

## EXPLORING THE RELATIONSHIP BETWEEN PURPOSE OF COMPUTER USAGE AND READING SKILLS OF TURKISH STUDENTS: EVIDENCE FROM PISA 2006

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### ABSTRACT

Organization for Economic Co-Operation and Development (OECD) has conducted a series of educational assessments in many OECD and non-OECD countries to support their sustainable economic growth since 2000. These assessments are named Program for International Student Achievement (PISA); they focus on the capabilities of 15-year olds in three main subjects: mathematics, science, and reading. PISA also measures students' interests and tendencies toward information and communication Technologies. This study investigates the relationship between Turkish students' reading scores and their use of computers for educational and entertainment purposes across males and females, by using the data from PISA 2006. In order to examine the relationship between these variables, Structural Equation Modeling (SEM) is used in the study. Results of this study indicate that while the use of computers for entertainment purposes affects students' reading scores positively, the use of computers for educational purposes affects their reading scores negatively. Also, according to our results, there is not a statistically significant difference between male and female students in this relationship.

**Keywords:** Computer use, PISA-2006, Reading, Structural Equation Modeling (SEM).

### INTRODUCTION

It is a well known fact that education plays a unique role in individuals' well-being and the development of societies. Well-educated people may possess sufficient knowledge about the world and usually are capable of planning for their futures and making the right decisions. At this point, it can be safely argued that having well-educated young individuals greatly influences the future of a nation since they can actively contribute to innovation in business and industry (Roberts, 1995). In accordance with this argument, the Organization for Economic Co-Operation and Development (OECD) has conducted a series of educational assessments in many OECD and non-OECD countries to support their sustainable economic growth since 2000. These assessments are named Program for International Student Achievement (PISA); they focus on the capabilities of 15-year olds in three main subjects: mathematics, science, and reading. This age group is selected because 15-year olds generally come to the end of their compulsory education in most OECD countries and should have acquired a certain amount of knowledge, skills, and attitudes (OECD, 2006).

PISA was performed first in 2000 and has been repeated every three years. Four assessments have been implemented thus far (in 2000, 2003, 2006, and 2009). In all these cycles, the number of countries participating in the assessment is different: 43 countries in 2000, 41 countries in 2003, 57 countries in 2006, and 65 countries in 2009. PISA assessments provide information about students' real-life knowledge and their preparedness for higher education levels and future adult participation in society. In other words, in addition to students' knowledge of the school curriculum, PISA addresses essential skills required in adult life. PISA also measures students' interests and tendencies toward Information and Communication Technologies (ICT), math, and science. Furthermore, PISA contains a great deal of data about characteristics of students, families, and schools. Hence, it allows researchers to investigate the relationship between different variables and students' achievement, and it makes possible comparing students' performances across a large number of countries.

Since its first implementation, a great number of studies have been conducted to analyze and interpret PISA results across many participating countries. Several studies which investigated Turkey's performance on these assessments have occurred as well. However, to our knowledge, all of these existing studies (Aypay, 2010; Ziya, Dogan, and Kelecioğlu, 2010; Demir, Kilic, and Unal; 2010; Alacaci and Erbas, 2010; Anil, 2009; Unal and Demir, 2009; Altun, 2007; Ciftci, 2006; Duman, 2006; Yilmaz, 2006) focused on either the math or science performance of Turkish students. It is very interesting to see that none of the previous studies investigated the reading performance of Turkish students, although having good reading ability is known to be one of the most important and essential skills in life after formal school, including finding a good job. In addition, Turkish students' performances in reading were lower than all OECD countries, except Mexico, in both PISA 2003 and

PISA 2006. Hence, it can be claimed that there is an important gap in the literature in terms of analyzing Turkish students' reading performance in PISA and investigating the factors which may affect students' performance in reading.

Students' computer and internet use is also one of the important areas about which PISA contains information. It is not hard to imagine that using a computer has become an essential part of our daily life in the 21<sup>st</sup> century. People do a variety of their daily activities, including working, studying, communicating, and entertaining, by using computers. In addition, basic computer skills such as writing documents using in word processors, calculating formulas in excel sheet, and using communication tools, etc., should be known in order to find an occupation in most job markets. It is undeniable that both being able to use computers for different purposes and having effective reading skills are among the most important characteristics of well-educated people in today's world. Thus, it is very important for Turkey to investigate the relationship between students' computer usage and their reading skills in order to take the necessary steps toward improving students' achievement. At this point, PISA plays a key role because it indicates the students' reading skills and provides significant information about their accessibility to and use of computers. To this end, this study addresses how using computers for different purposes may affect students' reading scores across females and males in Turkey, by examining these variables from PISA's 2006 results.

