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Full Length Research Paper

Development of teachers' attitude scale towards science fair

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This study was conducted to develop a new scale for measuring teachers' attitude towards science fair. Teacher Attitude Scale towards Science Fair (TASSF) is an inventory made up of 19 items and five dimensions. The study included such stages as literature review, the preparation of the item pool and the reliability and validity analysis. First of all, the draft scale including 48 items was prepared depending on science fair studies and interviews of teachers reported in related literature. The draft version of the scale was applied to 275 teachers from the cities of Zonguldak and Isparta in Turkey. The results of the exploratory factor analysis revealed that the teachers' attitude scale towards science fair made up of five factors including such dimensions as contribution to students' development, educational importance, judgment, negative behaviour and mentorship. The final version of the TASSF included 19 items. The reliability coefficients were found to be 0.82, 0.84, 0.70, 0.76 and 0.66, respectively, and the explained variances were calculated as 15.14, 14.09, 7.83, 7.35 and 6.93, respectively. The total variance of TASSF was 51.37, and the Cronbach alpha coefficient was 0.77. The results of the study demonstrated that this new Teacher Attitude Scale towards Science Fair was a valid and reliable scale to measure teachers' science fair attitudes.

Key words: Science fair, attitude, teacher, instrument.

INTRODUCTION

Science fair, which has become a convention in our education systems, is generally a public exhibition where students present their projects and judges evaluate them. Science fair ensures to students with an opportunity to apply scientific method in conducting research projects and developing certain skills, such as scientific literacy and self-confidence (Grote, 1995; Bunderson and Anderson, 1996; Abernathy and Vineyard, 2001). "Students participating in science fairs [competitions] are doing more than learning something new; they are using and extending knowledge gained previously throughout their experiences" (Balas, 2003).

In order for individuals to acquire the 21st century skills, education programs are re-designed in most places in the World. Turkey, one of such places, has made changes appropriate to the constructive approach at primary school level in science program. In Turkey, the new science curriculum for primary school aims at bringing up children who inquire, search, investigate and establish science in their daily life, use scientific methods in every field of life to solve problems and consider scientists' perspective around the world (National Educational Board of Turkey, 2005). In this view, science fair is a very important tool for education, especially for science education. However, some researchers state that there are advantages and disadvantages of science fair on pedagogical aspect. They include, for instance, learning new things, entertaining time, enhancing researching and critical thinking skills, developing a positive attitude towards science, and at the same time causing unhappiness at the end of fair, stressing students, increasing anxiety etc. (Grote, 1995; Czerniak, 1996; Jackson, 1995; Abernathy and Vineyard 2001; Balas, 2003; LaBanca, 2008; Marsa, 1993; Bellipanni and Lilly, 1999; Bunderson and Anderson, 1996; Wang and Yang, 2003; Gomez, 2007; Kankelborg, 2005; Yayla and Uzun, 2008; Syer and Shore, 2001; Yasar and Baker, 2003).

Some researchers reported that students' projects reflect their parents' work and students exposed to parental pressure for involving in science fair (Grobman, 1993; Shore et al., 2007). For this reason, science teachers have a critical role in influencing students to take notice of science fair and scientific research projects (Blenis, 2000; Van Eck, 2006). Teachers are important elements for decreasing or increasing students' involvement in science fairs (Fisanick, 2010). Students, whose teachers and parents encouraged and approved their participation in the science fair competition, demonstrated more positive attitudes towards science fair competitions (Czerniak and Lumpe, 1996).

Teachers' attitudes towards science fair and their views are shaped with some factors. These are teachers' motivations of engagement in science fair; conducted projects in the curriculum, expectations of administrators for teacher or students in participating in science fair and so on (Fisanick, 2010). For this reason, science teachers' views on science fairs and attitudes towards science fairs are important. In order to measure teachers' attitudes towards science fair, a valid and reliable instrument is needed. There are few studies on developing a science fair attitude scale and on teachers' attitudes (Grote, 1995, 1996; Cook, 2003; Fisanick, 2010; McDonough, 1995; Schapiro, 1997).

This study aimed to develop a scale to measure the attitudes of teachers regarding science fair.

MATERIALS AND METHODS

The stages were followed at process of developing teachers' attitude scale towards science fair. Firstly, the author made a comprehensive and extensive review of the related literature and of the existing surveys and solicited options from teachers' experiences in science fair. A number of studies on science fair were examined (Grote, 1995, 1996; McDonough, 1995; Yayla and Uzun, 2008; Fisanick, 2010; Tortop, 2010).

The initial draft consisted of draft of 48 items. The draft was sent to experts in educational psychology and researchers who frequently study science fair or project based learning, in order to check content relevance, readability, and consistency. The draft was revised by the author, and his views of each item were regulated. The final instrument consisted of 46 items which included 22 negative and 24 positive items. This scale is a 5-point Likert type scale consisting of strongly disagree:1; disagree:2; undecided:3; agree:4; strongly agree:5. The higher score on scale indicated more positively attitudes towards the science fair.

Sample

The study was carried out in Zonguldak and Isparta cities in Turkey, in the spring term of the academic year of 2011-2012. The sample of study included 275 teachers working in these cities. The sampling method is criterion sampling (Büyüköztürk et al., 2011). Certain criteria were determined by the researcher for the selection of the teachers who would participate in the study. Firstly, the teaching fields related to science fair and project-based learning model in the curriculum were selected. The participants were teachers of science, mathematics and classroom teaching at primary and secondary schools and those of mathematics, geography, history, physics, chemistry and biology in high school. The second criterion was that these teachers previously joined a science fair as a project mentor.

