Education and Science

Original Article

Vol 47 (2022) No 209 25-53

The Relationship Between Reading Fluency, Writing Fluency, Speaking Fluency, Reading Comprehension, and Vocabulary *

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Abstract

The aim of this study is to examine the relationships between reading fluency, writing fluency, speaking fluency, reading comprehension, and vocabulary. A correlational survey method was used in the research. The data for the study were collected in the 2018-2019 academic year. A total of 94 5th grade students from 9 different schools, 8 state schools and 1 private school, in the city center of Kars formed the study group and the socioeconomic levels of the students were homogeneous. According to the results, vocabulary is the skill with the highest number of correlations with other skills, which indicates the importance of vocabulary. Fluency skills had a relationship with each other in some dimensions such as accuracy and speed. Reading comprehension skills were correlated with other variables mostly in three dimensions (total score, scores for informative text, and scores for inferential questions), although not in all dimensions. The results of the study are discussed in light of the literature.

Keywords

Reading fluency
Writing fluency
Speaking fluency
Reading comprehension
Vocabulary

Article Info

Received: 03.26.2020
Accepted: 01.04.2022
Online Published: 02.09.2022

DOI: 10.15390/EB.2022.9609

Introduction

Language skills are considered as a whole in the Turkish teaching curriculum (Ministry of National Education [MoNE], 2006, 2009, 2019; Temizyürek & Balcı, 2015), but this does not mean that language is an indivisible whole (Berninger et al., 2006). The correlation values of the relationships between language skills or how they affect each other were widely investigated. In fact, the correlation and cause-effect relationships between some language skills were mentioned in reports published nationwide in the United States (Daane, Campbell, Grigg, Goodman, & Oranje, 2005; Gamse, Jacob, Horst, Boulay, & Unlu, 2008; National Reading Panel, 2000).

To date, the relationships between language skills were studied in many different dimensions. The relationships between reading-writing (Abbott & Berninger, 1993; Abbott, Berninger, & Fayol, 2010; Ahmed, 2011; Cho & Krashen, 2019; Cragg & Nation, 2006; Kandel, Soler, Valdois, & Gros, 2006; Kent, Wanzek, Petscher, Al Otaiba, & Kim, 2014; Murphy, 2016; Palmer, 2010; Shanahan & Lomax, 1986), reading-speaking (Auten, 1983; Cho & Krashen, 2019; Günaydın, 2020; Kent vd., 2014; Loban, 1963; Rodriguez-Aranda, 2003), reading-reading comprehension (Abbott vd., 2010; Baker, 1977; Fasano, 1985; Palmer, 2010; Shanahan & Lomax, 1986; Yamaç & Çeliktürk Sezgin, 2018; Yeo, 2008; Yıldırım, Rasinski, & Kaya, 2017), reading-vocabulary (Bandini, Bandini, & Neto, 2017; Cook, 2010; Katzir, Schiff, & Kim,

* This article is derived from Huzeyfe Bilge's PhD dissertation entitled "The relationships between reading, writing and speaking fluencies, reading comprehension and vocabulary", conducted under the supervision of İhsan Kalenderoğlu.

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2012; Kent vd., 2014; Murphy, 2016; Rountree, 2006; Shanahan & Lomax, 1986; Yazanoğlu, 2011), writing-speaking (Auten, 1983; Berninger vd., 2006; Cho & Krashen, 2019; Kent vd., 2014; Loban, 1963), writing-reading comprehension (Abbott & Berninger, 1993; Abbott vd., 2010; Ağın Haykır, 2012; Ahmed, 2011; Berninger vd., 2006; Cragg & Nation, 2006; Frey, 1993; Hudson, 2002; Murphy, 2016; Palmer, 2010; Roberta, 1983; Shanahan, 1984), writing-vocabulary (Hestad, 2014; Kent vd., 2014; Murphy, 2016; Rodriguez-Aranda, 2003; Shanahan, 1984; Shanahan & Lomax, 1986; Yazanoğlu, 2011), speaking-reading comprehension (Berninger vd., 2006), speaking-vocabulary (de Jong & Bosker, 2013; Fillmore, 1979), and reading comprehension-vocabulary (Beck, Perfetti, & McKeown, 1982; Murphy, 2016; Oakhill, Cain, & Elbro, 2015; Oslund, Clemens, Simmons, Smith, & Simmons, 2016; Quinn, 2012; Shanahan, 1984; Shanahan & Lomax, 1986; Yıldırım, Yıldız, & Ateş, 2011) were investigated in various contexts. Studies found correlations between language skills in opposite directions (negative-positive) and at changing rates (significant-not significant). The number of skills accepted to be related to each other by the general population of academics is few in number. There are different interpretations and findings about the relationships between some skills. As a result of research, it cannot be concluded that the relationships between language skills are clearly revealed. Discussions about the relationships between some language skills continue among researchers (e.g., for a discussion on the writing-reading relationship, see Ahmed, 2011; Graham & Perin, 2007) and there are relationships between language dimensions that have not yet been researched or that are relatively under-researched.