### LITERATURE REVIEW

Turkey has been implementing many reforms in its educational system recently in order to raise the quality of education and reduce inequalities between different sectors of society in terms of access to education (Aksit, 2007). These reforms started with extending the duration of compulsory education from five years to eight years in 1997. Then, in 2003 Turkey participated in PISA to assess the level of Turkish students' knowledge, figure out the place of their level, and determine the factors of students' achievement in the global world. At the same time, an important attempt was initiated with the aim of changing a long held curriculum which could not respond to students' needs anymore. This involved experts from OECD visiting Turkey in order to start the process of integrating contemporary technical and vocational standards into the curriculum, and to develop a high-quality curriculum which can meet the nation's needs. An important part of this process was to integrate Information and Communication Technology (ICT) into every school, and to secure fast internet connections to them, because this age is called the era of Information Technology (IT) (Ministry of National Education, 2005).

In this new era of IT, computers have become one of the essential parts of education. In recent years, computers and other ICT devices have been introduced into schools and teachers have been expected to use these devices in their instructions across the world (Ham & Cha, 2009). In accordance with this trend, almost all schools in Turkey have been equipped with computer technology. Even though it is hard to claim that all teachers effectively use technology as an instructional tool in practice, it is safe to note here that many activities have started to be implemented with computers and other ICT devices in Turkish schools and classrooms. In addition, many students either have their own computers and internet access at home or use internet cafes, which are very common in Turkey. As a result, most students in Turkey can use computers and the internet at various levels, and at least know basic computer components.

There is considerable amount of studies which show the benefits of the internet as a teaching and learning tool (Luan, Fung, Nawawi, & Hong, 2005). The internet helps students to learn in many different ways. It allows students to find information on a variety of topics, read news from all around the world, and communicate and share information with their friends. In general, the internet has made the earth a global village, and it saves a great amount of time. Furthermore, nowadays most students are motivated to use computers and the internet instead of reading books and listening to traditional lectures. Thus, using these tools in education can also motivate students and get their attention. Without a doubt, there are also some unplanned consequences of increased internet and computer use (Sharma & Maleyeff, 2003). For instance, students may spend most of their time on the internet and neglect their homework and other responsibilities. At this point, some parents and educators view the usage of computer and internet as a waste of time for students. However, using the internet and computers may also unintentionally support students' learning process because students do a variety of activities, such as reading, watching, writing, and thinking even if they are just using computers for entertainment purposes.

Although using ICT for either entertainment or learning purposes is an inevitable fact in today's world, it is also a necessity for young people to effectively read, write, and communicate with others in order to be successful in their adult life. At this point, reading is known as an important tool for developing an individual's mind and imagination. In addition, having effective reading skills and habits can be a key factor for students to develop their writing and communication skills. Thus, assessing students' reading skills and investigating factors which

are related to these skills are very important steps for improving the reading ability and habits of coming generations. Because of many different reasons stated earlier in this paper, asking about the relationship between students' purposes of computer use and their reading skills is a legitimate question. In addition, many previous studies have indicated gender as an important predictor of students' reading achievement and use of computers. Hence, gender differences should be also taken into the account when investigating the relationship between computer use and reading skills. A significant number of studies about gender differences in reading and using computers have been conducted thus far. Many of these studies show that gender is a significant factor associated with students' reading performance, for example, girls get significantly higher scores than boys in standardized tests (Chiu & McBride-Chang, 2006). This difference between females and males students can be explained by various motivational and behavioral factors in their reading and learning processes (Logan & Johnston, 2010). Similarly, according to the literature, there is a difference about attitude towards the use of computers between females and males. The association between computer attitudes and computer experience is stronger for males than females (Lily, 1994). It has also been found that attitudes towards the internet are more positive for males than females (Durdell & Zsolt, 2002).

Even though this study is the first attempt to investigate the relationship between computer use and Turkish students' reading achievement in PISA, there are a few existing studies which analyzed the effects of computer use on Turkish students' achievement in mathematics and science. Ziya, Dogan, and Kelecioğlu (2010) found that students' self-reliance in performing internet-related operations has a positive effect on their mathematical achievement scores, while students' using computers for program and software purposes has a negative effect on their mathematical achievement scores in PISA 2006. Erbas (2005) also found similar results for the relationship between computer use and the scientific literacy of Turkish students in PISA 2003. His findings indicated that the use of the internet and basic computer skills might have a positive relation with scientific literacy, but the use of software programs and advanced computer skills showed a negative relationship with scientific literacy. On the other hand, Aypay (2010) found no significant relationship between students' mathematic achievement in PISA 2006 and their use of computer software, as well as the use of computers for entertainment and internet purposes.

## METHOD

### Participants

Turkey has participated in PISA since 2003. However, only data from 2003 and 2006 cycles is currently available for Turkey, since the data of PISA 2009 has not yet been released. Hence, the latest available data, PISA 2006, was used in this study. PISA 2006 was implemented in a stratified random sample at 160 schools across 78 provinces in seven geographical regions of Turkey. For implementation of PISA 2006, 35 students from a list of all 15-year-old students in each school were randomly selected. The Turkish data for PISA 2006 had a sample of 4942 fifteen-year-old students (2290 girls and 2652 boys) attending 7<sup>th</sup> (n=23), 8<sup>th</sup> (n=93), 9<sup>th</sup> (n=2007), 10<sup>th</sup> (n=2671) and 11<sup>th</sup> (n=148) grades.

