

Examination of Factors Affecting Students' Reading-Comprehension Achievement with Structural Equation Modeling

Hakan Ülper ^{1,*}, Gökhan Çetinkaya², Ayhan Dikici³

¹Burdur Mehmet Akif Ersoy University, Education Faculty, Turkish Language Education, 15100, Burdur, Turkey

²Pamukkale University, Education Faculty, Turkish Language Education, 20700, Denizli, Turkey

³Nigde Omer Halisdemir University, Education Faculty, Department of Educational Sciences, 51100, Nigde, Turkey

Abstract: It is noted in the light of several studies associated with the reading-comprehension skills that fluent word reading, connectives knowledge and fluent text reading are closely related to the comprehension skill. Hence it seems possible to create a model over these concepts and their interrelationships. Within the scope of this research two different models are proposed considering theoretical information. The study group of the research was composed of 263 secondary school students at a state school in Burdur province. Three different confirmatory factor analysis (CFA) were performed to see whether factor structures were confirmed on the sample by using the maximum estimate method of the AMOS 18 software. Analysis of Covariance and Multivariate Analysis of Covariance were performed to determine whether the demographic variables grade level and gender had a significant effect on the scale scores. These analyzes were also performed in the SPSS 18 program. It has been found that as the grade level of the students increases, connective usage knowledge increases, the fluent silent word reading, the fluent silent text reading, the reading comprehension and the academic achievements increase as the grade level increases. This research concluded that reading comprehension strongly and significantly predicted academic achievement. But however, fluent silent text reading did not predict reading comprehension significantly. According to the results of the research, the model formed by the sub-dimensions of binding usage information shows better fit.

ARTICLE HISTORY

Received: 11 March 2018

Revised: 13 May 2018

Accepted: 09 June 2018

KEYWORDS

Fluent reading,
Comprehension,
Academic achievement,
Structural equation
modelling

1. INTRODUCTION

According to “the simple view of reading theory”, reading is composed of two main categories: word reading and language comprehension. Word reading category includes the subcategories of letter knowledge-phonics, reading accuracy and automatic reading whereas language comprehension is constituted by the subcategories of word comprehension, sentence

CONTACT: Hakan ÜLPER ✉ hakanulper@gmail.com 📧 Burdur Mehmet Akif Ersoy Üniversitesi, Eğitim Fakültesi, Türkçe Eğitimi Anabilim Dalı, 15100, Burdur, Turkey

ISSN-e: 2148-7456 /© IJATE 2018

comprehension and text comprehension. Hence, activation of word meaning, understanding the sentences, inference, control of comprehension and understanding the text structure are covered by this subcategory. When either of these categories does not work, reading performance is not achieved in the desired quality (*see* Oakhill, Cain, & Elbro, 2015).

In this sense, fluent processing particularly on the word level during the process of reading-comprehending a text is regarded as being of top priority for cognitive processing required for the text comprehension. Because it would be possible to focus mental sources on text comprehension with the automatization of word recognition (NRP, 2000; Perfetti, 1998), relating the word reading skill to comprehension seems probable in the theoretical framework.

It is remarkable in the literature that there is a high-level relationship between fluent word reading and comprehension in the first periods of reading particularly (Kim, Wagner, & Lopez, 2012). In the research conducted with 2143 students, Verhoeven and Leeuwe (2008) achieved comparable results. According to their research, word reading has an important effect of comprehension in early stages. In the study, it is concluded that there is a high-level relationship between fluent word reading and comprehension; the relationship is shown .50 at the lowest and .87 at the highest (*see* Castillo, Torgesen, Powell-Smith, & Al-Otaiba, 2009).

On the other hand, according to the Lexical Quality theory, lexical quality refers to how important formats and meaning elements of the word seen by a reader and the lexical knowledge are. Accordingly, a reader should be able to know both textual, phonological and morphological-syntactic attributes and semantic attributes of a word and include the words in the textual context in the text processing (Perfetti, 2007). Then, the reader should be able to read simple words fluently and process these words in accordance with the meaning required by the context and fluently. The consequent type of reading is not the act of reading from a list of simple words but reading of a text is the exact opposite.

In such reading, two main concepts are focused on in silent reading for fluency: reading accuracy and reading rate. Hence, it is possible to define this reading as fluent silent text reading.

A reader who gets into the fluent text reading process should perform inter-sentence cognitive transactions such as understanding small structures (word and phrase recognition, etc.) as well as integrating the meanings (inter-sentence grammatical and semantic relations), inferring the semantic information from text by focusing on inter-proposition relation networks, making the connections of references and filling the gaps in regard to cohesion through bridging so that he/she can comprehend a text, that is, create the mental representation of the text content (McNamara, Kintsch, Songer and Kintsch, 1996). In other words, he/she should make consistent semantic relations on the sentence level other than the word level. To that end, readers need to understand the directions for the pronouns and the referred expressions in the text and comprehend how sentences are interrelated and how clauses, paragraphs, parts and groups of part are related to the general subject (Caccamise, Snyder, & Kintsch, 2008). Again, as stated by van Silfhout, G., Evers-Vermeul, J. & Sanders, T. (2015), it is very important for reader to establish the proper relations both locally and wholly between the units of the text for structuring the mental representation of text. In this process, connectives come across as some of the most important guides in inter-sentence connection.

Linguists divide words into two groups as function words and content words. In addition to this classification, it is observed that functional and content words are also defined as open/closed class or grammatical and substantial words. Open class words are basic lexical groups such as nouns, verbs and adjectives. Closed class words are syntactic processors including grammatical groups such as determiners, prepositions and connectives (d'Arcadais, 1984). Semantic contribution of functional words is more abstract and less referential than

content words. They are the latest acquired constructs in language acquisition (Littlefield, 2005; Smith & Witten, 1993).

Hence, readers should have internalized content words like connectives for efficient reading. Because readers receive information required about the function of connectives from their long-term memory when reading. If a reader is not informed of what functions connectives have in his/her long-term memory, it will not matter when he/she reads connectives properly and fluently, that is, simply performs a decoding process. As in fluent word reading, the reader will read the word properly first, then access the information in its function/meaning in his/her mental glossary. In the next stage, this will enable the reader to use this function/meaning in accordance with the context properly and achieve fluent text reading. In this case, it is obvious that the reader needs to read connectives in the text automatically and fluently.