One of the dimensions of language skills that has not been studied extensively yet is the dimensions of fluency in language skills and their relationship to vocabulary and reading comprehension. Revealing these relationships will contribute to finding ways to help children succeed in lessons and exams because there is a relationship between language fluencies (and their sub-elements) and reading comprehension and academic success (Barnett, Stainthorp, Henderson, & Scheib, 2006; Björn, Aunola, & Nurmi, 2016; Buck & Torgesen, 2003; Cimmiyotti, 2013; Kıvrak, 2014; Montgomery, 2007; Özdemir & Sertsöz, 2006; Yıldız et al., 2019). Considering the studies conducted especially in Turkey, there are limited studies about the relationship between fluencies in language skills, vocabulary and reading comprehension, and there is a need to increase the information on this subject.

This study aimed to examine the relationships between 5th-grade students' reading fluency, writing fluency, speaking fluency, vocabulary, and reading comprehension. Knowing the relationships between these skills is important for two basic reasons: (1) discovering important relationships can lead to new activities that can improve more than one skill at the same time, and (2) if enough information can be obtained about the relationships between language skills, difficulties with these skills can be detected more easily in the early stages. By measuring and evaluating one language skill, it may be possible to make predictions about the others. Thus, the increase in the gap between students who have reached a sufficient level in related skills and who are behind can be prevented. This is important for language skills, as the gaps between students will increase as diagnoses required for language skills are delayed. This difference may cause students who have difficulties not to achieve what is expected of them in education. To find the relationships between these skills, answers to the following questions were sought:

Q1-Are there significant relationships between reading fluency and writing fluency, speaking fluency, reading comprehension (of informative and narrative text), and vocabulary?

Q2-Are there significant relationships between writing fluency and speaking fluency, reading comprehension (of informative and narrative text), and vocabulary?

Q3-Are there significant relationships between speaking fluency and reading comprehension (of informative and narrative text) and vocabulary?

Q4-Are there significant relationships between reading comprehension of informative and narrative texts and vocabulary?

Automaticity and Fluency

It is accepted that actions taken in daily life or processes in the mind (Moors & Houwer, 2007) are based on two different types of information: controlled and automatic (Clore & Ketelaar, 1997). Since there is effort and attention in controlled processes, the person has difficulty in carrying out these types of tasks. For example, a person who wants to knit for the first time has to focus seriously on holding the needles, controlling the wool, and knitting. Such a process is likely to be quite laborious, slow, and error-prone. However, it is accepted that many behaviors or mental processes in life are automatic (Bargh, 1997; Tzelgov, 1997). Many physical activities such as walking, running, or climbing stairs, and mental processes such as remembering the name of a family member (for example, a child) and remembering the way home are quite easy, usually accurate, and fast (automatic).

Automaticity is defined as the quality of being able to perform a mental process or a behavior quickly, effortlessly, unintentionally, and without being affected by other mental processes/behaviors (Spafford, Pesce, & Grosser, 1998; VandenBos, 2015). To test whether a behavior or mental process is automatic, it is necessary to look at whether another behavior or mental process is performed at the same time (LaBerge & Samuels, 1974). For example, a person who can cook while singing must be automated in at least one of these two tasks. In other words, at least one task must be repeated enough and the person must be automated in the sub-processes of that task. If a person who is not very good at cooking, deals with other tasks at the same time, it either results in the food not being as desired or increases the possibility of doing the other job wrong. From this point of view, automaticity is vital for the fast, accurate and effortless execution of many of the processes in our minds or our daily activities.

Although more than a hundred years have passed since the first research on automaticity, there has been more interest in automaticity recently, especially after the 1980s (Logan, 1997; Moors & Houwer, 2006; Tzelgov, 1997). Automaticity is a very comprehensive and important concept in all fields of psychology, which is associated with different topics such as attention, memory, and reading skills (Moors & Houwer, 2006) because automaticity has areas of use both in daily life and in mastering certain skills.

Whereas automaticity has a very wide research area, some uncertainties remain in the literature. Quite different theories and approaches were proposed about the concept, and these approaches and theories have been updated or abandoned over time. For example, the features that should be added to the definition of automaticity were discussed and whether automaticity is the same to unconsciousness (Tzelgov, 1997). These differences are due to different reasons such as the subjects of the studies and the methods of investigation, and there is still no consensus today (Moors & Houwer, 2006, 2007).

The theories/approaches about automaticity that were proposed so far can basically be grouped according to two characteristics: those who treat automaticity as a feature and those who treat it as a process. According to the view that attempts to explain automaticity in terms of certain features, behaviors are automatic if they include certain features, but not automatic if they do not. For example, a behavior or mental process is described as "automatic" if it is fast, does not require attention, and is spontaneous, and "non-automatic" if it is slow, requires attention, and is controlled. An automatic behavior has all of these properties, while another non-automatic behavior has none of them. In short, there are two possibilities for each behavior or mental process. On the other hand, the mechanism-based approach, which deals with automaticity as a process, considers automaticity as a memory phenomenon and explains automaticity as the reduction of the related behavior in the mind from multiple steps (algorithm calculations) to a single step (direct recall). For example, a child who has just learned the addition process in mathematics thinks and decides one by one in each addition process. However, after practice with the same addition question over and over, the child can obtain the result of the operation with a single step, thanks to the direct retrieval of the result from memory (Logan, 1997, 2018; Moors & Houwer, 2006, 2007).

