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Computer, electrical and electronic engineering students' attitude towards cooperative learning

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Abstract

The aim of this study is to adapt the Cooperative Learning Attitude Scale into Turkish and determine engineering students' attitudes towards the cooperative learning. The study is based on the descriptive scanning model. The study group consists of 466 engineering students. The validity of the scale is confirmed through exploration factor analysis and item discriminative power methods. On these data descriptive statistics and t, Anova and Scheffe tests have been employed (p<0, 05). The findings show that the adapted scale is valid and reliable in determining the level of cooperative learning attitudes of the engineering students in Turkish cultural environment. Moreover, the level of the attitude towards the cooperative learning for engineering students is found to be high and does not show any meaningful difference across the gender and engineering disciplines. On the other hand, the level of the attitudes shows a meaningful difference across the grade levels in engineering education.

Keywords: Cooperative learning, attitude, engineering education, reliability, validity;

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1. Introduction

As in almost all societal spheres, the teaching methods are also exposed to dramatic changes due to the technological developments imposed in the recent decades. The conventional teaching methods are recently witnessed to experience a great change and as a consequence, new paradigms in teaching methods are aroused. As a social being, the education of human beings in a cooperative environment is seemed to be a natural approach and have been somehow in use for decades. However, due to new recent technological developments, "learning in group" is conceptualized as a new learning approach.

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In this process of the change, the new approach is called as the cooperative learning and in the knowledge based society; the new opportunities, rules and principles have recently been advised for the cooperative learning. In this context, the modern cooperative learning is considered as the most original instance of the “learning in group” (Korkmaz, 2012).

However, for a successful and effective employment of the cooperative learning, some requirements such as the positive inter-dependency, individual responsibilities and equal undertaking of individuals should be taken into consideration in the design of learning environment (Nam & Zellner, 2011; Yesilyurt, 2010; Veenman et al., 2002). There are plenty of studies which confirm that, if the design of learning environment adequately satisfies the essential requirements listed above, the cooperative learning contributes to academic achievement, improving the social developments, thinking abilities and self-confidence of the student; increasing learning and cognitive level, problem solving abilities and motivating student working in a group and developing positive attitudes towards courses and school, and motivate the students (Law, 2011; Nam & Zellner, 2011; Sharan, 2010; Yesilyurt, 2010; Kumaran, 2009; Yesilyurt, 2009; Hew Cheung, 2008; Johnson et al., 2007; Zhi & Liu, 2007; Wang et al., 2007; Jones & Issroff, 2005; Veenman et al., 2002). The cooperative learning is considered as being an effective and mostly preferred teaching methodology in all level of academic phases (Johnson et al., 2007). However, if the requirements in the design of the cooperative learning are not satisfied, it is not possible to expect the method to contribute the quality of learning at all. Nam and Zellner (2011) and Korkmaz and Yesil (2011) state that the students are reluctant in cooperating effectively into group works; which is a matter of rising concerns in the success of the cooperative learning. In such circumstances some students are compelled to take all the responsibilities, while the others are avoiding any engagement due to group works.

Korkmaz and Yesil (2011) reveal that the underlying cause behind the negative motivation and lack of enthusiasm towards the group works is to be the aforementioned-attitudes. Therefore, it can be suggested that the success of cooperative learning depends on the students’ attitudes towards the method. Consequently, determining the level of students’ attitude and taking into account the related problems in designing educational environment would be indispensable contribution to the success of the cooperative learning. As a result, based on the suggestion drawn above, adapting the scale developed by McLeish (2009), into Turkish cultural environment and determining the level of attitude of the engineering students towards cooperative learning is set to be main aim of this study. In this context, we are looking for the answers to the following questions:

1. Is Cooperative Learning Attitude Scale valid and reliable in Turkish culture?

2. How is the engineering students' attitude towards cooperative learning?

3. Does the students' attitude towards cooperative learning show any difference between universities and engineering disciplines?

4. Does the engineering students' attitude towards cooperative learning vary according to their genders?

5. Does the students' attitude towards cooperative learning show any variation based on their grades?

2. Method

2.1. Research model

The study was conducted as a descriptive study. It was carried out through scanning model. In this context, the aim is to describe the students' attitude towards cooperative learning, in engineering faculties of four different universities in Turkey.