### Measurement and Variables

Two independent variables, students' gender and their purpose of computer use, were selected in this study to predict the Turkish students' reading performance. Five plausible reading values showing the students' reading performance in PISA 2006 are used as dependent variables. To identify students' use of computers for education and entertainment purposes, eleven variables were determined by using a rotated component matrix in factor analysis, as detailed below. These 11 variables about the use of computers for entertainment and educational purposes are shown in Table 1. Three latent variables were generated in order to employ Structural Equation Modeling (SEM) in this study using the dependent and independent variables. The first latent variable has three indicators, including 5 reading scores, which is called READ. The second one has three indicators, including 6 variables about the use of computers for entertainment purposes, which is called ENT. The last one has also three indicators, including 5 variables about the use computers for education purposes, which is called EDU.

Table 1: Variables about the Use of Computers for Different Purposes

- (IC4a) Browse the Internet for information about people, things, or ideas<sup>2</sup>
- (IC4b) Play games<sup>2</sup>
- (IC4c) Write documents<sup>1</sup>
- (IC4d) Use the Internet to collaborate with a group or team<sup>2</sup>
- (IC4e) Use Spreadsheets<sup>1</sup>
- (IC4f) Download software from the Internet (including games)<sup>2</sup>
- (IC4g) Drawing, painting or using graphics programs<sup>1</sup>
- (IC4h) Use educational software such as Mathematics programs<sup>1</sup>

- (IC4i) Download music from the Internet<sup>2</sup>  
 (IC4j) Writing computer programs<sup>1</sup>  
 (IC4k) For communication (e.g. Email or “chat rooms”)<sup>2</sup>

Notes:

<sup>1</sup>Using computers for education purposes

<sup>2</sup>Using computers for entertainment purposes

### Procedures for Data Analysis

Regression analysis is frequently used to examine the relationship between a dependent variable and independent variables. However, in this study, Structural Equation Modeling (SEM) was chosen because SEM enables us to flexibly and powerfully examine the relationships between observed and latent variables, as well as test cross-group similarities and differences among multiple latent variables (Kline, 2010). While the regression approach to modeling does not allow working with latent variables and measurement error, the techniques in SEM make possible taking measurement error into account and working with latent variables when the data is statistically analyzed (Schumacker & Lomax, 2010). Furthermore, it is possible to assess the similarities and differences in means, variances, correlations, and regression relationships among the latent variables by using SEM (Little, 1997).

The PISA data used in study had some issues to be addressed at the outset of the SEM process. Missing data was another problem that had to be addressed. There were approximately 5.8% missing data, 4.8% for females and 7.0% for males. After the SPSS format was saved as LISREL format, the MCMC imputation algorithm was applied to fix missing data in LISREL. After the missing data was imputed, the number of latent constructs for variables about the purposes of computer usage was determined by using a rotated component matrix in factor analysis, as shown in Table-2, in SPSS.

Table 2: Rotated Component Matrix

	Component 1	Component 2
Question-1	0.345	0.609 <sup>2</sup>
Question-2	0.205	0.566 <sup>2</sup>
Question-3	0.718 <sup>1</sup>	0.255
Question-4	0.447	0.591 <sup>2</sup>
Question-5	0.784 <sup>1</sup>	0.225
Question-6	0.413	0.708 <sup>2</sup>
Question-7	0.737 <sup>1</sup>	0.248
Question-8	0.718 <sup>1</sup>	0.219
Question-9	0.187	0.816 <sup>2</sup>
Question-10	0.693 <sup>1</sup>	0.281
Question-11	0.145	0.834 <sup>2</sup>

Notes:

<sup>1</sup>The using computers for education purpose

<sup>2</sup>The using computers for entertainment purpose

After determining the number of latent constructs, parceling techniques, which offer many advantages to researchers, were applied. Parceling, the average (or sum) of two or more items, responses, or behaviors, is a technique commonly employed and suggested by experts (Little, Cunningham, Shahar, & Widaman, 2002). Parceling has two very important advantages: 1) The sum of many items is more representative than only one item; and 2) aggregating items yields greater precision. Moreover, parceling contributes to reductions in sampling error. The score reliability of parcels (total scores) tends to be greater than that for the individual items (Kline, 2010). There are some techniques to create parcels for each construct. In this study, the balancing technique (unidimensional) and the facet representative parcels technique (multidimensional) were performed by using SPSS 18.0. The number of indicators was decreased by using these two techniques.

The construct ENT, the use of computers for entertainment purpose, had three indicators instead of six indicators, as shown in Table-3.

Table 3: Balancing Technique for Using Computers for Entertainment Purpose

	Q1	Q2	Q4	Q6	Q9	Q11	Q_Total
Q1	1						
Q2	0.308	1					
Q4	0.49	0.336	1				
Q6	0.506	0.399	0.557	1			
Q9	0.452	0.399	0.47	0.615	1		
Q11	0.478	0.376	0.507	0.577	0.635	1	
Q_Total	0.7071	0.6232	0.7503	0.8162	0.7983	0.8011	1

Notes:

<sup>1</sup>Parcel 1 (ENT 1) = Q1&Q11

<sup>2</sup>Parcel 2 (ENT 2) = Q2&Q6

<sup>3</sup>Parcel 3 (ENT 3) = Q4&Q9

The number of indicators for the construct EDU, the use of computer for education purpose, decreased from five to three, as revealed in Table-4.