As a result, the consensus of many researchers regarding automaticity is that it is easy, fast and leads to correct behaviors or mental operations. Non-automatic processes require more attention and effort. A behavior or mental process becomes automatic with practice and exercise. Therefore, repetition/practice is required to make a mental process or an action easy, fast, and accurate.

As with most skills, automaticity is required in language skills. If a learner is sufficiently automatic in language skills, they can devote most of their attention to transmitting/receiving the message. At this stage, the term "fluency" emerges. Although it is defined in different ways in different fields, "fluency" can be defined as "language proficiency" when it is about language skills, and it can be said that fluency also includes a certain speed in language skills (Biancarosai & Shanley, 2016; Brand & Brand, 2006). In short, fluency is about not having difficulties in writing, reading, speaking and listening (Wolfe-Quintero, İnagaki, & Kim, 1998). Therefore, being competent in language skills means being fluent.

Reading Fluency

Reading fluency emerged at the end of the 19th century in the reading research literature (Rasinski, Reutzel, Chard, & Linan-Thompson, 2011). Reading fluency attracted more attention after the National Reading Panel (2000) dedicated a separate section to it. It was emphasized that reading fluency generally has an important relationship with reading comprehension, and it is widely accepted that fluent readers understand what they read better (Ahmed, 2011; Johnson, 2012; Murphy, 2016; Yıldırım et al., 2017). In this respect, reading fluency acts as a vehicle on the way to understanding what you read.

Reading fluency is considered as speed and accuracy after LaBerge and Samuels's (1974) theory of automaticity. Various objections to the scope of this reading fluency definition were made and it was stated that prosody should also be included (Dowhower, 1991). Today, when reading fluency is defined, speed, accuracy, and prosody are considered together (National Reading Panel, 2000; Rasinski, 2004, 2010; Schwanenflugel, Hamilton, Kuhn, Wisenbaker, & Stahl, 2004; Ulusoy, Ertem, & Dedeoğlu, 2011).

Rasinski (2010) stated that students who are below a certain level of accuracy can hardly understand the text. Speed, on the other hand, is an indicator of word recognition automaticity, and students who read below a certain speed are accepted in the risk group (Akyol, Yıldırım, Ateş, Çetinkaya, & Rasinski, 2014). Prosody, which includes elements such as intonation and emphasis, shows that the reader interprets and structures the text effectively (Rasinski, 2004). Some studies show that prosody has a higher relationship with reading comprehension than word recognition skills (Çetinkaya, Ateş, & Yıldırım, 2016).

The relationship between reading skills and other lessons (Björn et al. 2016; Korpershoek, Kuyper, & Werf, 2015; Obalı, 2009) and national exams (Buck & Torgesen, 2003; Doupone-Horvat, 2004) is remarkable for American and Slovenian students. This fact leads to the idea that students should be sufficiently advanced in terms of reading skills for academic success and job opportunities and therefore they should be able to read fluently.

Writing Fluency

Three sub-processes are common to all of the cognitive models proposed about the writing process: (a) generation of ideas, (b) writing down ideas (transfer), and (c) checking the written text (Beard, Myhill, Riley, & Nystrand, 2009). A glitch in one of these processes may affect the quality of the written text. For example, if a person spends most of their attention on typing letters, punctuation, or fetching words from long-term memory, they may forget their ideas. The more automatic the words are recalled from memory and converted into text, the less the load on working memory, and more space can be allocated to higher-level cognition processes (Berninger, 1999). In addition, people who have to pay too much attention to writing mechanics may face the danger of forgetting what they are writing, and in this case, the complexity and consistency of their text may be affected (Graham, Berninger, Abbott, Abbott, & Whitaker, 1997).

Writing fluency can be defined as being able to write quickly, effortlessly, and accurately (Hudson, 2002). While writing, working memory coordinates many processes such as goal setting, forming ideas, planning, checking, and reviewing word, sentence, and text structures (Berninger, 1999). To achieve the goals of writing, it is necessary to have more "space" in working memory. Otherwise, the writer can not achieve their intentions of writing because their memory is concerned with low-level processes such as remembering punctuation marks and words.

Writing fluency is used in different ways in studies. In some studies, elements of the content quality of writing such as the proper arrangement of ideas and the functionality of the writing (Atasoy, 2015) are measured as elements of writing fluency. This type of measurement considers writing fluency as a broad definition. Wolfe-Quintero et al. (1998) stated that fluency should be considered separately from accuracy and complexity, and it would be good to measure the number and ratio of units produced to calculate writing fluency. In some studies, the number of letters, syllables, words, sentences, and/or their ratios are used when measuring writing fluency (Berninger & Fuller, 1992; Graham et al., 1997; Hudson, 2002; Rosenthal, 2006). From this point of view, it can be concluded that there are two basic measurement approaches for writing fluency. According to the first approach, writing fluency is a skill that includes the quality of a produced composition (such as the harmony of ideas) and writing speed. In this view, besides speed and accuracy, data about the quality of the text are also collected. The second view focuses more on speed and accuracy. Various speed and time variables and correct spelling calculations are made for the text produced in this approach. The second view was adopted in this study.