As stated by Kurtul (2011), connectives function to demonstrate the logical connection between propositions or between a sentence and a noun phrase in some cases. In this sense, the meaning conveyed by connectives is very important for coherent connections among discourse sections. It will be difficult to achieve desired coherence when there is an incoherent relation between connective and semantic content of connected elements (Zufferey, Mak, Degand, & Sanders, 2015: 390). Process of comprehension will be affected negatively, too.

Several research results coincide with this theoretical information. Sanders and Noordman (2000) state that presence of connectives in texts makes text processing easier, referring to numerous studies on online texts. On the other hand, Geva and Ryan (1985) state based on the related research that competent readers have good connectives knowledge and use this knowledge to establish logical relations among the parts of text. This is an outcome which is expected to increase the speed of processing during reading. Noordman, Vonk and Kempf (1992) accordingly concluded that connectives accelerate readers' reading time. Likewise, van Silfhout, Evers-Vermeul and Sanders (2015) state that many young readers cannot construct the text in their minds properly because of their incompetence in making connections when reading. According to their research, connectives not only accelerate the processing of later information but also reduce the number of rereading the current information in the text. These findings indicate that connectives have a function of an initial "processing directive". Thus, the findings also refer to that having sufficient amount of connectives knowledge during reading will contribute to a reader's fluent reading and text comprehension.

As addressed above, it is noted in the light of several studies associated with the reading-comprehension skills that fluent word reading, connectives knowledge and fluent text reading are closely related to the comprehension skill. Two models can be accordingly suggested for these relations: The first model recognizes connectives knowledge as one dimension; the second model recognizes connectives knowledge along with its subdimensions. The following is the illustration of this model (see [Figure 1](#)). In this study, it was aimed to investigate the effect of connective usage knowledge, fluent silent word reading and fluent silent text reading on reading comprehension and direct effect of reading comprehension on academic achievement. For this purpose, the following hypotheses were developed:

- H1: Connective usage knowledge has a positive significant effect on fluent silent word reading, fluent silent text reading, and reading comprehension.
- H2: Fluent silent word reading and fluent silent text reading have a positive significant effect on reading comprehension.
- H3: Reading comprehension has a positive significant effect on academic achievement.

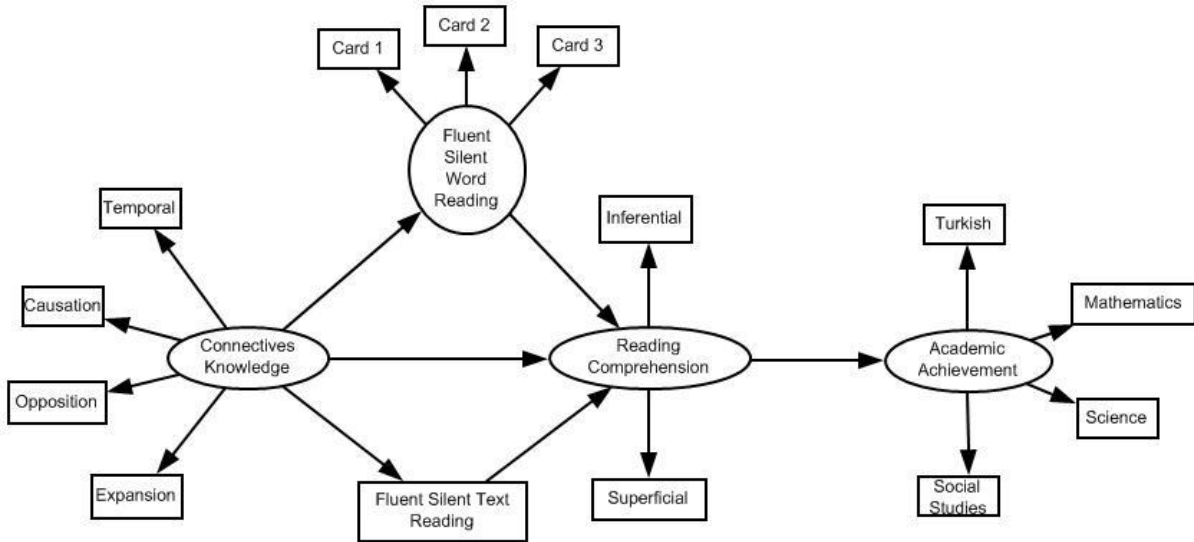


Figure 1. Proposed Model

2. METHOD

2.1. Participants

The study group of the research was composed of 263 secondary school students at a state school in Burdur province. This school was chosen because it is an easily accessible sample. 25.1% (f=66) of the students were fifth-graders, 24.7% (f=65) were sixth-graders, 24.3% (f=64) were seventh-graders, and 25.9% (f=68) were eighth-graders. 51.7% (f=136) of the students are girls and 48.3% (f=127) of them are boys. Ages of the students varied between 11 and 14. Accordingly, arithmetic means of the ages were 12.8 while the standard deviation was .26.

2.2. Instruments

Four assessment instruments and official achievement scores were used in this study:

2.2.1. Connective Knowledge Test

The items of the Connective Test developed by Çetinkaya, Ülper and Bayat (2014) were produced from sentences using side-by-side, top-and-bottom and discourse-marker connectives. Items under these three groups are based on another semantic classification. This classification is temporal, causation, opposition and expansion. There are 28 four-choice items in the instrument. Kuder-Richardson 20 (KR-20) reliability coefficient of the whole scale was found to be .74. Due to low reliability coefficients of the subscales, it was ensured that each factor was composed of three items at least (Comrey, 1988), and KR-20 reliability coefficients were .66 for the temporal factor, .71 for the causation factor, .62 for the opposition factor, and .89 for the expansion factor. Item difficulty values ranged from .47 to .73 and item discriminations ranged from .28 to .43.

2.2.2. Fluent Silent Word Reading Test

Developed by Ülper and Yağmur (2016), this test is composed of three reading cards. The first card includes 110 (+110), the second card 100 (+100), and the third card 90 (+90) actual words and fake words derived from those actual words in the same amount. In this test, students are expected to mark the actual words as many as possible in one minute. Cronbach's Alpha coefficient for the scores obtained from three cards is .96.

2.2.3. Fluent Silent Text Reading Test

Fluent Silent Text Reading Test measures the rate of silent and fluent reading of a given text. In this test, students are expected to read as many words as possible in one minute. The text in the test is narrative. The words used in the text can be known to that group of age. The text is on the independent reading level according to the formulation by Çetinkaya-Uzun (2014) in terms of readability. The experts were also consulted for opinion when choosing the text. It was seen in the preliminary practices that there was no significant difference between the scores obtained by two equivalent groups. This provides an important data of reliability.

