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Development of an attitude scale towards integral

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Abstract

The aim of this study was to develop a Likert type scale to measure the attitudes of prospective mathematics teachers in elementary program towards integral. The study was done in education faculty of a university in the city center of Ankara, Turkey. Two hundred seventeen prospective mathematics teachers joined this study. After the analysis, the final form of the scale had a structure composed of three factors with 30 items. KMO value of this scale was 0.95, Bartlett test significance value was 4524.53 and Cronbach's Alpha value was 0.96. This value was well enough.

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1. Introduction

Louis Thurstone is a social psychologist who revived concept of measuring attitudes at first and generalized it. Thurstone scale has stayed as so until today. In 1928 Thurstone described attitude as "Attitude is sum of personal tendencies and feelings, prejudice and bias, thought, belief, fear and anxiety on any subject." But in 1931 he expressed it simply; "Attitude is to be affected or not to be affected by the psychological object." In 1946 he described it as "The intensity of positive or negative effect towards a psychological object." on his article which he prepared hoping that doing the most general definition. To state these definitions jointly; an attitude is, towards a psychological object;

- to be affected or not to be affected
- assessment
- like or dislike
- positiveness or negativeness

With the concept of attitude from past to present definitions have been made by many social scientist. Some of these are:

- According to Emory Bogardus (1931) "Tendency of showing behavior towards or against some environmental factors."
- According to Donald Campbell (1950) "Consistency of reaction towards social objects."
- According to Gordon Allport (1935) "State of mental or nervous readiness."
- According to Doob (1947) "Implicit and incentive reaction which is thought to be important in the society in which person lived."

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Although world-wide arguments have continued if attitude has cognitive, affective and behavioral dimensions or not, in general social scientists expressed that attitude has three components; cognitive, affective and behavioral. Cognitive component includes beliefs about attitude object. If there is a positive or a negative attitude towards an object, there will be positive or negative belief about that object too. Affective component includes direct explanation of emotion about attitude object. Behavioral component contains behavioral tendency or behavioral preference about the object (Mueller, 1986).

2. Method and Procedure

The aim of this study was to develop a Likert type scale to measure the attitudes of prospective mathematics teachers in elementary program towards integral issue. Two hundred seventeen students who were studying at 1st, 2nd, 3rd and 4th grade of a elementary mathematics education department at a public university in the city center of Ankara, TURKEY joined this study.

To develop Attitude Scale Towards Integral Issue, first of all a group of students (n=100) who were studying at elementary mathematics education program, were asked to write a composition which they expressed their views about integral issue. With examining compositions, reviewing mathematics education literature and benefiting from previous studies relevant items were written. As a result of all investigations, item pool of 70 items was composed. Thirty two of items were negative and thirty eight of items were positive. All of attitude items were prepared for attitude's cognitive, affective and behavioral dimensions (Mueller, 1986).

Items which were in item pool were presented for their views to 3 instructors who were expert in mathematics education, 4 research assistants who were PhD students at mathematics education, an instructor who was expert in Turkish education and a instructor who was expert in the field of measurement and evaluation. In accordance with expert feedback 29 items were removed from a scale and the scale became 41 item scale. Rating of this scale was done as follows: "Strongly Disagree: 1", "Disagree: 2", "Undecided: 3", "Agree: 4" and "Strongly Agree: 5". 41 item draft scale which items were listed randomly was applied to the working group which composed of 217 students.

Within the scope of the validity analysis of the scale, at first exploratory factor analysis and item analysis studies were conducted, confirmatory factor analysis was completed later. Exploratory factor analysis of study and item analysis studies were carried out with SPSS 15.0 package program, confirmatory factor analysis was carried out with the LISREL 8.7 software. Firstly, item-total score correlations of data which were obtained after application were examined and then factor analysis was performed. As a result of factor analysis, items which gave loading to multiple factors were removed from the scale. Cronbach's alpha was calculated on the basis of factors and as related to the whole scale in order to determine scale's internal consistency coefficients. At last stage of the validity and reliability studies, confirmatory factor analysis studies were performed. In this study exploratory factor analysis was used to test which groups of variables were associated with a higher level which factor. Confirmatory analysis was used to determine if groups of variables which contributed to factors were represented with these factors or not (Şimşek, 2007).

3. Findings and Interpretations

As a result of item-total correlation analysis which was applied in the study, 2nd, 33rd, 36th and 40th items were removed from scale because of being 0.40 and under 0.40 (Fraenkel & Wallen, 2006). Thus, the scale decreased from 41 items to 37 items. Later, as a result of factor analysis studies, respectively, 4th, 10th, 20th, 24th, 25th, 32nd and 37th items were removed from the scale because of giving the loading to multiple factors (Harrington, 2009). The scale became 30 items with the final state. The lowest total score of the scale could be 30, the highest total score could be 150. The average of scores which were obtained from this scale was determined as 99.96 and standard deviation was determined as 22.19. As a result of the correlation coefficients, it was found that all items in the scale had significant relationship with total score at the 0.05 level.