Speaking Fluency

A speech is fluent to the extent that it is natural, normal, and automatic (Richards & Schmidt, 2010; Schmidt, 1991). In studies, it is mentioned that fluency is used in two senses: narrow and broad. While fluency in a broad sense –especially in a foreign language- means speaking at the highest level, fluency in a narrow sense –in a foreign language- is being able to speak at the speed of native speakers (Lennon, 1990). Speaking fluency is a skill rather than knowledge (Schmidt, 1991) and refers to performance (Lennon, 1990).

The fluency of a speech is associated with the processes in the mind about what will be said. Thornbury (2005) stated that the planning of speech and expressions can overlap. According to de Jong (2016), if something is said and the next thing to be said cannot be planned in the mind, stuttering occurs and this can cause speech to pause, slow down, or various speech errors to occur. Thus, automaticity is very important for the quality of speaking (Thornbury, 2005).

Possible reasons for a person's inability to speak fluently are processing load, editing processes, chatting with a stranger, age, and gender (Bortfeld, Leon, Bloom, Schober, & Brennan, 2001). Thinking too much about what to say and having difficulty with speaking (processing load), using working memory to control what will be spoken (editing) can cause the person to be unable to plan what to say next and fill the conversation with many fillers and pauses. These disfluencies and interruptions can cause the listener not to listen or be unable to understand the message.

Reading Comprehension

Reading comprehension is creating meaning from the expressions in the written text and is a constructive process (Duke & Carlisle, 2011). Reading comprehension is considered as an indispensable element of reading by most researchers (Brassell & Rasinski, 2008) and is considered crucial by the National Reading Panel (2000) in the development of a child's reading skills and therefore in education. Studies showing the relationship between reading comprehension and other lessons and exams (Baştuğ, 2014; Björn et al., 2016; Grimm, 2008; Kıvrak, 2014; Vilenius-Tuohimaa, Aunola, & Nurmi, 2008) supports the conclusion of the National Reading Panel (2000) about the relationship between reading comprehension and a child's education.

Reading comprehension is not a one-layer process. There are many factors such as word recognition skills, text reading fluency, word reading fluency, phonetic awareness, morphological awareness, expressive vocabulary, orthographic awareness, and working memory (Kim, 2015; Ribeiro, Cadime, Freitas, & Viana, 2016; Santos et al., 2017) that are related to reading comprehension. These elements show how the reading comprehension process is complex.

Although many researchers use different names, reading comprehension is usually measured in two stages: literal and inferential. Literal understanding is achieved as a result of associating the pieces of information explicitly given in the text with each other in the form of microstructures, thanks to reading words, phrases, and sentences accurately. Literal comprehension is necessary for deeper understanding but is not sufficient on its own because there are also implicit meanings in the text. Establishing semantic connections between microstructures lays the groundwork for structuring the macrostructures. These consist of information not explicitly stated by the author and are the essence of the text. In order to understand macrostructures, the reader must be able to make inferences. This kind of understanding is called inferential understanding. Literal questions are the easiest to answer, as they are found directly in the text. Inference-based questions, on the other hand, are based on the reader's interpretation, experience, and knowledge and are more complex to answer. Inferential questions are at the heart of the understanding process (Caldwell, 2008).

Vocabulary

Vocabulary means knowing the meaning of words in general, and it is a skill that develops throughout life and cannot be fully mastered (Kamil & Hiebert, 2005). Vocabulary is essential for other language skills such as reading comprehension (Bishop & Starkey, 2006; National Reading Panel, 2000; Oakhill et al., 2015; Stahl & Fairbanks, 1986) and reading (Bandini et al., 2017; Cena, 2009; McKeown, Beck, Omanson, & Perfetti, 1983).

In addition to studies showing a relationship between reading fluency and vocabulary (Kopponen et al., 2016; Santos et al., 2017), there are also studies showing that vocabulary teaching has no effect on reading fluency (Cena, 2009). McKeown et al. (1983) stated that the reason for the unrelatedness in studies that found no correlation between vocabulary and reading may be due to differences in vocabulary teaching. Words must be encountered many times in order to learn and use them (Karadağ, 2013; McKeown et al., 1983). Nagy (2005) stated that serious effort is required for the development of reading comprehension by increasing vocabulary. Therefore, short-term interventions may not lead to improvements in some language skills.

There are various methods for teaching vocabulary, but most researchers think that most words (written and spoken) are learned as a result of random encounters with the language. No matter how impressive the vocabulary teaching methods are, no method can ensure teaching of all the words necessary in life, but it should not be considered unnecessary to teach vocabulary directly (Cunningham, 2005).

Method

In this study, the statistical relationship between reading fluency, writing fluency, speaking fluency, reading comprehension, and vocabulary was examined. Data were collected from the participants and no intervention was made to the variables. Because there was no interference with the data, the findings can be considered to reflect the nature of existing relationships. Thus, this study was designed as correlational research (Fraenkel, Wallen, & Hyun, 2012). Correlational studies examine the relationships between at least two variables. A significant correlation indicates a simultaneous change in scores, either in the same or in the opposite direction. Positive correlation indicates that the change in one score will differ in the same direction as the change in another score, while negative correlation indicates an opposite difference between the scores. Correlation uses the score for one variable to predict how much the score for the other variable will increase or decrease.

