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Correlation between Computer and Mathematical Literacy Levels of 6th Grade Students

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Abstract: Literacy has been defined in the literature frequently. Each new interpretation leads to the idea that the definition can change based on the relevant environment, instruments used and/or the intended objective and there might be different types of literacy including computer literacy, media literacy and visual literacy (Reinking, McKenna, Labbo and Kieffer, 1997; Tuman, 1994). This is also true for computer literacy and mathematical literacy. Therefore, there is a need for studies on computer and mathematical literacy. The objective of the present study was to determine the computer and mathematical literacy levels of secondary school 6th grade students and to reveal the correlation between computer and mathematical literacy levels. The study sample included students that attended provincial, district and village schools, as well as the private schools. The correlation between the computer and mathematical literacy levels of the students that were selected from various regions was determined and the differences based on these levels among the schools were also identified. Since the study aimed to determine the correlation between computer literacy and mathematics literacy of the 6th grade students, relational screening model was utilized in the study. Relational (correlative) studies aim to determine whether there is a correlation between two or more variables (Karasar, 2009). Study population included 139 6th grade students attending a secondary school in Turkey. In the study, "Mathematics Literacy Scale" and "Computer Literacy Scale," which were developed by the author and tested for validity and reliability were used. The obtained data were analyzed by specific statistical techniques. After the findings were analyzed, results were discussed based on the findings in the literature and necessary recommendations were presented.

Keywords: *Computer literacy, Mathematics literacy, literacy.*

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Introduction

Humankind left the era behind, where the knowledge had a static and absolute structure and knowledge derived from memorization of the existing accumulated information, and thus, education should be identical for all. Today, it is universally emphasized that education should be dynamic and improve continuously (Unal and Ipek, 2009). Thus, primarily, it is necessary to be literate on the topic rather than memorization and accumulation of knowledge.

Literacy was defined in various forms such as "awareness of the students about numerical, logical and mathematical processes as well as reading and writing activities" (NRC, 1989), "the ability to read and write scripts using the alphabet" (Reinking, 1994), and "ability to access, assess and utilize written resources to develop the individual's knowledge and potential that is required for effective participation in the society" (Akyuz and Pala, 2010). The achievement of the ability to use communication symbols that are meaningful for the society could be considered as a more current definition of literacy (Kellner, 2001).

The definition of literacy is constantly interpreted and renewed by the common contribution of individuals that constitute the society (McCarthy and Raphael, 1992). Each new definition indicates the fact that the definition could differentiate based on the environment, the instruments utilized and/or the objective and various literacy definitions such as visual literacy, media literacy, computer literacy, etc. can be developed (Reinking, McKenna, Labbo and Kieffer, 1997; Tuman, 1994). This is also true in the cases of computer literacy and mathematical literacy.

Mathematics is known as one of the most important instruments that improve thinking. Thus, the basic feature that distinguishes human beings from other living organisms is the ability to deduct meanings from events, to rearrange the

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conditions suitable for themselves, and to think. This suggests that mathematics education is one of the most important building blocks in education, perhaps the most important one (Umay, 2003). The rules of and operational knowledge in mathematics courses that are instructed in elementary schools, which are the first step of compulsory education, are required for every citizen in democratic countries, thus, all citizens should be literate in this subject and develop mathematical skills (Ersoy, 1997).

Ersoy (2003) stated that an individual with mathematical literacy skills could predict the outcome by conducting mental operations about the probable solution of the problem, judge the accuracy of the result, and use numerical intuition to interpret the measurements (Ersoy, 2003). Accordingly, having mathematical literacy skills requires certain basic skills and competences in mathematics at different levels. These skills and competences include a wide range of skills such as mathematical operations, mathematical thinking and conceptualization, as well as having knowledge on and practice a range of mathematical content (EARGED, 2008).

Equal to the significance of mathematical literacy skills, due to advances in technology computer literacy skills became important for the individual. Furthermore, computers became an indispensable part of our lives. Unlike other instructional tools, the computer is defined as a versatile tool that offers unique possibilities in teaching and learning. The most fundamental characteristic that distinguishes computers from other educational instruments and emphasizes their significance in education is the capacity to utilize the computers as a production, management, presentation, instruction and communication instruments spontaneously (Yalin, 2002).

It could be stated that individuals who acquire skills such as ability to learn basic computer knowledge, ability to use the computers to improve quality of life or as an entertainment tool, ability to follow and discuss innovations related to computers and to comment on these innovations, the ability to compare and appreciate information technologies at a certain level could be considered as computer literate individuals (Yazici, 2006).

