

Development of Electrical Energy Achievement Test

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Extended Summary

Purpose: The aim of this study is developing a measurement tool to assess seventh grade students' academic achievement in Electrical Energy Unit.

Method and Findings: The participants of this study were 255 eight graders who were studying in three different public schools in Istanbul in the 2016-2017 academic year. In order to developing achievement test 10 steps were followed.

1. Defining the necessity for test: Due to lack of appropriate achievement tests about Electrical Energy Unit, developing a new reliable and valid achievement test was essential to assess seventh grade students learning.

2. Literature review and collecting a variety of questions: According to objectives of this unit, 39 questions collected from a variety of sources such as textbooks, high school entrance exams and identifying students' level exams.

3. Writing items: Questions were examined and similar questions were eliminated thus the number of questions was reduced to 27. These items except questions written by researcher were rewritten by researcher.

4. Making a table of specifications: In order to give the proof that this test has content validity, the table of specifications was made. Test items were classified according to Revised Bloom Taxonomy.

5. Taking the expert opinions: Two Turkish teachers, four science teachers, one research assistant in the department of physics and an instructor examined the questions on the basis of comprehensibility of questions, fluency in questions, suitability for target group and consistency in scientific knowledge.

6. Constructing the first version of test: Questions were edited in the light of the experts opinions. An explanatory instruction about the aim of study was inserted to the test.

7. Applying the test: Electrical Energy Achievement Test (EEAT) consist of 27 items was applied 255 eight graders. Sample size should be more than 200 (Haladyna, 2004).

8. Item analysis: Firstly all students' EEAT results were scored. One point is awarded for each correct answer and 0 point is given for each wrong or blank answer. Students' total score arranged in descending order and students divided into three groups. Item difficulty and item discrimination were analyzed taking into consideration of lower group (n=69) and upper group (n=69) scores. Item 14 was not as qualified as other questions so it was eliminated.

9. Reliability and validity analysis: The data analyzed via SPSS 24 and Lisrel 9.30 programs. Electrical Energy Unit consists of two parts which are "Connecting Light Bulbs" and "Transformation of Electrical Energy" respectively. Because of the fact that questions were written according to these two factors, confirmatory factor analysis was performed. Based on confirmatory factor analysis question 18 were omitted. These two factors were verified. Confirmatory factor analysis can be useful when the factors are known (Güriş and Astar, 2015; Türkmen, Baykal and Seren, 2011; Kılınç, 2011). Model fit indices were examined. The values of model fit indexes which were NNFI (1.02), IFI (1.03), GFI (0.87), CFI (1.00), AGFI (0.85) and RMSEA (0.00) were satisfactory.

After two item were omitted, Cronbach's alpha reliability coefficient calculated as 0.79. EEAT was administrated 30 students as re-test and test-retest reliability was found 0.80.

10. Final version of the test: After item analysis item 14 were omitted and according to confirmatory factor analysis results item 18 were omitted. Final version of EEAT consists of 25 multiple choice questions.

Conclusion and Discussion: Reliability coefficient of Electrical Energy Achievement Test consisting of 25 questions was found 0.79 in this study. Confirmatory factor analysis was performed and two factors were found suitable. Name of the factors are “*Connecting Light Bulbs*” and “*Transformation of Electrical Energy*”.

This study indicates that the Electrical Energy Achievement Test consisting of 25 questions is valid and reliable instrument to assess seventh grade students’ achievement.