

## The Relationship Between Faculty Of Education Students' Argumentation Skills And Critical Thinking, Creative Thinking And Problem Solving Skills

**Abdulkerim KARADENİZ**

*Department of Turkish Education  
Ahi Evran University, Turkey  
akaradeniz@ahievran.edu.tr*

### ABSTRACT

This study aims to investigate the relationship between faculty of education students' argumentation skills and critical thinking, creative thinking and problem solving skills. First of all, the correlation value between the argumentation skill and other variables was determined in the study. Then, to what degree critical thinking, creative thinking and problem solving skills predicted the argumentation skill was examined. The findings of the study were obtained using the Critical Thinking Skill Scale, the Creative Thinking Skill Scale and the Problem Solving Skill Scale developed by the researcher. In order to determine argumentation skills of students, they were asked to write an essay and the essays were evaluated according to Toulmin's argument model. Study results showed a high-level correlation between students' argumentation skills and other variables. Also, another result of the study was that critical thinking, creative thinking and problem solving skills explained 74,1% of students' argumentation skill.

**Keywords:** Argumentation, critical thinking, creative thinking, problem solving.

### INTRODUCTION

The literature contains experimental studies investigating the effect of the argumentation-based science learning method on students' basic skills such as critical thinking, problem solving, creative thinking and decision making (Arlı, 2014; Demir, 2014; Demirbağ and Günel, 2014; Kardaş, 2013; Mcghee, 2015; Şahin, 2016; Tonus, 2012). The common result of these studies is that the argumentation-based science learning method has a positive effect on students' basic skills. In addition to these studies, there are also those revealing positive and high-level correlations between students' basic skills and argumentation skills (Demiral, 2014; Torun, 2015). We believe that the present study will contribute to the literature by revealing the relationship between university students' argumentation skills and critical thinking, creative thinking and problem solving skills. Also, this is the first study aiming to reveal to what degree critical thinking, creative thinking and problem solving skills predict the argumentation skill.

The Turkish Language and Literature Curriculum (2005) emphasizes the importance of developing critical thinking, problem solving and creative thinking skills and aims to develop these skills in students through text analysis. Today, the goal is to raise individuals who can investigate, question, reach information independently and identify whether information reached is reliable or not. It is necessary to develop verbal and written expression skills of students to achieve this goal. Interpretation, comparison and evaluation skills of students may be improved with literature education. The argumentation skill stands out as a skill seen in students with higher-order thinking skills. This study attempts to reveal the relationship between students' higher-order thinking skill and argumentation skills.

Driver, Newton and Osborne (2000) define argumentation as the thinking and writing activity performed individually or in groups. In 1958, Toulmin developed an argument model utilized by educators and especially science educator in order to determine factors and complexity of arguments between students (Kardaş, 2013). Toulmin's (2003) argument model consists mainly of the following components: claims, a qualifier, data, warrants, rebuttals and backing.

Argumentation scaffolding is a form of learner support designed to help bridge the gap between the students' current and desired ability to create evidence-based arguments (Mcghee, 2015). Argumentation allows students to understand that they can and should have an opinion, a claim, and they should back it up with evidence if they want to be truly understood and respected (Olsen, 2013).

The argumentation skill may be defined as a process in which students use reasoning in relation to a certain subject and associate their impressions by reasoning them out. In this process, students make use of their critical thinking, creative thinking and problem solving skills. Therefore, it is possible to think that argumentation skills of students are closely related to these skills defined as higher-order thinking skills.

Discussion and writing activities performed individually or in groups may be used in order to improve argumentation skills of students. To teach these skills to students is important, because argument and critique are at the very center of science—connecting the “hands-on” work of scientific inquiry with the “minds-on” work of developing scientific ideas and theories (Osborne et al., 2016). Argument and critique are skills that may be developed with Turkish and literature courses. It can be said based on previous studies that especially text analysis may be used as a tool to teach students these skills as well as higher-order thinking skills (Karadeniz, 2012; Karadeniz and Gürsoy, 2014).