There were 136 female teachers and 139 male teachers. As for the teaching experiences of the teachers, it was 20.0% (1-5 years), 21.8% (6-10 years), 21.1% (10-15 years), 17.8% (16-20 years), 9.8% (21-25 years), 2.5% (26-30 years) and 5.1 % (30 years or over).

RESULTS AND DISCUSSION

The final version of the instrument was administrated to 275 teachers. Afterwards, exploratory factor analysis was conducted. The Kaiser-Mayer Olkin (KMO) measurement of sample adequacy and Barlett's test of sphericity were calculated. The KMO coefficient was found to be 0.81, which was higher than the critical value of 0.3 (Klien, 1994; Büyüköztürk, 2007). The result of Barlett's test of sphericity statistic was significant ($p<0.05$). It seems that factor analysis could be applied to the results of these tests. The purpose of applying factor analysis was to determine the number of separate components. Whether the test demonstrated a normal distribution or not was examined. As there was no normal distribution, the principal axis factor analysis was used on all the data to extract the appropriate number of factors. The principal axis factoring analysis yielded five components with an Eigen value greater than one. These factors explained 51.37 of total variance. The varimax rotation was administrated, and factor loadings for each item were examined. The items with a loading less than 0.30, those loaded on more than one factor or those whose communality values decreased excessively were excluded (Klien, 1994; Büyüköztürk, 2007). At the end of the study, the factor analysis revealed five independent factor structures. The factor structures and loading of 19 items in TASSF are given in Table 1. At the end of the study, the factor analysis revealed five independent factor structures. The factor structures and loading of 19 items in TASSF are given Table 1.

As can be seen in Table 1, TASSF consisted of five factors. There were six items with items 7, 6, 20, 13, 15, 2 clustered as Factor 1; six items with items 26, 31, 46, 29, 42 clustered as Factor 2; four items with items 14, 12, 16 clustered as Factor 3; two items with items 39, 44 clustered as Factor 4; and three items with items 5, 11, 9 clustered as Factor 5. Then, these factors were labelled as Factor 1: Student Development; Factor 2: Educational Importance; Factor 3: Judgment; Factor 4: Negative Behaviour; and Factor 5: Mentorship.

Following the factor analysis, reliability analysis was conducted for each factor, and Cronbach alpha coefficients were used. Internal consistency coefficients for the 19 items of each subscale are 0.82, 0.84, 0.70, 0.76 and 0.66, respectively, and the explained variances were found to be 15.14, 14.09, 7.83, 7.35 and 6.93, respectively. Total variance of TASSF was 51.37, and the Cronbach alpha coefficient was calculated as 0.87. Correlation analysis revealed that all subscales and TASSF were highly related (Table 2) and ranged between 0.21 and 0.78.

Table 1. Factor structures and loading of the 19 items in TASSF.

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Item 7: Science fairs help build students' self-confidence and self-esteem.	0.820				
Item 6: Science fair projects prepared by students are quite important for their education.	0.678				
Item 20: Science fairs contribute to the development of students' scientific research skills.	0.647				
Item 13: Science fairs provide a friendly atmosphere for students.	0.628				
Item 15: Students feel like a scientist by using scientific research methods at science fair.	0.585				
Item 2: Projects do not contribute to students' learning*	0.458				
Item 26: Science fairs should be excluded from the school curriculum*		0.777			
Item 31: I don't think students would learn anything by taking part in a science fair. *		0.696			
Item 46: A science fair is just an unnecessary effort which is made to make students engaged with something and which does not contribute to their education.*		0.677			
Item 29: If I hadn't had to participate as a project mentor, I wouldn't have encouraged my students to take part in the project competitions. *		0.634			
Item 42: All those efforts that I made to participate in the science fairs were only for the advertisement of the school.*		0.592			
Item 14: Wrong and biased judgments of juries at science fairs leave negative effects on students' memory.			0.826		
Item 12: Juries in science fairs should be trained for the evaluation of projects.*			0.657		
Item 16: A project eliminated in one place yet selected for the final stage in another is a sign of inadequacy of judgment.*			0.505		
Item 39: Science fairs just teach students how to cheat instead of helping develop their scientific research skills. *				0.868	
Item 44: Science fairs cause students to cast out others and to develop negative behaviour because of addressing a specific group of students. *				0.715	
Item 5: I get bored to persuade students and parents for involving the science fair.*					0.671
Item 9: I don't like being a mentor at science fair.*					0.608
Item 11: Mentorship at science fairs take a lot of time.*					0.582

*negative statement.

Table 2. Correlation analysis of TASSF and subscales.

Variable	TASSF	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	0.622**				
Factor 2	0.775**	0.488**			
Factor 3	0.368**	-0.123	0.049		
Factor 4	0.217*	-0.108	-0.061	0.036	
Factor 5	0.553**	0.196**	0.308**	0.096	-0.112

** Correlation was significant at the level of 0.01 (2-tailed).* Correlation was significant at the level of 0.05 (2-tailed).

Conclusion

This study was carried out to develop a scale for teachers' attitude towards science fair. The findings obtained from the validity works revealed that this scale was valid. The fact that the internal consistency coefficient of the scale was found to be 0.77 shows that the scores to be taken from the scale were consistent with each other; therefore, the reliability of internal consistency is normal level (Klien, 1994; Büyüköztürk, 2007). The results of item-total statistics analysis demonstrated that the item-total correlations of the scale are ranged between 0.25 and 0.60. Based on the results of the study, it could be said that TASSF was a valid and reliable tool. This study was carried out to develop a scale for teachers' attitudes towards science fair. In the light of the findings, TASSF can be used in studies for measuring teachers' attitudes towards science fair. The 21-item opinionaire developed by Grote (1995) was a scale whose validity studies were not carried out. In addition, there is no scale of development study carried out with teachers in related literature. In this respect, the scale developed in the present study will bridge an important gap in studies regarding science fair.

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