Study Group

This study group consisted of 94 5th graders from Kars center. Data was collected in the 2018-2019 academic year from students in 9 schools, 8 state schools and 1 private school, who were randomly selected. One class from each school was included in the study. Students' socioeconomic levels were homogeneous as they differ from low to high. Students with a special learning disability diagnosis and those learning Turkish as a foreign language (children of immigrant families) were excluded. Descriptive statistics of the participants are shown in Table 1.

Table 1. Descriptive statistics of the study group

	N	%
Boys	40	42.6
Girls	54	57.4
Total	94	100

Data Collection Tools

Reading Fluency

In the study, a narrative text selected from the 5th grade Turkish textbook (Ağın Haykır, Kaplan, Kıryar, Tarakcı, & Üstün, 2017) was used within the scope of the curriculum-based assessment method (Deno, 1985). The text was one that the children had not read before and is a story that consisted of 200 words. Since the story was transferred in 11 point Cambria font to the A4 paper by the researcher, it did not include pictures, graphics, etc.

In order to collect data about reading fluency, students were taken to a room/class one by one and given one minute to read aloud. All readings were recorded. Students were told to read as "well" as they could, the goal was not to read fast. Despite this, fast readers were not interfered with. Three dimensions of reading fluency were measured: speed (in syllables), accuracy (rate), and prosody. In the calculation, firstly the total number of syllables was counted, and then reading errors were determined (Rasinski, 2010; Yıldız & Akyol, 2010). The number of syllables in the misread words was excluded from the total number of syllables. Thus, the "speed" variable was obtained. The ratio of the number of syllables in the words read correctly to the total number of syllables shows the "accuracy" variable. The Multidimensional Fluency Scale developed by Zutell and Rasinski (1991) was used to evaluate prosody. Two experts scored each student's prosody, but since the Kappa value, which examines consensus was low, the prosody variable was not included in the analysis. Calculations were made using one-minute readings.

Writing Fluency

There are two types of data collection methods for writing fluency: process-oriented and product-oriented. Process-oriented data collection refers to measurements between the start and end of writing. In this type of study, students are monitored as they write. In product-oriented data collection, measurements are made only on finished articles. In this study, a measurement was made on the finished writings of the students. To do this, students were given five different introductory sentences. Each of these sentences is an introduction to a story. The sentences are given below:

1. One day my father came home smiling and carrying a fancy package. I was wondering what was inside...
2. One day I was going home after school. A dog suddenly appeared in front of me...
3. Today I woke up early to go to school as usual. When I look at the clock, what should I see?
4. I was bored the other day. I was just sitting at home. Suddenly the doorbell rang…
5. Finally, summer vacation came. We got the report cards and we were going home…

The students were told to choose one of these sentences or to start with a sentence of their own. Students were given one minute to think and five minutes to write as fast as they could. Students were instructed not to focus too much on the content because focusing on the content may cause them to write more slowly. No eraser was used during writing. Instead, they were asked to cross out the area

they wanted to erase with a pencil and continue writing immediately. Thus, the aim was to ensure that students spend their time writing and to determine how many deletions they made. By crossing out the parts to be deleted with a pencil, the "deleting/editing ratio of the written text" could be calculated.

Speed (in syllables), accuracy (in ratio), and deleting/editing ratio were calculated. All numbers and abbreviations were accepted as one syllable regardless of their length (Atasoy, 2015). To obtain the accuracy variable, the total number of syllables was divided by the number of syllables in the correct words. The amount of deletion and the number of rewrites were calculated. All variables were obtained by dividing the total data for 5 minutes by one minute. It was thought that giving only one minute of time would provide limited data and affect the validity of the data for students who may experience disfluency at the beginning of the writing. For this reason, a longer time was given and the calculation was made over a one-minute ratio.

Speaking Fluency

In speaking fluency, a pool of 30 questions was created and five experts evaluated the questions in terms of suitability for the level of 5th graders and whether they required information (questions that did not require information were preferred). The evaluators consisted of Turkish teachers and specialists who were doctoral candidates in Turkish education. The teachers and experts scored each question as 2 “completely suitable”, 1 “partly suitable” and 0 “not suitable”. The total score for each question was 20 (five evaluators, a total of four points in two dimensions). If any evaluator gave a question a score of "0" for any dimension or if at least two evaluators gave a "1" score for the same dimension, the question was removed. Therefore, each question received at least 19 points. As a result of the evaluation, a pool of 25 questions remained.