2.2.4. Reading Comprehension Test

Developed by Ülper, Çetinkaya and Bayat (2017), the test includes 28 questions in total (11 multiple-choice, 3 fill-in-the-blank, 6 true-false, and 8 open-ended questions). Students are expected to answer all questions in the test. KR-20 reliability coefficients were found .76 for the Inference factor and .61 for the superficial text factor.

2.2.5. Academic Achievement

Official achievement scores obtained by the students in the courses of Turkish, Mathematics, Science and Social Studies were accepted as the academic achievement.

2.3. Procedure

All instruments were applied to the students under the control of the researcher on the basis of voluntariness within one week. It was explained to the students how to complete the tests before the application of all tests The Connectives Knowledge Test was applied first. All students completed the test in one class hour. On the next day, the Silent Word Reading Test was applied to the students. Card 1, card 2, and card 3 were handed to the students in this test, respectively. The students were admitted to the test in two separate groups and sat down to their places individually so that they could not be affected by each other. Following the necessary explanations, the practitioner started the one-minute duration of the test, and the students were asked to put down their pencils when the time was up. The Fluent Silent Text Reading Test was applied to the students on the next day. The students were admitted to the test one by one. It was explained to the students that they could go back and read any word again if they were to read it incorrectly. The text was handed to the students during the test, and they were asked to read it silently for one minute. The students were also asked to follow up what they read with their pencils, and if they were to go back, they would do it with their pencils so that their reading could be observed. In this process, the students were carefully watched and asked to draw a circle around the last read word once the time was up. On the last day, the Reading Comprehension Test was handed to the students, and they were asked to answer all questions. All students completed the test within one class hour. All the tests were applied in March 2017.

2.4. Data Analysis

Three different confirmatory factor analyses (CFA) were performed to see whether factor structures were confirmed on the sample by using the maximum estimate method of the AMOS 18 software. The first CFA examined whether the first-order factor structure (temporal, causation, opposition and expansion) was predicted by the second-order factor structure (Connectives Knowledge). The second CFA was carried out to find out whether the first-order factor structure (Card 1, Card, 2, and Card 3) was predicted by the second-order factor structure (Fluent Silent Word Reading). In the third CFA, it was examined whether the first-order factor structure (Superficial and Inference) was predicted by the second-order factor structure (Reading Comprehension).

Analysis of Covariance (ANCOVA) and Multivariate Analysis of Covariance (MANCOVA) and analyses were performed to determine whether the demographic variables grade level and gender had a significant effect on the scale scores. These analyses were conducted in SPSS 18 software. Levene's Test of Equality of Error Variances of ANCOVA analysis was not found significantly ($F_{(1-261)}=.38, p>.05$). Levene's Test values for MANCOVA analyses were ranged from .87 to 3.52 ($p>.05$). Box's Test of Equality of Covariance Matrices of MANCOVA was not significant ($F_{(10)}=1.71, p>.05$). Thus, ANCOVA and MANCOVA assumptions were met. Two models were tested in the Structural Equation Modeling (SEM), which is a strong method. In the first model, connectives knowledge was recognized as the independent variable while fluent silent word reading and fluent silent text reading were accepted to be the mediatory variables, and the reading comprehension was recognized as the dependent variable while academic achievement was accepted to be the output variable. Temporal, causation, opposition and expansion are the indicators of connectives knowledge were recognized as independent variables in the second model, and other measures were organized in the same way as in the first model. While connectives knowledge was included in the first model as the latent variable, subdimensions of connectives knowledge were examined as observed variables in the second model. Fluent Silent Text Reading was examined as the observed variable in both proposed models. Acceptability limits of CMIN/ χ^2 , RMR, RMSEA, NFI, CFI, GFI, and AGFI were considered in the evaluation of model fit (Byrne, 2010; Hair, Black, Babin, & Anderson, 2010; Hu & Bentler, 1995; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Schumacker & Lomax, 2004).

All scores were translated into standard scores for the analyses in the first place. No standard score lower than -3.0 and higher than +3.0 was observed (Bakeman & Robinson, 2014). It was additionally observed that linearity, singularity and multicollinearity assumptions of SEM analysis were met. Data of five students were excluded from the dataset due to high Mahalanobis d^2 . Then, Mahalanobis d^2 varied between 14.61 and 39.09 ($p>.001$). These findings and data were included in the proposed model. Sobel's z test (Sobel, 1982) was conducted to test the possible effect in case fluent silent word reading and fluent silent text reading had the mediatory effect between connectives knowledge and reading comprehension (Baron & Kenny, 1986; Kim & Bentler, 2006; Preacher & Hayes, 2004).

3. FINDINGS

3.1. Preliminary Analyses

3.1.1. Factor Structure of Connectives Knowledge Test

The CFA results showed good fit ($\chi^2_{(2)}=2.15, p>.05; \chi^2/df=1.07; RMR=.03; RMSEA=.01; NFI=.99; CFI=.99; GFI=.99; AGFI=.98$). The standardized parameter estimates differ between .38 and .71 and are significant at .001. In other words, connectives knowledge predicted temporal factor at .71, causation factor at .68, opposition factor at .38 and expansion factor at .66.

3.1.2. Factor Structure of Fluent Silent Word Reading Test

The CFA results indicated good fit of the Fluent Silent Word Reading Test ($\chi^2_{(2)}=0.01, p>.05; \chi^2/df=0.01; RMR=.00; RMSEA=.01; NFI=1.00; CFI=1.00; GFI=1.00; AGFI=.99$). The standard parameter estimates were found significant at .001. Fluent silent word reading predicted Card 1 at .93, Card 2 at .98 and Card 3 at .92.

3.1.3. Factor Structure of Reading Comprehension

The CFA results showed good fit of the factor structure of the Reading Comprehension Test ($\chi^2_{(2)}=0.01, p>.05; \chi^2/df=0.01; RMR=.00; RMSEA=.01; NFI=1.00; CFI=1.00; GFI=1.00$;

AGFI=.99). Reading comprehension predicted inferential at .93 and Superficial at .98. The standard parameter estimates were found significant at .001.