### **Objective of the Study**

This study aims to investigate whether there is a relationship between argumentation skills and critical thinking, creative thinking and problem solving skills of students attending the faculty of education. Based on this aim, the study seeks to answer the following questions:

1. Is there a relationship between argumentation skills and critical thinking, creative thinking and problem solving skills of students?
2. To what degree do critical thinking, creative thinking and problem solving skills of students explain their argumentation skills?

## **METHODOLOGY**

### **Research Model**

This study, aiming to investigate the relationship between faculty of education students' argumentation skills and critical thinking, creative thinking and problem solving skills, was designed as a mixed method research. The document analysis technique, which is a qualitative data collection technique, was used in order to examine essays written by students in order to determine their argumentation skills. In order to reveal the relationship between students' argumentation skills and critical thinking, creative thinking and problem solving skills, the relational screening model, which is a qualitative research method, was used. Relational screening models are research models which aim to identify the presence or the degree of covariance between two or more variables (Karasar, 2005: 81).

### **Working Group**

The study was performed with 64 prospective teachers selected through impartial assignment among 2200 prospective teachers attending the Faculty of Education, Ahi Evran University in 2015-2016 academic year. The study included 17 students from Turkish Teaching Program, 15 students from Social Sciences Teaching Program, 16 students from Science Teaching Program and 16 students from Primary School Teaching Program. Also, 28 students in the working group were male and 36 were female.

### **Data Collection Tools**

The data required for the study were collected using “Toulmin’s Argument Model”, “Critical Thinking Skill Scale”, “Creative Thinking Skill Scale” and “Problem Solving Skill Scale”. Measurement tools were tested for validity and reliability and following results were found:

The “Critical Thinking Skills Scale” developed by Karadeniz (2012) was applied to 453 out-of-sample university students to determine its compliance with the model. Model compliance values were tested by the researcher using confirmatory factor. Following results were obtained:  $\chi^2/df= 2,24$ ; RMSEA= 0,073; SRMR= 0,062; GFI= 0,90; AGFI= 0,90; CFI= 0,95; IFI= 0,95 and NNFI= 0,97. Also, the internal consistency of the scale was tested with Cronbach’s Alpha coefficient, which was found to be  $\alpha=,906$ .

The “Creative Thinking Skills Scale” developed by Karadeniz (2012) was applied to 453 out-of-sample university students to determine its compliance with the model. Model compliance values were tested by the researcher using confirmatory factor. Following results were obtained:  $\chi^2/df= 2,23$ ; RMSEA= 0,070; SRMR= 0,066; GFI= 0,90; AGFI= 0,87; CFI= 0,97; IFI= 0,94 and NNFI= 0,95. Also, the internal consistency of the scale was tested with Cronbach’s Alpha coefficient, which was found to be  $\alpha=,893$ .

The “Problem Solving Skills Scale” developed by Karadeniz (2012) was applied to 453 out-of-sample university students to determine its compliance with the model. Model compliance values were tested by the researcher using confirmatory factor. Following results were obtained:  $\chi^2/df= 2,31$ ; RMSEA= 0,067; SRMR= 0,065; GFI= 0,92; AGFI= 0,90; CFI= 0,96; IFI= 0,94 and NNFI= 0,96. Also, the internal consistency of the scale was tested with Cronbach's Alpha coefficient, which was found to be  $\alpha=.898$ .

Considering the results given above in relation to confirmatory factor analysis applied to scales, it is seen that compliance values are within acceptable levels (Jöreskog and Sörbom, 1993: 123; Raykov and Marcoulides, 2006: 43). In addition, results related to Cronbach's Alpha coefficient can be said to be good (Field, 2005: 668).

In order to measure their argumentation skills, students were asked to write an essay about problems faced by the Turkish language today and what can be done to solve these problems and essays written by students were evaluated according to Toulmin's argument model (2003). Essays were scored from 1 to 5 according to components of Toulmin's (2003) argument model. Accordingly; essays containing a simple claim against a claim were scored 1, essays containing data, grounds and counter-claims were scored 2, essays containing data, grounds and weak rebuttals were scored 3, essays containing clearly expressed rebuttals were scored 4 and essays containing multiple rebuttals were scored 5.

