95$ , $p=.000$ , $df=453$	

**TABLE 3.** Suggested Percentile Ranking of CCTST scores in nursing students

Score	Percentile
1-4	1
5	3
6	5
7	11
8	16
9	25
10	39
11	50
12	61
13	73
14	82
15	88
16	93
17	96
18	98
19	98
20-34	99

## Discussion

Because of the importance of critical thinking skills, the necessity of measurement and evaluation of these skills in the students is undisputable. But since critical thinking is a complicated process, development of measuring scales of critical thinking skills has been neglected. Unlike the previous tests which were based on inductive definition, CCTST is based on a consensus concept of critical thinking. Facione and Facione developed CCTST scale (13). The CCTST is based on the APA Delphi consensus conceptualization of critical thinking. Thirty four items of the CCTST are drawn from a pool of 200 items developed in a 20-year research program conducted for testing validity and reliability CT. Items selected for inclusion in the CCTST cover the domain of the five CT cognitive skills identified by the Delphi experts: interpretation, analysis, evaluation,

explanation, and inference. It seems that this scale in comparison with the other measuring tools of critical thinking is more comprehensive. To use the CCTST in Iran, it is necessary to fit the test with the social and cultural factors, and then the statistical indices of the translated test are investigated. The translator should apprehend the frame of concept, which is the basis of the test, and based on this frame adopt the test to new culture. Cultural comparison is crucial for validity and should not be ignored (4,12).

To address this issue properly CCTST-FormB was translated by researchers and English teachers and was edited by a faculty member of Persian language.

The viewpoints and judgement of psychologist and medical teachers and also the viewpoints of the students in pilot study were used in order to investigate the structure and content validity of test and the test was ready for use.

After collecting data the reliability coefficient of test with the method of internal consistency and with KR-20 was 0.62. The reliability coefficient of subscales after factor analysis was in the range of 62%-67%. The reliability coefficient resulted in this research has a great correlation with the reliability coefficient resulted in the standardization process of this test in USA (0.68-0.70) and little existing difference is acceptable because Iranian students are not familiar with this type of questions. These coefficients are within the acceptable range for scales, which measure the thinking ability in an individual. Facione and Facione(14) note that a KR-20 range of 0.65 to 0.75 for this type of instrument is acceptable.

After determination of test reliability, construct validity of test (which is the most important kind of validity in translated test) was investigated with three methods of factor analysis, internal consistency and group differences.

The result of factor analysis showed the correlation between structure of test and basic theory, which forms the basis of the test and indicated that the test is composed of 5 factors (subscales) which all of these factors measure one single item (Critical Thinking).

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