Table 4: Balancing Technique for Using Computers for Education Purpose

	Q3	Q5	Q7	Q8	Q10	Q_Total
Q3	1					
Q5	0.354	1				
Q7	0.55	0.525	1			
Q8	0.442	0.506	0.479	1		
Q10	0.445	0.521	0.49	0.501	1	
Q Total	0.7511	0.8051	0.7822	0.7532	0.7783	1

Notes:

<sup>1</sup>Parcel 1 (EDU 1) = Q3&Q5

<sup>2</sup>Parcel 2 (EDU 2) = Q7&Q8

<sup>3</sup>Parcel 3 (EDU 3) = Q10

The number of indicators for the construct READ, reading scores, decreased from five to three after being parceled, as indicated in table-5.

Table 5: Balancing Technique for Reading Scores

	R1	R2	R3	R4	R5	R_Total
R1	1					
R2	0.84	1				
R3	0.842	0.834	1			
R4	0.837	0.835	0.834	1		
R5	0.838	0.834	0.842	0.834	1	
R Total	0.9351	0.9211	0.9332	0.9312	0.9323	1

Notes:

<sup>1</sup>Parcel 1 (READ 1) = Q3&Q5

<sup>2</sup>Parcel 2 (READ 2) = Q7&Q8

<sup>3</sup>Parcel 3 (READ 3) = Q10

Each latent variable had three indicators, which included residuals. Structural equation modeling is presented in Figure 1.

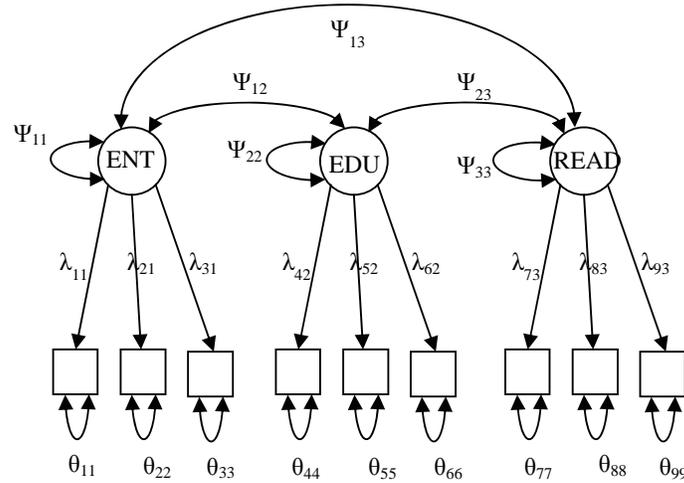


Figure 1: Structural Equation Modeling

Before SEM is built, identification is checked (Kline, 2010). Identification is assuming that the number of parameters is equal to or less than the number of variances and covariances, which is called the number of observations. To illustrate, according to Figure 1, the constructs ENT, EDU, and READ each have 3 indicators. The number of observations is 6 for each construct. The number of parameters for the construct ENT is seven ( $\Psi_{11}, \lambda_{11}, \lambda_{21}, \lambda_{31}, \theta_{11}, \theta_{22},$  and  $\theta_{33}$ ), for the construct EDU is seven ( $\Psi_{22}, \lambda_{42}, \lambda_{52}, \lambda_{62}, \theta_{44}, \theta_{55},$  and  $\theta_{66}$ ), and for the construct READ is seven ( $\Psi_{33}, \lambda_{73}, \lambda_{83}, \lambda_{93}, \theta_{77}, \theta_{88},$  and  $\theta_{99}$ ). All these paths are not identified because the number of observations (6) is less than the number of parameters (7) to be estimated. There are three methods to set the scale and identification: fix factor model, marker variable, and effects coding. The method of scale setting does not affect model fit. Therefore, the fix factor method was used, which revealed that the latent variances were equated to 1.0, and stated that  $\Psi_{11}, \Psi_{22},$  and  $\Psi_{33}$  were equated to 1.0 (i.e., sample LISREL syntax VA 1.0 PS (1,1) PS(2,2) PS(3,3,)).

**RESULTS**

Lisrel 8.8 student version was used in this study. There were three major steps before the regression model was applied, to determine whether the single-group models for females and males were acceptable and appropriate to use confirmatory factor analysis, to establish equivalence of measurement, and to compare the latent parameters across females and males.

*The models across females and males*

The first two models were single-group models for females and males. Results showed that these two models demonstrated acceptable fit (Female:  $\chi^2(24, 2290) = 294.4, p < .001, RMSEA = .071_{(.060-.083)}, NNFI = .97, CFI = .98$ ; Males:  $\chi^2(24, 2652) = 236.1, p < .001, RMSEA = .059_{(.026-.060)}, NNFI = .98, CFI = .99$ ). Confirmatory factor analysis (CFA) is presented in Appendix-A for females and Appendix-B for males.