### Data Analysis

In order to determine the statistical method used in the study, it was first examined whether the data showed normal distribution. In order to test the suitability of data to normal distribution, the Kolmogorov-Smirnov normal distribution test was performed, since the sample size was larger than 50 (Wright, 2006, 94). It was found as a result of the normal distribution test that the significance level was higher than 0,05 and it was decided based on kurtosis and skewness coefficients and histogram chart that the data showed normal distribution. Pearson Moment Correlation Coefficient (r) was calculated to determine relationships between faculty of education students' argumentation skills and variables. Multiple linear regression analysis was performed for prediction of students' argumentation skills. Standardized Beta ( $\beta$ ) coefficient and t-test results related to significance of this coefficient were taken into account when interpreting the regression analysis.

### FINDINGS

This section discusses the findings based on the data collected in accordance with sub-problems of the study. Table 1 shows mean and standard deviation values related to variables of the study and relationships between dependent and independent variables.

**Table 1:** Mean and Standard Deviation Values and Relationships Between Variables

Variables	$\bar{X}$	SD	1	2	3	4
<b>1. Argumentation</b>	3,72	,477	–	,756**	,584**	,832**
<b>2. Critical Thinking</b>	3,70	,439			,652**	,728**
<b>3. Creative Thinking</b>	3,99	,428				,577**
<b>4. Problem Solving</b>	3,74	,634				

\*. Correlation is significant at the level of 0,05. n=64

\*\*.. Correlation is significant at the level of 0,01.

Table 1 shows that argumentation skills of prospective teachers participated in the study were ( $r =3,72$ ). Correlation coefficients between variables reveal that the argumentation skill, the independent variable of the study, had a positive and significant relationship with all of the dependent variables. The relationship of the argumentation skill was at the level of ( $r=.756$ ,  $p<.01$ ) with the critical thinking skill, at the level of ( $r=.584$ ,  $p<.01$ ) with the creative thinking skill and at the level of ( $r=.832$ ,  $p<.01$ ) with the problem solving skill.

Table 2 shows the results of the stepwise regression analysis related to prediction of the argumentation skill by other variables.

**Table 2:** Results of Multiple Regression Analysis Related to Prediction of Argumentation Skill Scores

Predictor Variables	R	AR <sup>2</sup>	Std. Error	R <sup>2</sup> Change	F Change	F Regression	Beta	t	p
<b>Critical Thinking</b>	,756	,571	,312	,572	675,633	675,633	,295	8,130	,000
<b>Creative Thinking</b>	,766	,584	,308	,014	17,340	357,396	,052	1,721	,086
<b>Problem Solving</b>	,861	,741	,243	,156	305,191	483,514	,587	17,470	,000

Table 2 shows that there were significant relationships between the argumentation skill and critical thinking, creative thinking and problem solving skills. These predictor variables explain 74,1% of the total variance in

students' argumentation skills. Critical thinking explains 57,2%, creative thinking explains 1,4% and problem solving explains 15,6% of the argumentation skill.

## DISCUSSION AND CONCLUSION

The present study examines the relationship between university students' argumentation skills and various variables.

The Pearson correlation analysis performed in order to investigate whether there was a significant relationship between argumentation skills and critical thinking, creative thinking and problem solving skills of students showed a positive and significant relationship between the argumentation skill and other variables. Accordingly, the relationship of the argumentation skill was at the level of ( $r=,756$ ,  $p<,01$ ) with the critical thinking skill, at the level of ( $r=,584$ ,  $p<,01$ ) with the creative thinking skill and at the level of ( $r=,832$ ,  $p<,01$ ) with the problem solving skill. Based on this finding, it can be said that an increase in argumentation skill scores of students will result in an increase in their critical thinking, creative thinking and problem solving scores as well.

In her study, Kardaş (2013) concluded that argumentation-based learning had no effect on the problem solving skill, whereas Demir (2014) concluded that the argumentation-based science learning approach positively affected creative thinking skills of students.

A multiple linear regression analysis was performed in order to determine to what degree critical thinking, creative thinking and problem solving skills predicted the argumentation skill. As a result of the analysis, it was found that there was a high-level and significant relationship between the argumentation skill and dependent variables. Accordingly; critical thinking, creative thinking and problem solving skills explain 74,1% of the total variance in the argumentation skill. Critical thinking explains 57,2%, creative thinking explains 1,4% and problem solving explains 15,6% of the argumentation skill. It can be said based on the standardized ( $\beta$ ) coefficient and the t value that critical thinking, creative thinking and problem solving are significant predictors of the argumentation skill with relative significance levels.