According to the results of factor analysis which was applied in the study, Kaiser Meyer Olkin (KMO) value was found as 0.946. Bartlett test significance value was found as 4524.525. Bartlett test value was significant at the 0.05 level. According to the result of factor analysis which was done with using varimax rotation to determine the basic components; there were 3 factors whose eigenvalues were greater than 1. Total variance explained by these three factors was 60.177%. The percentages of total variance explained by these factors after the rotation, respectively

were; 28.682, 19.396 and 12.099. In consideration of the initial eigenvalues, because of the first factor had very high eigenvalues (14.021) than eigenvalues of the second factor (2.203) and eigenvalues of the third factor (1.829) it could be interpreted that the scale as a whole generally has one factor (Harrington, 2009). After the rotation it was reached final structure with 3 factor. Relationships between the factors were as follows: correlation between the first factor and the second factor was 0.80, correlation between the second factor and the third factor was 0.56 and correlation between the first factor and the third factor was 0.53. Factor loadings related to Attitude Scale Towards Integral Issue were given in Table 1.

Table 1. Factor loadings related to Attitude Scale Towards Integral Issue

Items**	Factor Loadings		
	1st dimension	2nd dimension	3rd dimension
1. (Item 1) Integral is among my favorite topics.	0.682		
2. (Item 3) I know the integral issue.	0.544		
3. (Item 6) I have enough knowledge about the importance of the integral issue.	0.522		
4. (Item 8) It is fun to me to solve the integral questions.	0.732		
5. (Item 9) It gives me pleasure to learn the integral issue.	0.752		
6. (Item 13) I do homework of integral issue **without getting bored**.	0.641		
7. (Item 16) I like trying to understand the integral issue.	0.668		
8. (Item 17) I take pleasure solving integral questions.	0.747		
9. (Item 19) I believe that I will use integral in many places through all my life.	0.557		
10. (Item 21) I join discussions about integral issue with pleasure.	0.741		
11. (Item 22) It gives me excitement to generate ideas for the solution of integral questions.	0.674		
12. (Item 23) I feel comfortable when I solve the integral questions.	0.732		
13. (Item 27) I **can not** understand how time passes when I solve integral questions.	0.730		
14. (Item 28) I think that learning integral issue expands my reasoning and logic framework.	0.677		
15. (Item 31) Taking integral is as fun as playing the game for me.	0.707		
16. (Item 34) Taking complex integrals give me incredible pleasure.	0.713		
17. (Item 35) Integral issue is as important as the four operations for me.	0.569		
18. (Item 5)* Integral issue is a complex issue for me.		0.601	
19. (Item 7)* I hate the integral issue.		0.696	
20. (Item 15)* I am upset when I solve the integral questions.		0.609	
21. (Item 18)* Even I can not juggle with integral questions.		0.741	
22. (Item 26)* Integral issue is my frightening dream.		0.746	
23. (Item 30)* I have prejudice towards integral issue.		0.707	
24. (Item 38)* I **do not** trust myself at integral issue.		0.705	
25. (Item 39)* I get feared when integral is mentioned.		0.715	
26. (Item 11) *I think that learning integral issue **would not** contribute to my profession.			0.833
27. (Item 12) *I think that integral applications **are not** appropriate for my department which I studying at.			0.709
28. (Item 14) *I **do not** think that knowing the integral issue will make my professional life easier.			0.779
29. (Item 29) *Integral **does not** mean anything to me out of encountering in exams.			0.644
30. (Item 41) *Learning integral issue is required only for those who want to have an academic career at the university.			0.614

*Refers to the negative attitude sentence.
**Items were written in Turkish at the original form of the scale.

Initially, according to the after rotation results by taking into consideration factor loadings 11 items were removed from the draft scale which composed of 41 items. As a result 30 items whose loading factor were above 0.50 remained on the scale. Seventeen of items were positive (1, 3, 6, 8, 9, 13, 16, 17, 19, 21, 22, 23, 27, 28, 31, 34, 35) and thirteen of items were negative (5, 7, 11, 12, 14, 15, 18, 26, 29, 30, 38, 39, 41).

1st factor: Positive Emotion: First sub-dimension of the scale composed of 17 items (1, 3, 6, 8, 9, 13, 16, 17, 19, 21, 22, 23, 27, 28, 31, 34, 35). These items include positive feelings towards integral issue. First sub-dimension was named as “Positive emotion towards integral issue” by taking into account like these items; "Integral is among my favorite topics.", " It is fun to me to solve the integral questions." Factor loadings of items which were in the first sub-dimension were range from 0.752 to 0.522.

2nd factor: Negative Emotion: Second sub-dimension of the scale composed of 8 items (5, 7, 15, 18, 26, 30, 38, 39). These items include negative feelings towards integral issue. Second sub-dimension was named as “Negative

emotion towards integral issue" by taking into account like these items; "Integral issue is a complex issue for me.", "I hate the integral issue." and "I am upset when I solve the integral questions." Factor loadings of items which were in the second sub-dimension were range from 0.601 to 0.746.