During data collection, students were free to stand wherever they wanted in the classroom (their own desk, in front of the table etc.). All conversations were recorded with a recorder. Students started when they were ready to speak and were stopped after two minutes. If a student gave a relatively short answer, the second and third questions were asked, if possible. However, the same question was not asked to more than one student in the same class. Therefore, each student heard the question they answered for the first time. Students were reminded that they should not focus too much on the content of the speech, as the desire was to prevent them from making mistakes due to anxiety. While the students were talking, the researcher nodded, etc. to show that they were listening. The data for the students who could not complete the two minutes were calculated over the total time. Before analysis, all variables were proportioned to one minute. The reason why the students were given two minutes of time and the data were proportioned to one minute was to facilitate comparison with the data for reading fluency and writing fluency in the interpretation. In addition, it was thought that a one-minute short-term data collection would affect the validity of the data. Considering that students may pause and talk more later on, it was deemed appropriate to give two minutes.

PRAAT was used to analyze speaking fluency. The variables to be calculated were taken from de Jong (2016), but the decision to use average pause length and the frequency of disfluency was made by the researchers. Calculations were made as follows:

-Total time (seconds and split seconds): This is the time between when the student starts (even if it is filler) and finishes speaking. Non-speech elements (such as the student saying "Don't Laugh!" to their friends) and parts that were not understood were excluded from the analysis.

- Filled pauses: While starting the answer repeating the question again, fillings (hmm, ıı, well, etc.), lengthening in sounds (hooomeee, goinnnnnggg, etc.), and thinking aloud were accepted as fillers.
- Unfilled pauses: Silent pauses lasting .25 seconds or longer (de Jong & Bosker, 2013).

- Total number of syllables: Since some syllables can be swallowed while speaking in Turkish, the calculation was made according to the canonical syllables. For example, if a students said "Gitcez [We will go]" (2 syllables), it was counted as if they said "Gideceğiz [We will go]" (4 syllables).
- Speaking time: Unfilled pauses and filled pauses (excluding word fillers) were subtracted from the total time.
- Actual number of syllables: The syllables in the words that are disfluent or incomplete and the syllables in the words that are filled were subtracted from the total syllable.
- Run of speech: Unfilled pauses and fillings (both .25 seconds or more) are considered the threshold for a run of speech.

The variables used for the speaking fluency of each student in the analyses were calculated as follows. The correlation values of each of these variables were calculated separately:

- Ratio of frequency of disfluencies: (total number of disfluencies /total time) X 60 seconds
- Speech rate: (total syllable/total time) X 60 seconds
- Articulation speed: (actual syllables/speaking time) / 60 seconds
- Pruned speech rate: (actual syllables/total time) X 60 seconds
- Phonation time ratio: (speaking time/total time) X 100
- Average run of speech length: (total syllables/ number of runs of speech)
- Average pause length: (total pause time/total time) X 60 seconds

Reading Comprehension Test

A multiple-choice test using two different texts was developed to evaluate the reading comprehension skills of the students. Multiple-choice tests are measurement tools with high reliability (Caldwell, 2008). In the process of developing the test, firstly, a narrative and informative text that the students had not seen before was selected from the 5th-grade Turkish textbook (Ağın Haykır et al., 2017). While the informative text used in the reading comprehension test consisted of 575 words, the narrative text consisted of 411 words. Then, 44 questions were prepared based on the achievements in the Turkish curriculum (MoNE, 2018). The questions were prepared in two categories as literal and inferential questions. The prepared questions were sent to four specialists who were either Turkish teachers or doctorate candidates in Turkish education. Specialists were asked to rate each question as 1=appropriate or 2=not appropriate in terms of learning outcome, answer, content, grammar, distracter, grade level, and question writing technique (Yıldırım, 2010). Questions which at least two raters gave two points in the same category were excluded. If an expert gave two points in a category, revision was performed if deemed necessary. After making the necessary revisions, 38 questions remained.

The pilot application of the test was applied to 132 fifth-grade students studying in six state schools and one private school randomly selected in Kars city center. However, since some students left the questions blank or could not complete the test in time, they were excluded from the sample and the analyses were conducted with 116 students. The answers of the students were coded as “1=true/0=false”. The following processes were performed in the analyses, respectively (Atılgan, 2017):

- Calculation of item difficulty index: Questions with item difficulty index below p.20 and above p.80 were excluded.
- Calculation of variance and standard deviation of items.
- Calculation of the distinctiveness of the items: Those with a distinctiveness below .30 were excluded from the question pool (Yıldız, 2010).
- Calculation of reliability coefficients of items.
- Calculation of the average difficulty of the test.
- Calculation of the standard deviation and variance of the test.

- Calculation of the difference and effect size between the upper and the lower 27% by independent t-test (Appendix-1)
- Calculation of the KR-20 value.

After the above analysis, a total of 9 questions were removed from the test and 29 questions remained. According to Brassell and Rasinski (2008), 10 questions are sufficient for each text.

The results of the reading comprehension achievement test analysis are given in Table 2.

Table 2. The results of the reading comprehension achievement test

n	$\bar{X}$	*Ss*	Median	Mode	Average difficulty	Kr-20
116	15.224	5228.17	13.5	9	.524	.877

Analyses were made by entering formulas into the Microsoft Excel program. According to the analysis results, the test has medium difficulty (.524) and high reliability (KR-20=.877).

The distribution of questions in the reading comprehension achievement test by text type and question type are given in Table 3.