The rapid change and advances in computer technologies clearly demonstrated that computer literacy is not a training process that could be completed in a short period of time and should be maintained for a lifetime (Kilinc and Salman, 2006).

Certain instruments have been utilized to perform mathematical operations in every age in time. In the early ages, calculations were conducted with pebbles, and today, information technologies have replaced these archaic tools. In the solution of mathematical problems, mathematical software and calculators were used commonly during recent years. It was observed that utilization of these tools led to the solution of mathematical problems that seemed unsolvable for a long time. It is also clear that mathematical computing systems represent power and conduct operations much easier than before (Ginsburg, Groose, Taylor & Vernescu, 1997).

It is obvious that the contributions of the computers to mathematics education along with the technological advances increase every day. Thus, it became compulsory for individuals to achieve both computer and mathematical literacies. Previous studies determined that computer literacy and mathematical literacy would have a continuous correlation and interaction and computer literacy would affect mathematical literacy especially under present conditions.

Research Problem

"What are the mathematical literacy and computer literacy levels of 6th grade students? and “is there a significant correlation between them?" are determined as the research problem statements in the present study.

Study Objective

The objective of the present study was to determine the mathematical and computer literacy levels of 6th grade students and the correlation between these two literacies. Thus, the following research questions were established:

- Is there a significant correlation among the mathematical literacy levels of 6th grade students who attend four different types of schools in the province of Elazig in Turkey (private school, central school, district school and rural school)?

- Is there a significant correlation among the computer literacy levels of 6th grade students who attend four different types of schools in the province of Elazig in Turkey (private school, central school, district school and rural school)?

- Is there a correlation between computer literacy levels and mathematical literacy levels of 6th grade students who attend four different types of schools in the province of Elazig in Turkey (private school, central school, district school and rural school)?

Significance of the Study

The most fundamental characteristic of the current times, which is called the information age, is the exposure of every individual in the society to a variety of information everyday and their need to analyze, interpret, use, and comprehend these information, in brief, being literate (Bekdemir and Duran, 2012). Information literacy increased the significance of mathematical and computer literacy along with the evolving technologies. The present study aimed to determine;

1. computer literacy levels,
2. and mathematical literacy levels of 6th grade students in 4 different schools in Elazig province in Turkey,
3. to determine the correlation between their mathematical literacy and computer literacy levels
4. and to provide a resource for future studies on mathematical and computer literacy.

Methodology

Study Model

In the present study, relational screening model was utilized. Relational screening model is defined as a research model that aims to determine the presence or degree of correlation between two or more variables (Karasar, 1998). Thus, the variables with a possible correlation are symbolized separately, allowing for a relational analysis. In the study, the data obtained from the students were used to determine the mathematical and computer literacy levels of the students and the correlation between computer and mathematical literacies and the difference among the schools. Since the study aimed to determine correlations, an attempt was made to determine whether the variables were correlated, and if a correlation was present, the study aimed to determine the type of this correlation.

Study Group (Population and Sample)

The study population included randomly selected 6th grade students that attended state schools (Ministry of National Education) in the provincial and district centers in the province of Elazig during the 2009-2010 and 2010-2011 academic years. The study sample included 139 6th grade students randomly selected from four different middle schools (private, central, district and rural) in Elazig province, Turkey.

Data Collection Instruments

In the present study, mathematical literacy and computer literacy scales developed by the author were used as data collection instruments. The mathematical literacy scale used in the study was developed based on the mathematical literacy self-efficacy scale by Ozgen and Bindak (2008). The computer literacy scale was developed based on the scale utilized in a study by Kilinc and Salman (2006). These are 3-point Likert type scales that include 15 items. Scales were applied to 6th, 7th and 8th grade students in private, central, district and rural schools.

Data Analysis

In the study, descriptive statistics were used to determine mathematical and compter literacy levels, ANOVA was used to determine the correlation among the schools and Pearson correlation values were used to indicate the significant difference and the correlation between computer and mathematical literacies. Data analysis was conducted with SPSS statistical software.

Findings and Interpretation

In the present section, descriptive statistics findings of mathematical literacy and computer literacy scores of the students at every grade, analysis results for the Scheffe test, which is one of the ANOVA tests, and Pearson correlation values are examined. In the present study, private schools were denoted with 1, central schools were denoted with 2, district schools were denoted with 3, and rural schools were denoted with 4 to determine the significant differences among the groups based on the ANOVA findings.