*Equivalence of Measurement*

The configural invariance model as a first model was applied to determine whether the indicators loaded onto the same constructs across females and males. This model was found as an acceptable fit ( $\chi^2(48, 4942) = 530.42, p < .001, RMSEA = .0650_{(.0601-.0699)}, NNFI = .979, CFI = .986$ ). These results showed that the female and male models were identical and could be combined as a single model.

The next step was employing the weak factorial invariance model, which tested if loadings were invariant across females and males. This model demonstrated acceptable fit ( $\chi^2(54, 4942) = 533.36, p < .001, RMSEA = .0610_{(.0565-.0657)}, NNFI = .985, CFI = .986$ ). After this model was compared with the configural model, it was found that loadings were invariant across females and males because there was no significant change in fit based on the RMSEA Model Test and the CFI Model Test. The RMSEA values of the weak model fell within the 90% RMSEA confidence interval of the configural model (Little, 1997). The difference of CFI was also less than .01 (Cheung & Rensvold, 2002).

Another model was the strong factorial invariance model, which showed that intercepts were invariant across females and males. This model demonstrated acceptable fit ( $\chi^2(60, 4942) = 799.34, p < .001, RMSEA = .0719(.0675-.0763), NNFI = .974, CFI = .979$ ). Results showed that intercepts were invariant across females and males after this model was compared to the weak model because there were no significant changes in fit based on the RMSEA Model Test and the CFI Model Test. Means of constructs were also found statistically significant after means of constructs for females fixed to 0.0 (Females:  $\text{Alpha}(\text{ENT}) = 0^*, \text{Alpha}(\text{EDU}) = 0^*, \text{Alpha}(\text{READ}) = 0^*$ ; Males:  $\text{Alpha}(\text{ENT}) = .63(z = 19.8), \text{Alpha}(\text{EDU}) = .28(z = 8.8), \text{Alpha}(\text{READ}) = -16.8$ ), because the z scores of means of all constructs for males were bigger than 1.96.

Equivalence of measurement was established thus far (i.e., are the same constructs being measured in each group?). Table 6 shows the summary of the level of the invariance.

Table 6: Equivalence of Measurement Summary

Model	$\chi^2$	Df	RMSEA	90%CI	NNFI	CFI	$\Delta$ CFI	Tenable?
Configural Invariance	530.42	48	0.065	.0601-.0699	0.979	0.986	...	...
Loading Invariance <sup>1</sup>	533.36	54	0.061	.0565-.0657	0.985	0.986	<.001	Yes
Intercept Invariance <sup>1</sup>	799.34	60	0.0719	.0675-.0763	0.974	0.979	0.007	Yes

Note:

<sup>1</sup>Evaluated with the RMSEA Model

#### Comparing the Latent Parameters

In this process, homogeneity of variance/covariance of latent constructs across females and males was tested. The results showed a significant variance/covariance difference across two groups after comparing this model with the weak model ( $\Delta\chi^2(6, n=4942) = 389.91$  and  $p < .001$ ). The next step was to evaluate whether there was a significant variance difference between females and males. A significant difference was found after comparing this test with the weak test again ( $\Delta\chi^2(3, n=4942) = 43.90$  and  $p < .001$ ). In addition, the equivalence of the correlations among the constructs across females and males was tested by using phantom constructs. The results showed that there was a significant difference in the pattern of correlations among the latent constructs across two groups after comparing this model with weak model ( $\Delta\chi^2(3, n=4942) = 94.97$  and  $p < .001$ ). These steps are shown in Table 7.

Table 7: Comparing Latent Parameters

Model	$\chi^2$	Df	P	$\Delta\chi^2$	$\Delta$ df	P	Constraint Tenable
Homogeneity of Var/Cov <sup>1</sup>	923.266	60	<.001	389.91	6	<.001	No
Equality of Variance <sup>1</sup>	577.256	57	<.001	43.9	3	<.001	No
Equality of Correlations <sup>1</sup>	638.034	57	<.001	94.97	3	<.001	No

Note:

<sup>1</sup>Evaluated with the  $\chi^2$  Difference Test Model Test

Three latent constructs, which were identified above, were also evaluated. There were three steps to apply in this process. First, the correlation between the construct EDU and ENT was equated. After comparing this model with the weak model, it was found that the findings were not statistically significant ( $\Delta\chi^2(1, n=4942) = .227$  and  $p > .05$ ), which indicated that the correlation between EDU and ENT was not different across females and males. Second, the correlation between the construct EDU and READ was compared to weak model, it was found that the result was statistically significant ( $\Delta\chi^2(1, n=4942) = 79.05$  and  $p < .001$ ), which demonstrated that the correlation between EDU and READ was different across females and males. Last, the correlation between the construct ENT and READ was compared with the weak model, the result was not statistically significant ( $\Delta\chi^2(1, n=4942) = .060$  and  $p > .05$ ). That is the correlation between ENT and READ was not different across females and males. Table-8 presents equality of correlations across the latent variables for females and males.