Table 3. Distribution of questions in the reading comprehension achievement test by text type and question type

	Informative text	Narrative text	Total
Literal questions	9	7	16
Inferential questions	5	8	13
Total	14	15	29

Five variables were obtained for reading comprehension: percentage of the total score (PTS), percentage of score for informative text (PSIT), percentage of score for narrative text (PSNT), percentage of score for literal questions (PSLQ), and percentage of score for inference questions (PSIQ).

Vocabulary

Vocabulary has two dimensions: productive and receptive. In this study, productive vocabulary was measured. Blank A4 papers were distributed to the students and they were asked to write texts of at least 150 words about the subject and of the type they wanted. They were not allowed to write memorized songs, poems, etc.

Measurements were made using the first 100 words in the written texts. Idioms, proverbs etc. Were counted as one word. Proper nouns and numbers (except for "one" because "one" can often be used with different meanings and functions such as noun and adjective) were not included in the analysis. Vocabulary coefficient (VC) was calculated as "total number of different words/total number of words" (Karadağ, 2018). VC can have a value between 0-1. The value 1 indicates that all words are different; 0 indicates that all words are the same.

Data Analysis

Before conducting the analysis, Pallant's (2016) recommended checks for missing data, extreme values, incorrectly entered values, etc. were completed and some corrections were made. First of all, the box plot was used to remove the extreme values. Before each correlation analysis, all the extreme values were removed by looking at the box plot. Before analysis, the normality of the distribution was also examined. The Kolmogorov-Smirnov test and skewness-kurtosis coefficients (Can, 2017) were examined. For the normal distribution, values were checked so the significance value was below .05 for the Kolmogorov-Smirnov test and the skewness-kurtosis coefficient was between -1.96 and +1.96. Spearman correlation was chosen when there was no normal distribution in one of the two criteria; Pearson correlation was used if both criteria had normally distributed data. Cohen's (1988) criteria were used to interpret the correlations. Accordingly, $r \geq .10$ was small correlation while $r \geq .30$ was moderate and $r \geq .50$ was large.

Results[1]

The findings of the study are presented in three parts. First, the descriptive statistics for the students about the relevant variables are given. Then, the correlational values of the variables are presented. To do this, a single table (Table 5) was created in order to show the correlations together. Descriptive statistics are not included in this table, as the aim was to present all correlation operations for 18 different variables (153 correlations in total) as simply as possible. The descriptive statistics for correlations, which is the third part of the findings of the study, are in the appendices. In Table 4, the descriptive statistics for 18 variables about the students are given.

Table 4. Descriptive Statistics of the Sub-Dimensions of Skills

		n	$\bar{x}$	s
Reading Fluency	Speed	94	85,4	19,5
	Accuracy	94	92	8,7
Writing Fluency	Average total number of syllables per minute	94	28,6	8
	Average percentage of syllables in words spelled correctly	94	94,2	6,4
	Average number of deleting/editing per minute	94	,59	,46
Speaking	Ratio of frequency of disfluencies per minute	94	6,3	4,1
Fluency	Speech rate (slyllables)	94	221,8	59,2
	Articulation speed (syllables)	94	313,8	39,2
	Pruned speech rate (syllables)	94	191,3	56,8
	Phonation time ratio (percentage)	94	67,3	14,4
	Average run of speech length (syllables)	94	11,7	3,5
	Average pause length (seconds)	94	23,6	9,1
Reading	Percentage of the total score	94	68	15,6
Comprehension	Percentage of score for informative text	94	63,3	19,2
	Percentage of score for narrative text	94	72,4	17,1
	Percentage of score for literal questions	94	72,3	16,9
	Percentage of score for inference questions	94	63,4	19,7
Vocabulary	Vocabulary coefficient	94	,62	,08

Table 4 indicates that the average reading speed of the students was 85.4 words per minute and accuracy was 92%. The average writing speed (syllables per minute) was 28.6; the percentage of syllables in correct spelled words was 94.2%; and the average of deleting/editing of written words was 59%. The statistics of the students for speaking fluency are as follows: the number of disfluencies was 6.3; speech rate was 221.8; articulation speed was 313,8; pruned speech rate was 191.3; phonation time ratio was 67.3; average run of speech length was 11.7; and the average pause length was 23.6. The general average of the students on the reading comprehension test was 68%. This average was 63.3% for informative texts; 72.4% for narrative texts; 72.3% for literal comprehension questions; and 63.4% for inferential questions. Vocabulary coefficient results show that an average of 62 of the first 100 words in student writings was different.

[1] Descriptive statistics for the correlations are given in the appendices.