3.1.4. Effects of Demographics on Measures

Gender and grade level were found to be significant on dependent variables in analyses conducted without controlling gender or grade level. Wilks Lambda= 2.05, $p < .05$, $\eta^2 = .06$ for the gender effect and Wilks Lambda= 26.14, $p < .001$, $\eta^2 = .45$ for the grade level effect. Grade level was found to have a statistically significant effect on subscales of connectives knowledge in the results of MANCOVA performed with students' genders being kept constant (Wilks Lambda= 16.06, $p < .001$, $\eta^2 = .20$). Grade level's partial eta-squared levels were found ($\eta^2 = .25$) on the temporal factor, ($\eta^2 = .32$) on the causation factor, ($\eta^2 = .22$) on the opposition factor, and ($\eta^2 = .27$) on the expansion factor. Bonferroni test showed that fifth-grade level was different from all other levels in all factors. The results indicated that connectives knowledge increased as the grade level increased. Gender was found to have no statistically significant effect on subscales of connectives knowledge in the results of MANCOVA performed with students' grade levels being kept constant (Wilks Lambda= .88, $p > .05$, $\eta^2 = .01$).

Grade level was found to have a statistically significant effect on subscales of silent word reading test in the results of MANCOVA performed with students' genders being kept constant (Wilks Lambda= 59.21, $p < .001$, $\eta^2 = .40$). Grade level's partial eta-squared levels were found ($\eta^2 = .71$) on Card 1, ($\eta^2 = .73$) on Card 2 and ($\eta^2 = .72$) on Card 3. Bonferroni test showed that fifth-grade level was different from all other levels in all factors. The results indicated that achievement of fluent silent word reading increased as the grade level increased. Gender was found to have a statistically significant effect on subscales of connectives knowledge in the results of MANCOVA performed with students' grade levels being kept constant (Wilks Lambda= 2.22, $p < .05$, $\eta^2 = .02$). The results were in favor of the girls.

Grade level was found to have a statistically significant effect on fluent silent text reading test in the results of ANCOVA performed with students' genders being kept constant ($F = 175.25$, $p < .001$, $\eta^2 = .67$). Bonferroni test showed that fifth-grade level was different from all other levels in all factors. According to the results, achievement of fluent silent word reading increased as the grade level increased. Gender was found to have a statistically significant effect on fluent silent text reading in the results of ANCOVA performed with students' grade levels being kept constant ($F = 7.96$, $p < .01$, $\eta^2 = .03$). The results were in favor of the girls.

Grade level was found to have a statistically significant effect on subscales of reading comprehension test in the results of MANCOVA performed with students' genders being kept constant (Wilks Lambda= 22.69, $p < .001$, $\eta^2 = .21$). Grade level's partial eta-squared levels were found ($\eta^2 = .28$) on the inferential factor, ($\eta^2 = .25$) on the superficial factor, and ($\eta^2 = .72$) on Card 3. Bonferroni test showed that fifth-grade level was different from all other levels in all factors. The results indicated that reading comprehension increased as the grade level increased. Gender was found to have no statistically significant effect on subscales of reading comprehension test in the results of MANCOVA performed with students' grade levels being kept constant (Wilks Lambda= .11, $p > .05$, $\eta^2 = .001$).

Grade level was found to have a statistically significant effect on subscales of academic achievement in the results of MANCOVA performed with students' genders being kept constant (Wilks Lambda= 9.42, $p < .001$, $\eta^2 = .13$). Grade level's partial eta-squared levels were found ($\eta^2 = .28$) on the Turkish course, ($\eta^2 = .30$) on the Mathematics course, ($\eta^2 = .31$) on the Science course, and ($\eta^2 = .26$) on the Social Studies course. Bonferroni test showed that fifth-grade level was different from all other levels in all factors. According to the results, students' academic achievement increased as the grade level increased. Gender was found to have no statistically significant effect on subscales of reading comprehension test in the results of

MANCOVA performed with students' grade levels being kept constant (Wilks Lambda= .48, $p > .05$, $\eta^2 = .008$). Arithmetic means and standard deviations obtained in the measures are shown in Table 1.

Table 1. Arithmetic Means and Standard Deviations of Measures by Gender and Grade Levels

		n	Connectives Knowledge		Silent Word Reading		Silent Text Reading		Reading Comprehension		Academic Achievement	
			M	SD	M	SD	M	SD	M	SD	M	SD
Grade Level	5	64	5.42	3.33	54.35	5.06	125.78	6.87	11.20	3.91	293.04	55.95
	6	64	9.32	1.79	65.95	4.44	137.85	6.48	14.35	2.34	342.03	31.90
	7	63	9.76	.92	69.79	1.52	141.85	4.07	15.65	1.88	345.79	25.70
	8	67	10.20	1.14	74.32	4.37	153.31	9.53	16.61	1.93	356.26	25.54
Gender	Female	134	8.79	2.80	66.62	8.05	140.73	12.00	14.47	3.06	336.26	40.14
	Male	124	8.58	2.75	65.71	8.92	138.90	12.29	14.47	3.61	332.58	48.01

3.2. Measurement Model

The measurement model was established on four latent variables and one observed variable. Temporal, causation, opposition and expansion which are four indicators of connectives knowledge; Card 1, 2, and 3 which are three indicators of silent word reading; and silent text reading were included in the measurement model as the observed variables whereas inferential and superficial which are two indicators of reading comprehension; and Turkish, Mathematics, Science and Social Studies courses' achievement grades which are four indicators of academic achievement were included in the measurement model. The goodness-of-fit indexes were found to be within the good fit limits ($\chi^2_{(61)} = 87.24$, $p > .05$; $\chi^2/df = 1.43$; RMR=.06; RMSEA=.04; NFI=.99; CFI=.99; GFI=.99; AGFI=.92). Factor loads varied between .53 and .97. It was also observed that all standardized parameter estimates were significant at .001.

3.3. Structural Model

Regarding the goodness-of-fit indexes of the two proposed model, the fit indexes of Model 2 ($\chi^2_{(54)} = 57.64$, $p < .05$; $\chi^2/df = 1.06$; RMR=1.04; RMSEA=.01; NFI=.99; CFI=.99; GFI=.97; AGFI=.94) were found better than the fit indexes of Model 1 ($\chi^2_{(65)} = 161.15$, $p < .05$; $\chi^2/df = 2.47$; RMR=2.19; RMSEA=.07; NFI=.96; CFI=.97; GFI=.92; AGFI=.87). Causations between connectives knowledge and reading comprehension and between silent text reading and reading comprehension were excluded from Model 1. After the proposed modifications had been done, the fit indexes achieved the good fit. According to Figure 2 and Table 2, connectives knowledge predicted fluent silent word reading ($\beta = .57$, $t = 6.12$, $p < .001$) and fluent silent text reading ($\beta = .77$, $t = 9.29$, $p < .001$); fluent silent word reading predicted reading comprehension ($\beta = .83$, $t = 13.21$, $p < .001$), fluent silent text reading predicted fluent silent word reading ($\beta = .48$, $t = 6.80$, $p < .001$), and reading comprehension predicted academic achievement ($\beta = .84$, $t = 12.68$, $p < .001$) significantly.