Table 8: Equality of Correlations across latent parameters

Model	$\chi^2$	Df	P	$\Delta \chi^2$	$\Delta df$	P	Constraint Tenable
EDU- ENT <sup>1</sup>	533.562	55	<.001	0.227	1	>.05	Yes
EDU- READ <sup>1</sup>	612.36	55	<.001	79.05	1	<.001	No
ENT- READ <sup>1</sup>	533.395	55	<.001	0.06	1	>.05	Yes

Note:

<sup>1</sup>Evaluated with the  $\chi^2$  Difference Test Model Test

### Regression

The last part of this analysis was to determine if the use of computers for different purposes affected the students' reading scores across two groups, which meant asking if there was any difference between females and males for ENT and EDU to predict READ. The results of regression analysis showed that for females ( $R^2=.09$ ), ENT affected READ positively ( $\beta_1=.370$ ) while EDU affected READ negatively (-.491) as seen in Appendix-C. The findings for males were similar to the findings for females. It was found that ENT affected READ positively ( $\beta_1=.379$ ) while EDU affected READ negatively (-.507), as seen in Appendix-D ( $R^2=.10$ ). In conclusion, while the use of computers for entertainment purposes affected reading scores positively, the use of computers for education purposes affected reading scores negatively across both females and males. However, without equating each part of the model, whether regression coefficients for females and males were statistically significant could not be determined. Before equating regression coefficients for ENT and EDU, regression models for females and males were applied in the same model ( $\chi^2 (54, 4942) = 533.335, p<.001, RMSEA=.0610_{(.0565-.0657)}, NNFI=.982, CFI=.986$ ). Then, regression coefficients for ENT were equated across females and males. Once this model was compared with the previous model, the findings showed that the regression coefficient for ENT was not different across females and males ( $\Delta \chi^2 (1, n=4942) = .018$  and  $p<.001$ ). The same process was applied for EDU, and it was found that the regression coefficient for EDU also was not different across females and males ( $\Delta \chi^2 (1, n=4942) = .056$  and  $p<.001$ ). These steps are shown in Table 9.

Table 9: Equality of Regression Coefficients across females and males

Model	$\chi^2$	Df	P	$\Delta \chi^2$	$\Delta df$	P
Configural Model	533.34	54	<.001	...	...	...
Equality of ENT <sup>1</sup>	533.35	55	<.001	0.018	1	>.05
Equality of EDU <sup>1</sup>	533.39	55	<.001	0.056	1	>.05

Note:

<sup>1</sup>Evaluated with the  $\chi^2$  Difference Test Model Test, based on configural model

### CONCLUSION

The purpose of this study was to find out how the use of computers for entertainment and education purposes influences students' reading performance across females and males. With this aim, the relationship between Turkish students' reading scores in PISA 2006 and their purposes of computer use was examined. Structural Equation Modeling (SEM) was used for the analysis because SEM enabled us to apply the regression model in this study. Furthermore, SEM made possible exploring the relationship among latent constructs across two groups, females and males. Regression Analysis was applied to predict reading scores by the use of computers for entertainment and for education purposes across females and males. The findings show that while the use of computers for education purposes influenced students' reading scores negatively, the use of computers for entertainment purpose affected reading scores positively across both gender. These findings are consistent with the findings of two previous studies (Ziya, Dogan, & Kelecioğlu, 2010; Erbas, 2005), which respectively investigated the relationship between Turkish students' mathematics and science performance in PISA and their purpose of using computers.

In general, our findings suggest that students who use computers to perform more advanced tasks show less achievement in reading. At this point, one could argue that these students devote too much time to learn and perform these advanced tasks on computers, and this process may prevent them for reserving enough time for doing their homework and reading different materials. On the other hand, using computers for entertainment purpose may reduce students' stress, increase their motivation, and enable them to study more efficiently. Furthermore, students who use computers for gaming, chatting with friends, or surfing on the internet may unintentionally develop their reading skills. These entertainment activities may also enable students to read in detail and think critically, which are necessary for understanding the context of a reading. However, this study

does not, and did not intend to, fully explain the casual relationship between using computers for entertainment purposes and students' performance in reading. Hence, it is very important for further researchers to explore this issue. In the future, our focus will be how the use of computers for different purposes affects students' self-motivation and the learning of different school subjects.

