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The reliability and validity study of the attitude scale for physics course

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Abstract

With their cognitive, affective and behavioral dimensions; attitudes constitute one of the factors which are effective on the behaviors of an individual. Positive attitudes developed by students towards Physics course play an important role in their academic success in Physics course. This study aimed at developing an attitude scale for Physics course. Study samples were composed of 159 students to have attended Science High School in Kırklareli Province, Turkey, in 2008-2009 education year. The scale was subjected to factor analysis, and scale was a six dimensional. Cronbach alpha reliability coefficient of this 34-item attitude scale for Physics course was calculated to be .96.

Keywords: Attitude scale; Physics course; Attitude toward physics; Reliability and validity

1. Introduction

It is a commonly known fact that being able to adapt to advances in science and technology is necessary in ensuring the country improvement. Developing individuals' scientific discovery, thinking and evaluation abilities, building the compatible work force, facilitating skills to have access to contemporary technology are among the fundamental tasks of science education (Sılay, 2002). Physics education, on the other hand, plays an important role in this field.

Physics, a natural science, is defined as a branch of science researching the structure of matter and energy and their interactions and trying to find the explanatory laws to which physical events are connected. (Erden, 2009). Physics is the most comprehensive course which enables us to comprehend all the natural events around us. All the laws and rules described and taught in physics course are directly related to the outer environment and the happenings in the world. People's full comprehension of the happenings in their environment depends on the extent to which they associate what they have learnt in classes with those events, and on knowing which events are explained with which physical laws (Gürel, Güven and Gürdal, 2003).

Several factors affecting students' achievement in physics (such as the ability to think logically, visual ability, mathematical skills and problem solving skills) have been emphasized in research studies done so far in the field of physics education, and it has been demonstrated that some problems are available in physics education of various levels (Kızılcık and Ünsal, 2010). One of those problems is that physics is considered to be very abstract and is believed to be very difficult by students. This belief causes most of the students to develop a negative attitude towards physics.

Attitudes are individuals' mental biases to people, objects, topics and events (Aiken, 1985). An attitude is described as the tendency to give learnt consistent, positive or negative responses to an object of attitude (Fishbein

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and Ajzen, 1975; quoted by Gök and Sılay, 2008). Attitudes are usually learnt through direct experience, reinforcement, imitation and social learning, and are considered as an important explanation of the behavior in the cognitive, sensorial and behavioral dimensions. One of the basic aims of physics course, just as in the case of other fields of science, is to develop positive attitudes in students. Therefore, an "attitudes towards physics course scale" was developed so as to determine students' attitudes towards physics course in this research.

2. Method

2.1. Study Group

The study group was composed of the 159 students attending Kırklareli Science High School in the 2008-2009 academic years.

2.2. Data Collection Tool

The 34-item attitudes towards physics course scale which was developed by the researchers and whose Cronbach alpha reliability was found as .96 was employed by adapting it to physics course. Consulting to the measurement and evaluation as well as physics education experts' opinions, the corrections and modifications were made to the attitude statements which were developed for the physics course.

2.3. Data Analysis

Factor analysis was conducted so as to determine the functionality of the measurement tool which had been developed for physics course.

3. Findings

Factor analysis was conducted to achieve the construct validity of the attitude scale and to determine the factor loads of the items in the scale and thus to obtain a functional size (Büyüköztürk, 2006). Prior to the factor analysis, the compatibility of the data with factor analysis was tested through Kaiser-Meyer-Olkin and Bartlett tests. The KMO value for the factor analysis of the 37 items was found to be 0.926 whereas the result of Barlett test was found as $\chi 2$= 3466,678 ($p \leq .05$). It is suggested that the KMO value should be 0.60 at the minimum so that factor analysis could be done with the data (Pullant, 2001). In our case, the KMO value found is 0.93; which is higher than the recommended value and is clearly suitable for factor analysis.

On examining the item total correlations of the 37-item scale, it was found that the item total correlation was low (0.19, 0.17, 0.23) for items 13, 15, and 27. Thus, the three items were removed from the scale and it was found, according to basic components analysis results, that the items clustered under one factor and that the adapted scale was single dimensional. The item total correlations of the scale and the factor loads are shown in Table1. On examining the item total correlations, they were found to be bigger than 0.4 for all the items. Besides, the factor loads of the items were found to be in the 0.51- 0.75 range. The total variance accounted for by those items in one factor was found to be 45%. The variance, which is above the acceptable level of 41% (Kline, 1994), apparently enables us to evaluate the scale as a scale of one factor.

Table 1. The item Total Correlation of the Scale, the Factor Loads of the Items and Factor Common Variance

Item no	Item total correlations	Factor loads
F1	0,63	,67
F2	0,69	,71
F3	0,77	,75
F4	0,79	,75
F5	0,67	,58
F6	0,61	,67
F7	0,63	,67
F8	0,65	,58
F9	0,57	,63
F10	0,70	,62
F11	0,62	,62
F12	0,59	,65
F13	0,55	,59
F14	0,53	,53
F15	0,51	,55
F16	0,42	,69
F17	0,65	,65
F18	0,59	,57
F19	0,68	,66
F20	0,66	,54
F21	0,55	,68
F22	0,68	,64

F23	0,64	,65
F24	0,59	,51
F25	0,64	,70
F26	0,62	,55
F27	0,70	,56
F28	0,61	,60
F29	0,51	,68
F30	0,68	,68
F31	0,56	,64
F32	0,70	,61
F33	0,69	,62
F34	0,74	,71
	Explained variance: Total: 44. 3%	

The Cronbach alpha internal consistency coefficient of the scale was found to be .96.

4. Discussion

It was found following the factor analysis results that the scale developed by the researchers was a single factor scale and that the factor loads were between 0.51 and 0.75. The reliability coefficient for the attitudes towards physics course scale was calculated as.96.

Having reviewed the field literature, it was concluded that the number of attitude scales to measure the attitudes towards physics course was insufficient. The results of all the analyses conducted showed that the "attitudes towards physics course scale" with high reliability and validity could be used to determine students' attitudes towards physics course. It is expected that the scale will contribute considerably to determining students' attitudes towards physics and to organizing activities to raise the students' attitudes if they are low. Moreover, it is suitable for application in high schools and higher level groups to determine the attitudes towards physics course when needed in scientific research.

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