2.2. Study group

The study group of the research consists of collectively 466 engineering students from four different universities. The students are within the faculty of engineering in their respective universities and they are from 1st to 4th year students either from the department of computer engineering or from the department of electrical & electronic engineering. The distribution of students with respect to their genders, universities, grades and departments is as summarized in Table 1.

Table 1. The Distribution of Study Group with respect to Gender, University, Grade and Department

Departments	Class	Gender	Bulent Ecevit Un.	Erciyes Un.	Karabuk Un	Nigde Un.	Total
Computer Eng.	1st	Male	0	20	39	0	**59**
		Female	26	3	16	0	**45**
	2nd	Male	12	10	15	0	**37**
		Female	0	4	0	0	**4**
	3rd	Male	3	6	0	0	**9**
		Female	0	5	1	0	**6**
	4th	Male	0	6	0	0	**6**
		Female	0	7	0	0	**7**
Electrical & Electronic Eng.	1st	Male	0	0	18	0	**18**
		Female	0	0	48	0	**48**
	2nd	Male	6	14	10	29	**59**
		Female	8	17	1	11	**37**
	3rd	Male	24	0	0	37	**61**
		Female	3	0	1	5	**9**
	4th	Male	14	0	0	34	**48**
		Female	5	0	1	7	**13**
Total			**101**	**92**	**150**	**123**	**466**

2.3. Measurement tool

The data have been collected using Cooperative Learning Attitude Scale (CLAS) designed by McLeish (2009). The instrument consists of eight items. The strength of the attitude is measured by responses on a 5-point Likert-type scale ranging from 1 (not confident at all) to 5 (absolutely confident). This is a one-dimensional scale.

In the process of scale adaptation, the translation step is the one of the most critical phases according to Hambleton and Patsula (1999). In this stage the original scale has been translated by an educational technologist and a computer engineer who are efficient in both Turkish and English languages. Subsequently, the adapted scale has been reviewed and amended by a language specialist. Final translation form has been retranslated into English by two experts as stated by Hambleton and Patsula (1999) as well and the consistency with the original item structures has been analyzed. In this analysis, it has been realized that the items in original scale and the ones in the Turkish form have

linguistic equivalence. Following the formation of the scale form accordingly, the scale has been applied on total 466 students, in order to evaluate the factor structure of the scale, the structure validity, and the reliability of the scale scores and the distinctiveness of items. Based on the data obtained from the application, factor structures for the Turkish form of the scale have been analyzed. Results obtained from the application of the draft scale on the study group, have been entered to SPSS 15.0 so as to conduct statistically scale validity and reliability analyses.

Furthermore, the factor structure of the scale has been analyzed via exploratory factor analysis. As part of the statistical analyses, KMO and Bartlett test analyses were carried out on the collected data. In the light of the results, the scale's allocation to factors was specified through principal component analysis and the factor loads were examined using the Varimax rotation method. As for the item distinctiveness effects, item total correlations have been calculated.

2.4. Validity and reliability of the scale

In order to test the structural validity of the CLAS, firstly Kaiser-Meyer-Oklin (KMO) and Bartlett tests were applied to the data and the results were found to be KMO= 0.893 and $\chi 2$= 1740.401; df=28 (p=0,000) for the Bartlett test, respectively. Based on these values, a factor analysis could be conducted on the 8-item scale. Then the Varimax rotation method was used based on the principal components. In line with this, the items with less than 0.30 item load were removed from the scale and the factor analysis was applied to the remaining items again. After these repetitive processes, it was seen that the remaining 7 items in the scale were gathered as a single factor. It was found that the KMO value of the final 7-item scale was 0.897 and the Bartlett values were $\chi 2$=1687.625; df=21; (p<0.000). The findings from the process are listed in Table 2 which shows the item load, the Eigen value and variance explaining the percentages of one dimension for the remaining 7 items.