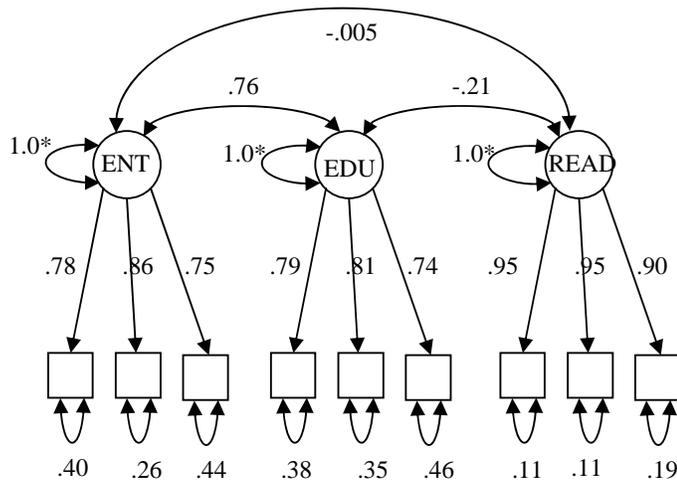
There are also some limitations in this study. First, the findings of this study cannot be generalized to other countries since the sample of this study only included 15-year-old students from Turkish high and middle schools. Second, PISA 2006 included a limited number of questions concerning students' purposes of computer use. Hence, the number of independent variables in this study might not be sufficient to show the relationship between the use of computers for different purposes and reading scores. Despite these limitations, the sample size was adequate ( $n=4952$ ) for employing SEM in this study, and by using the flexible SEM framework, the process of exploring the interrelationships between students' gender, purposes of computer use and their reading skills has begun.

## REFERENCES

- Aksit, N. (2007). Educational reform in Turkey. *International Journal of Educational Development* 27(2), 129-137.
- Alacaci, C. & Erbas A.K. (2010). Unpacking the inequality among Turkish Schools: Finding from PISA 2006. *International Journal of Educational Development*, 30 (2), 182-192.
- Anil, D. (2009). Factors Effecting Science Achievement of Science Students in Programme for International Students' Achievement (PISA) in Turkey. *Education and Science*, 34 (152), 87-100.
- Altun, A. (2007). *Effects of student and school related factors on the mathematics achievement in Turkey at eight grade level*. Unpublished master thesis. Ankara: Middle East Technical University.
- Aypay, A. (2010). Information and Communication Technology (ICT) Usage and Achievement of Turkish Students in PISA 2006. *The Turkish Online Journal of Educational Technology-TOJET*, 9 (2), 116-124.
- Cheung, G. W. & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, 9 (2), 233-255.
- Chiu, M. & McBride-Chang, C. (2006). Gender, Context, and Reading: A comparison of students in 43 countries. *Scientific Studies of Reading*, 10 (4), 331-362.
- Çiğci, A. (2006). *According to mathematics subtest results of PISA 2003 investigation of some factors' effect on student achievement in Turkey*. Unpublished master thesis. Ankara: Hacettepe University.
- Demir, I., Kilic, S., & Unal, H. (2010). Effects of students' and schools' characteristics on mathematics achievement: findings from PISA 2006. *Procedia Social and Behavioral Sciences*, 2 (2), 3099-3103
- Duman, A. (2006). *Evaluation of the factors which effect on mathematics achievement of primary school students for students and teachers (Eskişehir sample)*. Unpublished master thesis. Eskişehir: Osmangazi University.
- Durndell, A. & Zsolt H. (2002). Computer Self-Efficacy, Computer Anxiety, Attitudes Toward the Internet and Reported Experience with the Internet, by Gender, in an East European Sample. *Computers in Human Behavior*, 18 (5), 521-35.
- Erbaş, K. C. (2005). *Factors affecting scientific literacy of students in Turkey in Programme for International Student Assessment (PISA)*. Unpublished doctoral dissertation. Middle East Technical University, Ankara, Turkey.
- Ham, S. H. & Cha. Y. K. (2009). Positioning Education in the Information Society: The Transnational Diffusion of the Information and Communication Technology Curriculum. *Comparative Education Review*, 53 (4), 535-557.
- Kline, R. B. (2010). *Principles and practice of structural equation modeling*. New York: Guilford Press.
- Lily, S. (1994). Gender-Differences in Computer Experience and its Influence on Computer Attitudes. *Journal of Educational Computing Research*, 11 (4), 347-367.
- Little, T. D. (1997). Mean and covariance structures (MACS) analyses of cross-cultural data: Practical and theoretical issues. *Multivariate Behavioral Research*, 32 (5), 53-76.
- Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling*, 9 (2), 151-173.
- Logan, S. & Johnston, R. (2010). Investigating Gender Differences in Reading. *Educational Review*; 62 (2), 175-187.
- Luan, W.S., Fung, N. S., Nawawi, M., & Hong, T. S. (2005). Experienced and inexperienced internet users among pre-Service teachers: Their use and attitudes toward the Internet. *Educational Technology & Society*, 8 (1), 90-103
- Ministry of National Education (MONE). (2005). *Basic Education in Turkey background report*. Ankara, Turkey. Organization for Economic Co-operation and Development (OECD), 2006. *Assessing scientific, reading and mathematical literacy: A Framework for PISA 2006*. OECD, Paris.