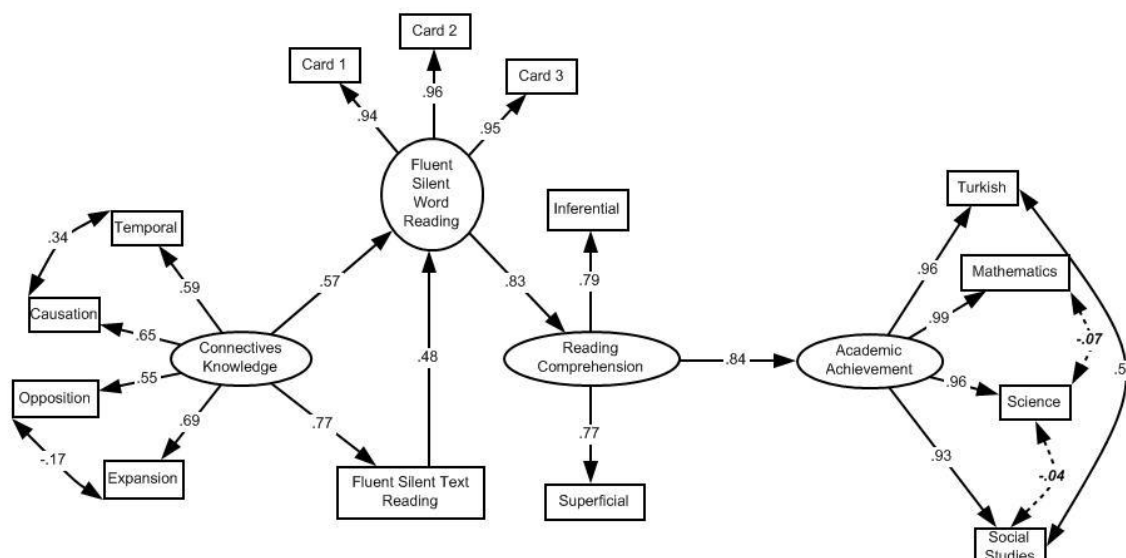


Figure 2. Results of Proposed Model 1

Note: Dashed lines and bold italic parameters are not statistically significant ($p > .05$).

Table 2. Results of Model 1’s SEM Analysis

Dependent Variables		Independent Variables	Estimate	Error	<i>t</i>	β	<i>p</i>
SITEREAD	<---	Conn._Know.	19.99	2.15	9.29	.77	***
SIWOREAD	<---	Conn._Know.	3.59	.58	6.12	.57	***
SIWOREAD	<---	SITEREAD	.11	.01	6.80	.48	***
Read._Comp.	<---	SIWOREAD	.45	.03	13.21	.83	***
Acad._Achieve.	<---	Read._Comp.	5.50	.43	12.68	.84	***

*** $p < .001$

The results obtained in the analyses of Model 2 are shown on Figure 3 and presented in Table 3. Following the proposed modifications, the fit indexes of Model 2 was found to be better than the fit indexes of Model 1. The proposed modifications are shown on Figure 3. Two of the standardized parameter estimates were not found statistically significant. One of these estimates, the temporal factor of connectives knowledge did not significantly predict fluent silent word reading ($\beta = .05, t = 1.61, p > .05$), and the other one, which is fluent silent text reading did not significantly predict reading comprehension ($\beta = -.10, t = -.89, p > .05$). All other standardized parameter estimates were found statistically significant. Differently from Model 1, it was seen in Model 2 that all factors of connectives knowledge significantly predicted reading comprehension. Moreover, fluent silent text reading predicted fluent silent word reading ($\beta = .72, t = 22.38, p < .001$) more strongly. Sobel’s *z* test was performed to test whether fluent silent word reading had a mediatory effect between connectives knowledge factors and reading comprehension. Fluent silent word reading was found to have a mediatory effect between causation and reading comprehension ($z = 2.41, p < .01$), opposition and reading comprehension ($z = 2.31, p < .05$), and expansion and reading comprehension ($z = 2.73, p < .01$).

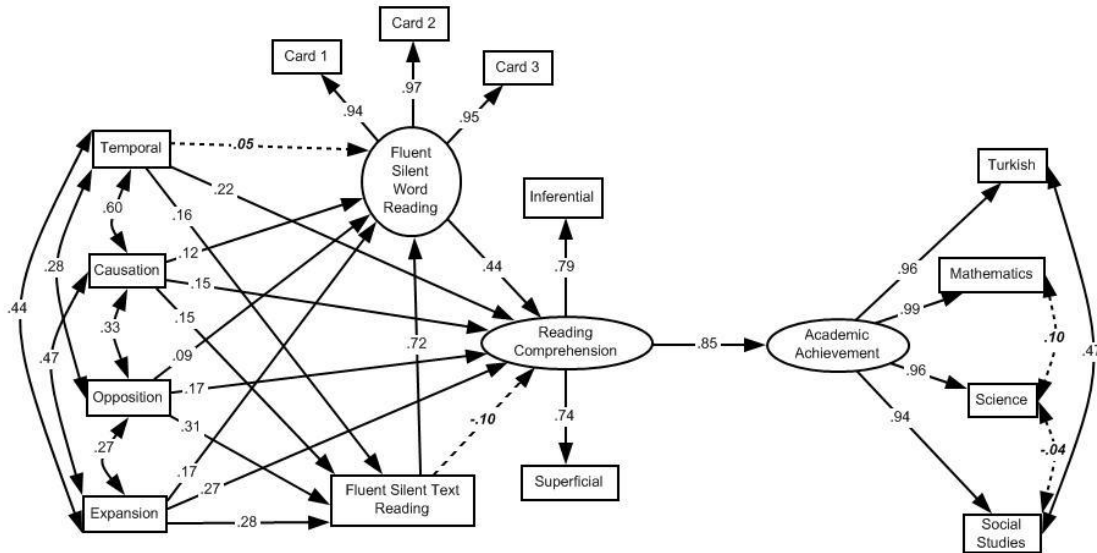


Figure 3. Results of Proposed Model 2

Note: Dashed lines and bold italic parameters are not statistically significant ($p > .05$).