3rd factor: Necessity: Third sub-dimension of the scale composed of 5 items (11, 12, 14, 29, 41). These items related with necessity of knowing or learning integral issue. Third sub-dimension was named as "Necessity of using integral issue" by taking into account like these items; "I think that learning integral issue **would not** contribute to my profession.", "Learning integral issue is required only for those who want to have an academic career at the university.", "I **do not** think that knowing the integral issue will make my professional life easier." Factor loadings of items which were in the third sub-dimension were range from 0.614 to 0.833.

After finalizing exploratory factor analysis and item analysis which were done on the Attitude Scale Towards Integral Issue it was started to reliability analysis studies. Internal consistency coefficients of Attitude Scale Towards Integral Issue were given in Table 2 and Table 3.

Table 2. Internal consistency coefficients regarding to whole of Attitude Scale Towards Integral Issue

	Cronbach's Alfa
Internal consistency coefficients	0.96

Cronbach's alpha internal consistency coefficients regarding to whole of Attitude Scale Towards Integral Issue was 0.96; Cronbach's alpha internal consistency coefficients of sub-dimensions were; for first sub-dimension 0.95, for second sub-dimension 0.90 and for third sub-dimension 0.83. According to these results, it can be said that Attitude Scale Towards Integral Issue is a reliable measurement tool (Tezbaşaran, 1996).

Table 3. Internal consistency coefficients regarding to sub-dimenson of Attitude Scale Towards Integral Issue

Internal consistency coefficients	**Cronbach's Alfa**
1st dimension (Positive)	0.95
2nd dimension (Negative)	0.90
3rd dimension (Necessity)	0.83

Confirmatory factor analysis was conducted in order to determine if groups of variables which contributed to factor at Attitude Scale Towards Integral Issue which composed of three dimension as a result of exploratory factor analysis was represented by these factors or not. Fit measures, good fit values, acceptable fit values (Schermelleh-Engel & Moosbrugger, 2003) and proposed models' fit values were given in Table 4.

Table 4. Fit measures, good fit values, acceptable fit values and Attitude Scale Towards Integral Issue's fit values

Fit measures	**Good fit values**	**Acceptable fit values**	**Attitude Scale Towards Integral Issue's fit values**
RMSEA	0.00<RMSEA<0.05	0.05<RMSEA<0.10	0.064
SRMR	0.00<SRMR<0.05	0.05<SRMR<0.10	0.056
GFI	0.85<GFI<1.00	0.90<GFI<0.95	0.81
AGFI	0.90<AGFI<1.00	0.85<AGFI<0.90	0.78
NFI	0.95<NFI<1.00	0.90<NFI<0.95	0.96
CFI	0.95<CFI<1.00	0.90<CFI<0.95	0.98
RFI	0.90<RFI<1.00	0.85<RFI<0.90	0.96

As a result of confirmatory factor analysis, IFI = 0.98, PGFI = 0.70 and PNFI = 0.89 were found. In addition NNFI = 0.98, RMR = 0.069 and RMSEA = 0.064 were found. If RMR and RMSEA values are less than 0.05, fit of the model is perfect and if they are range from 0.05 to 0.08, it shows that fit of model is acceptable (Schermelleh-Engel & Moosbrugger, 2003). These values were in the range of the reference where the fit of model was acceptable.

On the other hand SRMR = 0.056, CFI = 0.98, NFI = 0.96 and RFI = 0.96 were found. Results of analysis were perfect or near perfect fit values. GFI = 0.81, AGFI = 0.78 values were within acceptable limits. The other fit index

which was taken into consideration was a chi-square. Chi-square value was 794.50 and degree of freedom was 402. When these values were proportioned each other, it was seen that chi-square was 1.98. In large samples, if this ratio is under 3, it corresponds to perfect fit and if it is under 5, it corresponds to medium-level fit (Kline, 2005). In this context, it could be expressed that this ratio gave perfect fit value for analyze which was done.

4. Conclusions and Suggestions

In this study it was tried to develop valid and reliable Likert-type scale on the purpose of determining attitudes of prospective mathematics teacher in elementary program towards integral. As a result of analysis of the research data, 30 item three-dimensional attitude scale has emerged. Cronbach's alpha internal consistency coefficient of the scale was found as 0.96. According to this result, it can be said that the scale has a good reliability coefficient (Tezbaşaran, 1996).

Within the scope of confirmatory factor analysis of the research RMSEA = 0.064, SRMR = 0.056, GFI = 0.81, AGFI = 0.78, CFI = 0.98, NFI = 0.96, and RFI = 0.96 were determined. It is possible to say that the values are within the acceptable limits even if not results of the analysis have perfect fit values (Şimşek, 2007). In accordance with these results it can be said that items of scale are compatible with the three-factor structure.

Attitude Scale Towards Integral Issue can be used to determine attitude of students who study at elementary mathematics education department of university towards integral issue. In addition, according to the findings of the research Attitude Scale Towards Integral Issue which is valid and reliable can be used to determine that positive and negative attitude depends on what kind of variables.

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