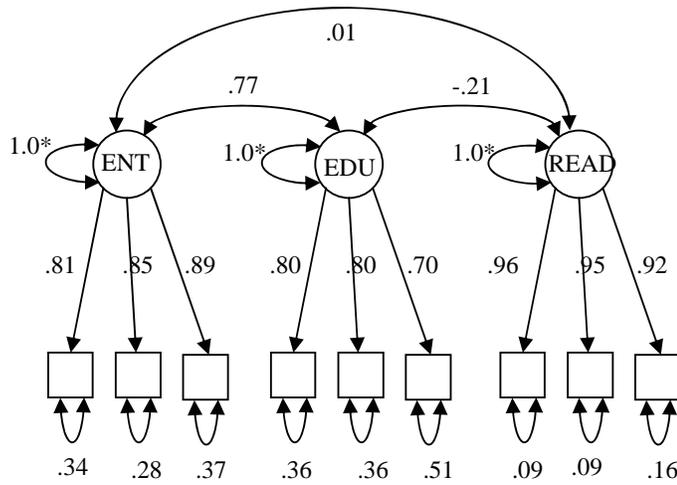
- Unal, H. & Demir, I. (2009). Divergent thinking and mathematics achievement in Turkey: Findings from the programme for international student achievement (PISA-2003). *Procedia Social and Behavioral Sciences*, 1(1), 1767-1770.
- Roberts, D.H. (1995). The role of universities in industrial innovation and technology transfer. *Industry and Higher Education*, 9 (3), 149-156.
- Sharma, P. & Maleyeff, J. (2003). Internet education: potential problems and solutions. *The International Journal of Educational Management*, 17 (1), 19-25.
- Schumacker, R. E. & Lomax, R.C. (2010). *A Beginner's Guide to Structural Equation Modeling*. New York: Routledge.
- Yılmaz, E. T. (2006). *The factors which effect on mathematics achievement of Turkish students in PISA 2003*. Unpublished master thesis. Ankara: Hacettepe University.
- Ziya, E., Dogan, N., & Kelecioğlu, H. (2010). What Is the Predicted Level of Which Computer Using Skills Measured in PISA for Achievement in Mathematics. *The Turkish Online Journal of Educational Technology-TOJET*, 9 (4), 185-191.

**Appendix A: Confirmatory Factor Analysis for Females**



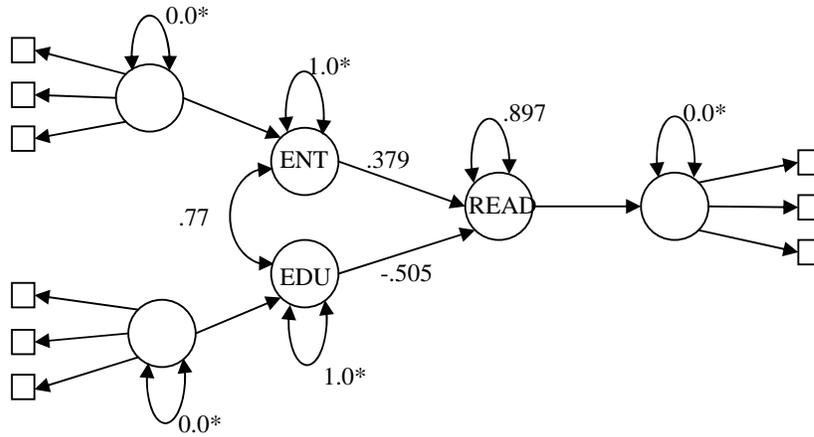
$\chi^2_{(24, 2290)} = 294.4$       RMSEA=0.071<sub>(.060-.083)</sub>      CFI=.98      NNFI=.97

**Appendix B: Confirmatory Factor Analysis for Males**



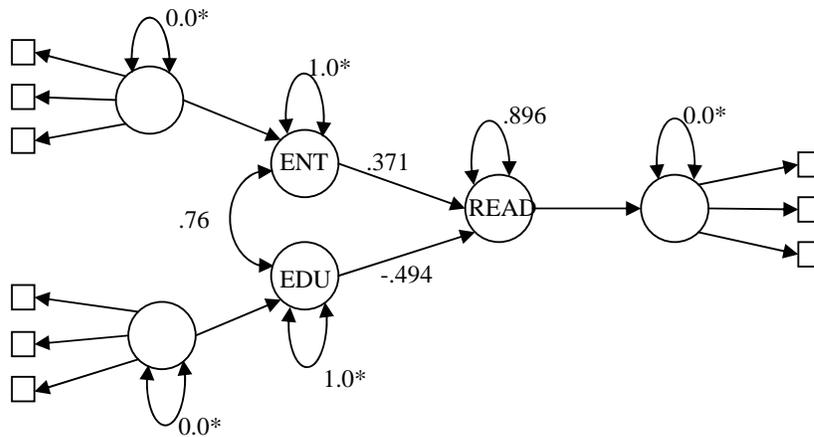
$\chi^2_{(24, 2652)} = 236.1$       RMSEA=0.059<sub>(.026-.060)</sub>      CFI=.99      NNFI=.98

**Appendix C:** Confirmatory Factor Analysis of regression model for females



$\chi^2_{(24, 2290)} = 295.3$       RMSEA=0.071<sub>(.064-.078)</sub>      CFI=.98      NNFI=.97

**Appendix D.** Confirmatory Factor Analysis of regression model for Males



$\chi^2_{(24, 2652)} = 233.5$       RMSEA=0.071<sub>(.052-.066)</sub>      CFI=.99      NNFI=.98