## REFERENCES

- Arlı, E. E. (2014). *The impacts of argumentation based science inquiry approach on seasonal agricultural worker students' academic achievement and thinking skills*. Unpublished master dissertation. Atatürk University, Erzurum.
- Demir, B. K. (2014). *The effect of the argumentation based science learning approach on students' mathematical achievement and skills of creative thinking*. Unpublished doctoral dissertation. Atatürk Üniversitesi, Erzurum.
- Demiral, Ü. (2014). *Investigating argumentation skills of pre-service science teachers in a socio-scientific issue in terms of critical thinking and knowledge level: GM foods case*. Unpublished doctoral dissertation. Karadeniz Technical University, Trabzon.
- Demirbağ, M. & Günel, M. (2014). Integrating argument-based science inquiry with modal representations: Impact on science achievement, argumentation, and writing skills. *Kuram ve Uygulamada Eğitim Bilimleri*, 14(1), 373-392.
- Driver, R., Newton, P. & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, 84(3), 287-312.
- Field, A. (2005). *Discovering statistics using SPSS*. London: Sage Publications.
- Jöreskog K & Sörbom D. (1993). *Lisrel 8: Structural equation modeling with the simplis command language*. USA: Scientific Software International.
- Karadeniz, A. (2012). *The effects of modern analysis methods in poetry analysis skills and availability of the methods in teaching poetry*. Unpublished doctoral dissertation. Gazi University, Ankara.
- Karadeniz, A. & Gürsoy, Ü. (2014). The effects of modern analysis methods in poetry students' critical thinking, creative thinking and problem solving skills. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD)*, 15(2), 99-117
- Karasar, N. (2005). *Research method*. Ankara: Nobel Yayın Dağıtım.
- Kardaş, N. (2013). *The impact of argumentation focused teaching in science education on the decision making and problem solving skills of students*. Unpublished master dissertation. Eskişehir Osmangazi Üniversitesi, Eskişehir.
- Mcghee, M. (2015). *The effects of argumentation scaffolding in a problem-based learning course on problem-solving outcomes and learner motivation*. Unpublished doctoral dissertation. The Florida State University, Florida.
- MEB. (2005). *Orta Öğretim Türk Edebiyatı Dersi 9, 10, 11, 12. Sınıflar Öğretim Programı*. Ankara: Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı.

- Olsen, (2013). *A longitudinal examination of interactional, social, and relational processes within the teaching and learning of argumentation and argumentative writing*. Unpublished doctoral dissertation. The Ohio State University, Ohio.
- Osborne, J. F., Henderson, J. B., MacPherson, A., Szu, E., Wild, A. & Yao, S. (2016). The development and validation of a learning progression for argumentation in science. *Journal Of Research In Science Teaching*, 53(6), 821-846.
- Raykov, T. and Marcoulides, G. A. (2006). *A First course in structural equation modeling*. New Jersey: Lawrence Erlbaum Associates, Inc., Publishers.
- Şahin, E. (2016). *The effect of argumentation based science learning approach (ABSL) on academic success, metacognition and critical thinking skills of gifted students*. Unpublished doctoral dissertation. Gazi University, Ankara.
- Tonus, F. (2012). *Effect of the argumentation-based teaching to critical thinking and decision making skills on primary students*. Unpublished master dissertation. Hacettepe University, Ankara.
- Torun, F. (2015). *The relationship level between argumentation - based teaching and decision - making skills in social studies course*. Unpublished doctoral dissertation. Gazi University, Ankara.
- Toulmin, S. (2003). *The Uses of Argument (Updated Edition)*. Cambridge, England: Cambridge University Press.
- Wright, D. B. (2006). *Discovering statistics using SPSS*. London: SAGE Publication.

This study was supported by Ahi Evran University Scientific Research Projects (SRP) with the project number: EGT.A3.16.018

This study was presented in INTE 2016-International Conference on New Horizons in Education between 13 and 15 July 2016 as an oral declaration.