Findings on Mathematical Literacy Levels of 6th Grade Students and Interpretation of These Findings

Descriptive statistics on mathematical literacy of 6th grade students based on the private, central, district and rural schools are presented in the table "Descriptive statistics data on mathematical literacy levels".

Table 1. Descriptive statistics data on mathematical literacy levels

Descriptive Statistics	Private	Central	District	Rural	Total 6th graders
Mean	38.424	36.285	30.176	27.533	33.410
Skewness	-.166	-.660	-.028	-.216	-.624
Kurtosis	-.614	.243	.372	-.769	-.324
# of Students	33	42	34	30	139

Analysis of the data presented in the table demonstrate that the mean mathematical literacy level in the private school was 38.424, the same figure was 36.285 in the central school, 30.176 in the district school, and 27.533 in the rural school. The ranking from the highest to lowest average mathematical literacy level was as follows; the private, central, district and rural schools. Total mathematical literacy scores for all four schools in the province demonstrated that the mean mathematical literacy score was 33.410. Furthermore, the analysis results presented in the above table reflected that there was no excessive skewness and kurtosis in the mathematical literacy values.

In Table 2, the ANOVA results for the mathematics literacy levels of the 6th grade students based on the private school, the central school, the district school and the rural school in the province are presented.

Table 2. ANOVA test results for the mathematics literacy level based on groups

Source of the Variance	Sum of Squares	Mean of Squares	Degree of Freedom	F	p	Significant Difference
Between Groups	2568.586	856.195	3			
In-Groups	2245.040	16.630	135	51.485	.000	1-3, 1-4, 2-3, 2-4
Total	4813.626		138			

The mean values depicted in Table 1 show that the private school mean was 38.424, the central school mean was 36.285, the district school mean was 30.176, and the rural school mean was 27.533. Thus, the difference between the mean values listed in Table 2 was significant in the 95% confidence level ($F_{(3-135)} = 51.485$, $p \leq .05$).

In other words, the mathematical literacy levels of the 6th graders had significant correlation among the schools in the province. There was a significant difference between the private school and the district school, between the private school and the rural school, and between the central school and the district school. The differences between the private school and the central school, between the district school and the rural school that shared similar mean values were not significant ($p > .05$). The significant differences between the private school and district school and between the private school and rural school favored the private school, and the significant differences between the central school and district school and between the central school and rural school favored the central school.

Findings on Computer Literacy Levels of 6th Grade Students and Interpretation of These Findings

The descriptive statistics findings on the computer literacy levels of the sixth graders are presented in Table 3.

Table 3. Descriptive statistics data on computer literacy levels

Descriptive Statistics	Private	Central	District	Rural	Total 6th graders
Mean	40.030	37.190	33.588	28.966	35.208
Skewness	-.342	-.265	.526	.243	-.412
Kurtosis	-.903	-.881	-.376	-.738	-.539
# of Students	33	42	34	30	139

Analysis of the data presented in the above table demonstrate that the mean computer literacy level in the private school was 40.030, the same figure was 37.190 in the central school, 33.588 in the district school, and 28.966 in the rural school. Total mean for computer literacy level was 35.208. The ranking from the highest to lowest mean computer literacy level was as follows; the private, central, district and rural schools. Furthermore, the analysis results presented in the above table reflected that there was no excessive skewness and kurtosis in the computer literacy values.

In Table 4, the ANOVA results for the computer literacy levels of the 6th grade students are presented.

Table 4. ANOVA test results for the computer literacy level based on groups

Source of the Variance	Sum of Squares	Mean of Squares	Degree of Freedom	F	p	Significant Difference
Between Groups	2190.302	730.101	3	31.564	.000	1-3, 1-4, 2-3, 2-4, 3-4
In-Groups	3122.648	23.131	135			
Total	5312.950		138			

The mean values depicted in Table 3 demonstrate that the private school mean was 40.030, the central school mean was 37.190, the district school mean was 33.588, and the rural school mean was 28.966. Thus, the difference between the means listed in Table 2 was significant in the 95% confidence level ($F_{(3-135)} = 31.564$, $p \leq .05$).

The computer literacy levels of the 6th graders demonstrated a significant correlation between the schools in the province. There was a significant difference between the private school and the district school, between the private school and the rural school, between the central school and the district school, between the central school and the rural school and between the district school and the rural school. There was no significant correlation between the private school and the central school ($p > .05$). The significant differences between the private school and district school and between the private school and rural school were in favor of private school, the significant differences between the central school and district school and between the central school and rural school were in favor of the central school, and the significant difference between the district school and rural school was in favor of the district school.