Table 2: Factor analysis results of the scale

Items		**Common factor variances**	**Factor Loads**
I1	When I work together I achieve more than I work alone.	,395	,629
I2	I willingly participate in cooperative learning activities	,677	,823
I3	Cooperative learning can improve my attitude towards work.	,716	,846
I4	Cooperative learning helps me to socialize more.	,675	,822
I5	Cooperative learning enhances good working relationships among students.	,710	,843
I6	Cooperative learning enhances class participation.	,571	,756
I7	Creativity is facilitated in the group setting.	,470	,686
Eigenvalue			**4,215**
Explained variance			**60,217**

As seen in Table 2, the eigenvalue of the factor within the general scale is 4,215 and its contribution to the general variance is 60.217. The correlations between the scores obtained from each of the items and the total scores were calculated and each item's level of serving the general purpose was tested. The item-factor correlation values and corrected correlation values for each item are presented in Table 3.

Table 3. Item-factor scores correlation analysis

Items	R	Items	r
I1	,671	I5	,823
I2	,821	I6	,747
I3	,840	I7	,698
I4	,804	**N=466; **P<,001**	

As seen in Table 3, the item test correlation coefficients vary between 0.671 and 0.840. Each item is in a significant and positive relationship with the general factor p<0,000). In this regard, it can be said that each item contributes to the general purpose of the scale. The discrimination power of the items in the scale was also calculated. For this reason, firstly, the raw scores obtained from each item ranged from highest to lowest and then, the lowest and highest groups, which formed the lowest 27% and the highest 27%, and both of these which included 127 students were determined. The t test values of the independent groups were calculated with the total scores in the group. The findings regarding the t test values and significance level of the discrimination powers are presented in Table 4.

Table 4. Item Discrimination Powers

Items	t	Items	t
I1	15,894	I5	20,397
I2	23,451	I6	19,107
I3	22,301	I7	17,211
I4	20,474	Total	35,263
df: 252; p<.001; N=466			

In Table 4, it can be seen from the independent sample t test values regarding the 7 items that the total score in the scale vary between 15.894 and 23.451. The t value for the general scale was found to be 35.263. The level of each difference determined is significant (p<0,001). In this regard, it can be said that the general scale has high item discrimination power. The scale's whole reliability analyses were conducted using Cronbach's alpha reliability coefficient and it was found to be 0.883. In this regard, it can be said that the general scale can make consistent measurements.

2.5. Data Analysis

The score obtainable from the scale is in the range of the minimum of 7 and the maximum of 35 points. Accordingly, the levels that are the equivalents of scores obtained from sub scales can be given as: 7-16: Low Level; 17-26: Medium Level; 27-35: High Level. On these data in order to detect attitudes of students; some statistics such as the frequency, percentage, arithmetical means, and standard deviation have been computed and t, Anova and Scheffe tests have been employed. In differentiation analyses p<0,05 significance level has been considered to be sufficient.

3. Results

The findings on the engineering students' attitudes towards cooperative learning are summarized in Table 5.

Table 5. Engineering Students' Attitudes towards Cooperative Learning

Variables	N	M	sd	Min	Max	Levels (f/%)					
						Low		Medium		High	
Computer Eng.	173	26,53	6,00	7	35	14	8,1	54	31,2	173	60,7
Electrical & Electronic Eng.	296	26,06	5,89	7	35	22	7,4	115	38,9	159	53,7
Total	**469**	**26,23**	**5,93**	**7**	**35**	**36**	**7,7**	**169**	**36,0**	**264**	**56,3**

As shown in Table 5, students' attitudes towards cooperative learning mean is M=26,23. As data on the attitude levels are examined, it is detected that more than half of the students (56.3%) have high, 36.0% have medium and only 7.7% have low level attitude. Accordingly, it can be argued that students' attitudes towards cooperative learning are high. In Table 6, the findings relevant of students' attitudes towards cooperative learning with respect to departments are summarized.

Table 6. The Effect of Departments on Attitude Levels

Variables		N	M	SD	t	df	p
Attitudes	Computer Eng.	173	26.53	6.00	.829	467	.407
	Electrical & Electronic Eng.	296	26.06	5.90			

As given in Table 6, there is not a meaningful difference in students' attitudes with respect to department ($t_{(2-467)}$ =.829; p>0,005). Therefore it can reasonably be argued that department has no effect on students' attitudes. In Table 7, the engineering students' attitudes with respect to gender are summarized.