Table 3. Results of Model 2’s SEM Analysis

Dependent Variables		Independent Variables	Estimate	Error	<i>t</i>	β	<i>p</i>	Sobel's <i>z</i>
SITEREAD	<---	Expansion	5.07	.99	5.08	.28	***	
SITEREAD	<---	Opposition	3.51	.58	6.04	.30	***	
SITEREAD	<---	Causation	1.72	.73	2.34	.14	.019	
SITEREAD	<---	Temporal	2.03	.74	2.73	.16	.006	
SIWOREAD	<---	Temporal	.13	.08	1.61	.05	.107	
SIWOREAD	<---	Causation	.33	.08	3.94	.11	***	2.41**
SIWOREAD	<---	Opposition	.24	.07	3.54	.09	***	2.31*
SIWOREAD	<---	Expansion	.73	.11	6.14	.16	***	2.73**
SIWOREAD	<---	SITEREAD	.17	.00	22.38	.72	***	
Read._Comp.	<---	SIWOREAD	.23	.07	3.06	.44	.002	
Read._Comp.	<---	Temporal	.35	.07	4.59	.22	***	
Read._Comp.	<---	Causation	.23	.07	2.98	.15	.003	
Read._Comp.	<---	Opposition	.24	.06	3.78	.17	***	
Read._Comp.	<---	Expansion	.64	.12	5.29	.27	***	
Read._Comp.	<---	SITEREAD	-.01	.01	- .89	-.10	.370	
Acad._Achieve.	<---	Read._Comp.	5.62	.40	13.82	.85	***	

*** $p < .001$, ** $p < .01$, * $p < .05$

4. DISCUSSION AND CONCLUSION

It was concluded that students’ connectives knowledge increased as their grade levels increased. Higher grade levels also meant higher levels of fluent silent word reading, fluent silent text reading, reading comprehension and academic achievement. It was found that fluent silent text reading was in favor of the girls and their scores were higher.

The model established with the factors of connectives knowledge showed better fit. Only the temporal factor of connectives knowledge did not predict fluent silent word reading significantly. Factors of causation, opposition and expansion significantly predicted fluent silent word reading, fluent silent text reading and reading comprehension. These results highly coincide with the findings of few researches in the Turkish literature. In the study conducted

by Gençer (2013) to examine the relationship between connectives in the text and reading comprehension, reading comprehension scores of the poor readers were found negative significantly correlated to the connectives that report “opposition” and “expansion”. In other words, higher number of connectives in the text meant lower reading comprehension of the poor readers. The main reason for this is that poor readers cannot process connectives in the text.

It was found that fluent silent word reading was a partial mediator in the relationship between connectives knowledge factors of causation, opposition and expansion and reading comprehension. In the Turkish literature (*see* Yılmaz, 2008), it was observed that the activity of having students read the words in a simple way which they misread in the text by writing down them on cards with the word repetition technique had a positive impact both on reading fluency and elimination of reading errors and comprehension. The study performed by Çetinkaya, Ülper and Yağmur (2015) concluded that fluent silent word reading was correlated to comprehension. It is also known that studies in foreign languages have similar results (*see* Yılmaz, 2008). How the students who began to read the words automatically through the word repetition technique improved their reading skills refers to a similar situation that fluent word reading skill is closely related to comprehension. The presence of such relationship is remarkable in the foreign literature (Kim, Wagner, & Lopez, 2012; Verhoeven & Leeuwe, 2008). In a study, which concluded that there is a high-level relationship between fluent word reading and comprehension, the relationship is shown .50 at the lowest and .87 at the highest (*see* Castillo et al., 2009). Coincidence of these findings with the findings of our research is important in that it refers to similar situations in foreign languages. Another study that can be associated with the prediction of comprehension by word reading skill was the study of Yıldırım, Yıldız and Ateş (2011). In their study, participants’ lexical knowledge was found moderately correlated to narrative text comprehension and highly correlated to informative text comprehension. Since high levels of lexical knowledge are important for student to recognize words and read more fluently, it is obvious that this relationship indirectly refers to the fluent word reading-comprehension relationship. Hence, both oral and silent reading fluency is regarded as being associated with comprehension in the literature.

Considering the studies on fluent oral word reading both in Turkish and foreign literature, fluent word reading positively affects comprehension, individuals who can read a text fluently or become a fluent reader through the education have higher comprehension levels or there is an interaction in between (*see* Baştuğ & Keskin; 2013; Başaran, 2013; Fuchs, Fuchs, Hosp, & Jenkins, 2001; Pikulski & Chard, 2005;). According to the finding of this research, fluent silent text reading did not predict reading comprehension significantly. There can be two explanations to the case: The first is about the subject being discussed in the literature. Accordingly, do reading fluency predicts comprehension, or can individuals read fluently because they can comprehend well? Some researchers argue that this is a two-way relationship (*see* Dowhower, 1987; Yıldız, 2013). Yıldız (2013) explored a two-way relationship for the Turkish language. The second is that the studies in the literature generally conducted through oral reading. The general opinion is that oral reading predicts comprehension. However, fluent reading is not performed only orally but also in a silent manner. It is, on the other hand, apparent that prosodic qualities cannot be observed in silent reading fluency. In the study conducted by Jenkins and Jewell (1993) on the relationship between fluent silent reading and comprehension, fourth-grade students’ fluent silent reading levels were found weakly correlated to their comprehension levels ($r=.38$), and second-grade students’ fluent silent reading levels were strongly correlated to their comprehension levels ($r=.76$). This finding does not coincide with the finding of our research. Yet, it is remarkable that there is no study on this subject in the Turkish literature. As many studies on the fluent silent text reading-comprehension relationship as in oral reading are required to achieve a literal knowledge on the subject. Only then it will

be possible to provide more concrete explanations of the relationship between fluent silent text reading and comprehension.

This research concluded that reading comprehension strongly and significantly predicted academic achievement. Similarly, Yıldız (2013) confirmed the hypothesis that reading comprehension has a significant effect on academic achievement. Likewise, Ural and Ülper (2013) drew attention to the relationship between reading comprehension skill and mathematical modeling. Akay (2004) and Özdemir and Sertsöz (2006) remarkably explored a similar relationship in terms of mathematical problem solving. Bayat, Şekercioğlu and Bakır (2014) found that reading comprehension achievement significantly predicted the science course achievement.