Findings on the Correlation Between Mathematical Literacy Levels and Computer Literacy Levels of 6th Grade Students and Interpretation of These Findings

The correlations between total mathematical literacy level and computer literacy level of 6th grade students are presented in Table 5.

Tablo 5. Pearson correlation values for total mathematical literacy and computer literacy levels

	Correlation	p
"Mathematical literacy" and "Computer literacy"	.412	.000

Reanalysis of the total mean mathematical and computer literacy levels of the 6th grade students demonstrated that the mean mathematical literacy level was 33.410 points and the mean computer literacy level was 35.208 points. The mean computer literacy level of 6th graders was higher than the mean mathematical literacy level of the same group. Based on the mean scores, it was observed that there was a positive and medium level correlation between the mean mathematical and computer literacy levels of the 6th grade students ($r = .412$, $p \leq .05$).

Conclusion and Recommendations

The present study findings demonstrated that the mathematical literacy levels of the 6th grade students who attended private and central schools were higher when compared to the mathematical literacy levels of the 6th grade students who attended rural and district schools. In a study conducted on PISA 2003 data, Schnulz (2005) found that school type variable was effective on differentiation of mathematical literacy scores. This finding is consistent with the findings obtained in the present study because, the mathematics literacy levels differed among the central, private, district and rural schools. The mathematical literacy of students attending central or private schools was higher than the district and rural areas due to the opportunities offered in the former types of schools.

Similar findings were obtained on computer literacy levels. The fact that computer literacy levels in the private and central schools were higher could be related to high Internet use in younger ages, computer use at home, and playing novel computer-based games with peers. In their study, Hoffman and Vance (2005) focused on the achievement of computer literacy skills. Their study findings demonstrated that most of these skills were acquired at home due to Internet and word processor use and due to the fact that family members and peers assisted the individual in the achievement of these skills. In this context, the abovementioned study findings supported the results obtained in the present study.

Analysis of the correlations among the schools revealed no significant correlation between private and central schools in computer literacy and between district and rural schools in mathematics literacy. It was observed that the educational facilities available at schools, the support of teachers and the family members, and economic and physical conditions were similar at these schools, thus, the private school and the central school scored higher points when compared to other schools. These findings were consistent with a study by Kalender and Berberoglu (2005), where differences between the findings based on school type, region and the achievement were higher in private and public schools. Furthermore, the fact that there was a positive and medium correlation between the total computer literacy levels and mathematical literacy levels in all schools demonstrated that computer and mathematical literacy levels were interrelated and the correlation was positive, rendering the present study significant.

Findings of the present study demonstrated that there was a significant correlation between the mathematical literacy and computer literacy levels of 6th grade students except between the private and central schools in computer literacy levels and between district and rural schools in mathematical literacy levels. Furthermore, it was found that there was a moderate and positive correlation between computer literacy and mathematical literacy levels of 6th graders. In addition, mean computer literacy scores were higher than mean mathematics literacy scores at all grade levels. Thus, it was observed that computer literacy influenced the mathematical literacy of an individual. Based on the present study findings, the following recommendations can be made.

- Computers at school laboratories could be renewed to improve the students' study conditions and time they spend at computer terminals both during the day and after-school hours. Thus, the computer literacy levels could be increased.

- In math classes, students might be asked to associate mathematical concepts and operations with daily life events to increase their mathematical literacy levels. Students could be encouraged to utilize calculators and mathematics software on their computers when solving problems and to conduct mathematical research using the Internet.

- To avoid the abovementioned differences among the schools, the social and academic qualities of the rural and district schools could be improved and equal educational opportunities could be provided to all students.

Measures such as additional math courses, mathematics competitions and projects that are organized in schools with high socio-economic status such as private and central schools and the high number of computers per pupil could be extended to schools in all regions.

- Since the education level of the families is important in increasing the students' computer and mathematical literacy levels, meetings and conferences should be organized for family counseling and awareness should be raised among the families.

- Instructions and problem solving could be conducted using computers in math classes to make the classes more fun and remove the negative attitudes towards mathematics.

- PISA studies on mathematical and computer literacies could be reviewed and the related data could be analyzed to restructure the educational system.

- In the literature, mathematical and computer literacy levels are scrutinized under separate topics. The correlation between these literacies could be examined at high school and university levels, and without limiting the scope of the study by a province or school types. The present study was the first of its kind since no similar studies were found in the literature, hence it is a unique study.

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