Table 7. The Effect of Gender on Students' Attitudes

Variables		N	M	SD	t	df	p
Attitude	Female	158	26.94	5.80	1,848	467	,065
	Male	311	25.87	5.97			

As given in Table 7, there is not a meaningful difference in students' attitudes with respect to gender ($t_{(2-467)}$ =-1,848; p>0,05). Therefore, it can reasonably be argued that gender has no effect on engineering students' attitudes. Table 8 summarizes the findings concerning the relation between students' attitudes and the grades they attend to.

Table 8. Engineering students' attitudes based on their grades

Grades	N	M	Ss
1. Grades	144	25,77	6,33
2. Grades	163	26,00	5,36
3. Grades	88	26,22	6,40
4. Grades	74	27,44	5,66
Total	469	26,23	5,93

From Table 8 it is observed that the engineering students' highest level of attitudes was in the 4th Grade (M=27,44), and the lowest level was in the 1st Grade (M=25,77). A variance analysis is conducted in order to determine whether this difference is significant or not and the results are summarized in Table 9.

Table 9. Effect of the grades on the attitudes of engineering students

Source of Variance		Sum of Squares	df	Mean Square	F	P	LSD
Grades	Between Groups	144,430	3	48,143	1,371	,049	4th - 1st
	Within Groups	16333,770	465	35,126			
	Total	16478,200	468				

Table 9 shows that the students attitudes from different grades differentiates in a statistically significant way [$F_{(3\text{-}465)}$ =1,371; p<0,05]. According to the results of the LSD test, which was conducted in order to determine between which grades the difference occurs, it is determined that the difference occurs between 4th grades and 1st grades. According to this, it is possible to assert that the attitudes of engineering students attending to the 4th grades are significantly higher than the 1st grade students.

4. Conclusion and Discussion

In the present study, "Cooperative Learning Attitude Scale (CLAS)" has been adapted into Turkish. This consists of 7 items that can be collected as one dimension. The strength of attitudes is measured by responses on a 5-point Likert-type scale. According to all the validity and reliability analyses, it can reasonably be argued that "Cooperative Learning Attitude Scale (CLAS)" is a valid and reliable scale that can be employed in detecting computer and electrical-electronics engineering students' attitudes towards cooperative learning in Turkey.

The attitude level of the computer and electrical-electronics engineering are found to be high. The main reason behind this finding is believed to be the positive attitude acquired by the students in cooperative working environment which is usually common in engineering faculties. As it is indicated in a study by Dewiyanti et al., (2007), the positive experiences of the students towards cooperative learning increase the level of content of the student for the cooperative learning. On the other hand, the attitude of the 4th year students towards cooperative learning is found to be meaningfully different compared to the attitude of the 1st year students. This result indicates the validity of idea that the engineering education improves the attitude of the students towards cooperative learning. Furthermore, there are plenty of studies in the literature which state that the individuals are inclined to have a positive and high attitude towards cooperative learning (Fang, 2012; Perez Urrestarazu et al., 2011; Lukosch, 2007; Maushak & Ou, 2007; Kollias et al., 2005; Wang & Reeves, 2001). This could be an indication that the cooperative learning improves academic success greatly in the individual or group working environment (Nam & Zellner, 2011; Yesilyurt, 2010; Veenman et al., 2002)

On the other hand, it is also possible, in the literature, to encounter studies which show that the attitude level of individuals and their self-efficacy are not high enough and adequate (Ruys et al., 2010). This could be a result of unfavorable experience of the individuals who expose to the not-well-designed cooperative learning environments with full of design errors. Therefore it is crucially important to design the cooperative learning environment to have well-balanced number of groups, a

fair job-sharing within a group and a control mechanism in order to ensure meeting of individual responsibilities. Also results show that the gender factor and the department of the students do not have significant effect in determining students' attitudes and in literature, there are studies that confirm these findings. For instance, So and Brush (2007), Kitchen and McDougall (1998) and Yaverbaum and Ocker (1998) indicated that the students' age, gender, the grade level do not have effect on the attitude of the students towards cooperative learning.

Based on the findings of this study related to the attitudes of the students towards the cooperative learning in the department of electrical & electronic engineering and computer engineering, it is believed that the project based laboratory session should be incorporated as much as possible in the cooperative learning framework. By doing this, it is possible to contribute further to already positive attitude of the students and, hence, to improve their academic success.

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