Another related study compared students' score averages of reading comprehension with their achievements in the courses of Turkish, Mathematics, Social Studies, and Science and Technology. The study in question observed that students' reading comprehension achievements were statistically correlated to their achievements in the courses of Turkish, Mathematics, Social Studies, and Science and Technology (Yılmaz, 2011). Again, it was explored in another research that grade averages of the students who like reading books were higher than the students who do not (Yılmaz, 2012). The common reference point of these studies is that academic achievement requires sufficient level of comprehension. Coincidence between all these findings and the findings achieved in our research indicates the dominant role of comprehension in academic achievement.

It is possible that this research could be taken up in a wider frame and also be a source for other studies. In this context, similar studies can be done with different sample groups, and another model proposal can be made based on some other variables that explain the reading. The limitation of the present study is that the data were obtained from secondary school's students at a state school in Burdur province. Future studies should be carried out based on a larger number of students obtained from different schools and different provinces and in order to provide more comprehensive results.

ORCID

Hakan Ülper  <https://orcid.org/0000-0002-7067-599X>

5. REFERENCES

- Akay, A. A. (2004). *İlköğretim 2.sınıf öğrencilerinin okuduğunu anlama becerilerinin matematik problemlerini çözme başarısına etkisi [Effect of reading comprehension skills on mathematical problem solving among elementary second-grade students]*. İstanbul: Marmara University, Institute of Educational Sciences, Postgraduate Thesis.
- Bakeman, R. & Robinson, B. F. (2014). *Understanding statistics in the behavioral science*. Mahwah, New Jersey: Psychology Press.
- Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182.
- Başaran, M. (2013). Okuduğunu anlamanın bir göstergesi olarak akıcı okuma [Fluency reading as an indicator of reading comprehension]. *KUYEB*, 13(4), 2277-2290.
- Baştuğ, M. & Keskin, H. K. (2012). Akıcı okuma becerileri ile anlama düzeyleri (basit ve çıkarımsal) arasındaki ilişki [Relationship between fluency reading skills and comprehension levels (literal and inferential)]. *Ahi Evran University, Journal of Kırşehir Faculty of Education (KEFAD)*, 13(3), 227-244.

- Bayat, N., Şekerciöğlü, G., & Bakır, S. (2014). The Relationship Between Reading Comprehension and Success in Science. *Education and Science*, 39 (176), 457-466.
- Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). New York: Routledge, Taylor & Francis Group.
- Caccamisa, D., Snyder, L., & Kintsch, E. (2008). Constructivist theory and the situation model: Relevance to future assessment of reading comprehension. In C. C. Block, & S. R. Parris (Eds.), *Comprehension instruction: Research-based best practices* (2nd ed., pp. 80-97). NY: The Guilford Press. Chapple
- Castillo, J.M., Torgesen, J.K., Powell-Smith, K.A., & Al-Otaiba, S. (2009). Examining the decision reliability and validity of three reading fluency measures for predicting outcomes on statewide reading accountability tests. In R.K. Wagner, S. Schatsneider, & C. PhythianSence (Eds.), *Beyond decoding: The behavioral and biological foundations of reading comprehension* (pp. 195-223). New York, NY: Guilford Press.
- Comrey, A. L. (1988). Methodological contributions to clinical research. Factor-analytic methods of scale development in personality and clinical psychology. *Journal of Consulting and Clinical Psychology*, 56(5), 754-761.
- Çetinkaya, G. & Uzun, L. (2011). Türkçe Ders Kitaplarındaki Metinlerin Okunabilirlik Özellikleri [Readability Qualities of Turkish Course Book Texts], Ed. Hakan Ülper, *Türkçe Ders Kitabı Çözümlemeleri [Analyses of Turkish Course Book]*, Ankara: PegemA yay.
- Çetinkaya, G., Ülper, H., & Bayat, N. (2014). Bağlayıcı testinin geliştirilmesi ve öğrencilerin bağlayıcı bilgisinin çeşitli değişkenlere göre incelenmesi [*Developing Connectives Test and examining students' connectives knowledge based on various variables*] *International Journal of Language Academy*, 2(3), 88-98.
- Çetinkaya, G., Ülper, H., & Yağmur, K. (2015). Öğrencilerin Doğru ve Akıcı Sessiz Sözcük Okuma Becerileriyle Kavrama Başarıları Arasındaki İlişki [Relationship between Students' Reading Accuracy and Fluency and Comprehension Achievements], *İlköğretim Online*, 14(3), 993-1004.
- Dowhower, S. (1987). Effects of repeated reading on second-grade transitional readers' fluency and comprehension. *Reading Research Quarterly*, 22, 389-406.
- Flores d'Arcadais, G. D. (1984). Lexical knowledge and word recognition: Children's reading of function words. *Visible Language*, 18(4), 359-377.
- Fuchs, L.S., Fuchs, D., Hosp, M.D., & Jenkins, J. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading*, 5, 239– 259. Geva, E.; Ryan, E., B. (1985). Use of conjunctions in expository text by skilled and less skilled readers. *Journal of Reading Behavior*, 17(4), 331-345.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Upper Saddle River, New Jersey: Pearson Prentice Hall.
- Hu, L. T. & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp.76-99). Thousand Oaks, CA: Sage Publications.
- Jenkins, J. R. & Jewell, M. (1993). Examining the validity of two measures for formative teaching: Reading aloud and maze. *Exceptional Children*, 59, 421-432.
- Kim, K. H. & Bentler, P. M. (2006). Data modeling: Structural equation modeling. In J. L. Green, G. Camilli, & P. B. Elmore (Eds.), *Handbook of complementary methods in education research* (pp. 161-175). Mahwah, NJ: Lawrence Erlbaum.

- Kim, Y. S., Wagner, R. K., & Lopez, D. (2012). Developmental relations between reading fluency and reading comprehension: A longitudinal study from Grade 1 to Grade 2. *Journal of Experimental Child Psychology, 113*, 93-111.
- Kurtul, K. (2011). *Türkçe ve İngilizce'deki Bağlaçların Yazılı Metinlerde Kullanımı [Use of Turkish and English Connectives in Written Texts]*. (Unpublished doctoral thesis) Ankara University, Institute of Social Sciences, Ankara.
- Littlefield, H. (2005). Lexical and functional prepositions in acquisition: Evidence for a Hybrid Category. Boston University Conference on Language Development 29, Online Proceedings Supplement.
- McNamara, D.S., Kintsch, E., Songer, N.B., & Kintsch, W. (1996). Are good texts always better? Text coherence, background knowledge, and levels of understanding in learning from text. *Cognition and Instruction, 14*, 1-43.
- National Reading Panel. (2000). *Teaching children to read: An evidence-based assesment of the scientific research literature on reading and its implications for reading instruction*. Washington, DC: The National Institute of Child Health and Human Development.
- Noordman, L. G., Vonk, W., & Kempff, H. J. (1992). Causal inferences during the reading of expository texts. *Journal of Memory and Language, 31*(5), 573-590.
- Oakhill, J., Cain, K., & Elbro, C. (2015). *Understanding and teaching reading comprehension: A handbook.*, New York: Routledge.
- Özdemir, A.Ş. & Sertsöz, T. (2006). Okuduğunu anlama davranışının kazandırılmasının matematik başarısına etkisi [How bringing reading comprehension behavior to students affect mathematics achievement]. *M.U. Atatürk Faculty of Education Journal of Educational Sciences, 23*, 237-257.
- Perfetti, C. A. (1998). Two basic questions about reading and learning to read. In P. Reitsma & L. Verhoven (Eds.) *Problems and interventions in literacy development* (pp. 15-48). Dordrecht, The Netherlands: Kluwer-Academic Publisher.
- Perfetti, C. (2007). Reading ability: Lexical quality to comprehension. *Scientific Studies of Reading, 11*(4), 357-383.
- Pikulski, J. J. & Chard, D. J. (2005). Fluency: Bridge between decoding and reading comprehension. *Reading Teacher, 58*, 510-519.
- Preacher, K. J. & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers, 36*(4), 717-731. <http://dx.doi.org/10.3758/BF03206553>
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online, 8*(2), 23-74.
- Schumacker, R. E. & Lomax, R. G. (2004). *Beginner's guide to structural equation modeling* (2nd ed.). New York: Psychology Press, Taylor & Francis Group.
- Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equations models. *Sociological Methodology, 13*, 290-312.
- Smith, T. C. & Witten, I. H. (1993). Language inference from function words (Computer Science Working Papers 93/3). Hamilton, New Zealand: Department of Computer Science, University of Waikato.
- Sanders, T. J. M. & Noordman, L. G. M. (2000). The role of coherence relations and their linguistic markers in text processing. *Discourse Processes, 29*(1), 37-60.
- Ural, A. & Ülper, H. (2013). İlköğretim Matematik Öğretmeni Adaylarının Matematiksel Modelleme ile Okuduğunu Anlama Becerileri Arasındaki İlişkinin Değerlendirilmesi [Evaluation of the Relationship between Preservice Elementary Mathematics Teachers'

- Mathematical Modeling and Reading Comprehension Skills]. *Kuramsal Eğitim Bilim Dergisi - Journal of Theoretical Educational Science*, 6(2), 214-241.
- Ülper, H. & Yağmur, K. (2016) Akıcı sessiz sözcük okuma testinin geliştirilmesi [Developing the fluent silent word reading test]. *İlköğretim Online*, 15(2), 581-593.
- Ülper, H., Çetinkaya, G., & Bayat, Nihat (2017). Okuduğunu anlama testinin geliştirilmesi [Developing the reading comprehension test]. *Ahi Evran University, Journal of Kırşehir Faculty of Education (KEFAD)*, 18(1), 175-187.
- van Silfhout, G., Evers-Vermeul, J., & Sanders, T. (2015) Connectives as processing signals: how students benefit in processing narrative and expository texts. *Discourse Processes*, 52(1), 47-76
- Verhoeven, L. & Leeuwe, J. V. (2008). Prediction of the development of reading comprehension: a longitudinal study. *Applied Cognitive Psychology*, 22, 407-423.
- Yıldız, M. (2013). Okuma motivasyonu, akıcı okuma ve okuduğunu anlamının beşinci sınıf öğrencilerinin akademik başarılarındaki rolü [Role of reading motivation, reading fluency and reading comprehension on fifth-grade students academic achievements], *Turkish Studies - International Periodical for The Languages, Literature and History of Turkish or Turkic*, 8/4, 1461-1478.
- Yıldırım, K., Yıldız, M., & Ateş, S. (2011). Kelime Bilgisi Okuduğunu Anlamanın Anamlı Bir Yordayıcısı mıdır ve Yordama Gücü Metin Türlerine Göre Farklılaşmakta mıdır? [Is Lexical Knowledge a Predictor of Reading Comprehension and Do its Predictiveness Differ by Types of Text?] *Kuram ve Uygulamada Eğitim Bilimleri*, 11(3), 1531-1547.
- Yılmaz, M. (2008). Kelime tekrar tekniğinin akıcı okuma becerilerini geliştirmeye etkisi [Effect of word repetition technique on improving the reading fluency skills]. *Turkish Journal of Educational Sciences*, 6(2), 323-350.
- Yılmaz, M. (2011). İlköğretim 4.sınıf öğrencilerinin okuduğunu anlama seviyeleri ile Türkçe, matematik, sosyal bilgiler ve fen ve teknoloji derslerindeki başarıları arasındaki ilişkinin belirlenmesi [Relationship between elementary fourth-grade students' reading comprehension levels and achievements in the courses of Turkish, mathematics, social studies, and science and technology]. *Dumlupınar University Journal of Institute of Social Sciences*, 29, 9-13.
- Yılmaz, B. (2012). Okuma Alışkanlığının Okul Başarısına Etkisi: Ankara Keçiören Atapark İlköğretim Okulu Öğrencileri Üzerine Bir Araştırma [How Reading Habit Affects School Achievement: Research on Students of Ankara Keçiören Atapark Elementary School]. Külcü, Ö., Çakmak, T. & Özel, N. (Ed.), *Prof. K. Gülbün Baydur'a armağan [A Gift to Prof. K. Gülbün Baydur]* (210-218). Ankara: Özyurt Matbaacılık.
- Zufferey, S., Mak, W., Degand, L., & Sanders, T. (2015). Advanced learners' comprehension of discourse connectives: The role of L1 transfer across on-line and off-line tasks. *Visible Language*, 18(31), 389-411.