Table 5. Correlation analyzes of all variables

		RF		WF		SF							RC				V	
		SRF	ARF	NTS	AWF	D/E	RFD	SR	PSR	AR	PTR	MLR	MLP	PTS	PSIT	PSNT	PSLQ	PSIQ	VC
RF	SRF	X																	
	ARF	.31**p	X																
WF	NTS	.10s	-.15s	X															
	AWF	.34**s	.31**s	-.07s	X														
	D/E	-.00s	-.09s	.19s	-.13s	X													
SF	RFD	.06s	-.03s	-.11s	.05s	-.03s	X												
	SR	.30**p	.00p	.12p	.29**s	-.07s	.22*s	X											
	PSR	.28**p	.03p	.17p	.34**s	-.03s	.08s	.95**p	X										
	AR	.25*p	-.06p	.19p	.23*s	-.17s	-.30**s	.46**p	.51**p	X									
	PTR	.20s	.04s	.12s	.24*s	.04s	.21s	.89**s	.86**s	.17s	X								
	MLR	.21p	-.15p	.20p	.20s	.06s	-.10s	.70**p	.75**p	.43**p	.60**s	X							
	MLP	-.20p	-.08s	-.13p	-.25*s	-.09s	-.22*s	-.86**p	-.89**p	-.10p	-.94**s	-.63**p	X						
SC	PTS	.57**s	.20s	.15s	.26*s	.11s	.06s	.25*s	.30**s	.14s	.22*s	.27*s	-.27*s	X					
	PSIT	.47**s	.27*s	.18s	.25*s	.13s	-.02s	.24*s	.30*s	.18s	.17s	.27**s	-.24*s	.88*s	X				
	PSNT	.44**s	.10s	.09s	.20s	.05s	.09s	.13s	.15s	.14s	.15s	.06s	-.13p	.76**s	.35**s	X			
	PSLQ	.38**s	.23s	.12s	.12s	.12s	-.08s	.15s	.22*s	.16s	.13s	.21*s	-.19s	.78**s	.73**s	.51**s	X		
	PSIQ	.51**s	.20s	.11s	.32**s	.06s	.12s	.26*s	.28**s	.07s	.23*s	.20s	-.26*s	.89**s	.77**s	.67**s	.43**s	X	
V	VC	.26*	.21	.03s	.21*s	-.07s	.09s	.37**p	.32**p	.13p	.27*s	.39**s	-.35**p	.46**s	.39**s	.33**s	.33**s	.42**s	X

RF: Reading Fluency; WF: Writing Fluency; SF: Speaking Fluency; RC: Reading Comprehension; V: Vocabulary; SRF: Speed (Reading Fluency); ARF: Accuracy (Reading Fluency); NTS: Number of Total Syllables (Writing Fluency); AWF: Accuracy (Writing Fluency); D/E: Number of Deleting/Editing (Writing Fluency); RFD: Ratio of Frequency of Disfluency in SF; SR: Speaking Rate; PSR: Pruned Speech Rate; AR: Articulation Rate; PTR: Phonation Time Ratio; MLR: Mean Length Of Run; MLP: Mean Length Of Pauses; PTS: Percentage Of The Total Score; PSIT: Percentage Of Score in Informative Text; PSNT: Percentage Of Score in Narrative Text; PSLQ: Percentage Of Score Answers In Literal Questions; PSIQ: Percentage Of Corrects Answers in Inferential Questions; VC: Vocabulary Coefficient

p: Pearson Correlation coefficient s: Spearman rank-order correlation coefficient *: p<.05 **<.01

Table 5 shows the correlation analyses between all variables. There was a moderate and positive relationship between SRF and ARF (r=.31, n=75, p<.01). There was no significant correlation between any of the WF variables. The relationships among SF variables ranged from negative high-level relationships to positive high-level relationships, but it should be taken into account that there were variables (such as MLP and RFD) that have similar formulas and measure almost the same things. When variables with similar formulas are ignored, the most correlated pairs of variables were PSR-MLR (r=.75, n=91, p<.01), SR-MLR (r=.70, n=91, p<.01), MLR-MLP (r=-.63, n=91, p<.01), PTR-MLR (r=.60, n=90, p<.01) and PSR-AR (r=.51, n=93, p<.01). RC variables have significant and positive relationships, ranging from .35 to .89.

AWF had moderately positive correlation with ARF (r=.31, n=73, p<.01) and SRF (r=.34, n=87, p<.01).

The only variable for RF that had a significant relationship with SF variables was speed. SRF was correlated with SR (r=.30, n=91, p<.01), AR (r=.25, n=91, p<.05), and PSR (r=.28, n=91, p<.05).

SRF had positive correlations of between .38-.57 with all variables for RC. ARF had a significant relationship only with PSIT (r=.27, n=76, p<.05). The only variable associated with the VC in RF was SRF(r=.26, n=91, p<.05).

In WF, NTS and D/E variables did not have a significant correlation with any variable of SF. However, AWF had positive and negative relationships ranging from .23 to .34 with all variables, except RFD and MLR.

WF generally seems unrelated to RC variables. However, AWF (r=.26, n=89, p<.05) had significant correlations with PTS (r=.26, n=89, p<.05), PSIT (r=.25, n=89, p<.05), and PSIQ (r=.32, n=89, p<.01).

The only variable that had a significant relationship with the VC of WF was AWF (r=.21, n=89, p<.05).

RFD and AR did not have significant relationships with any of the RC variables. Similarly, no SF variable was found to be significantly associated with PSNT. The significant relationships between SF and RC vary from .30 to -.27. Of these relationships, only MLP was negatively correlated to variables for SF.

The correlations between RC and VC vary between .33 and .46 (p<.05).

Discussion and Conclusion

We aimed to investigate correlations between RF, WF, SF, RC, and vocabulary. For this purpose, relationships between 18 different variables were examined. Results are discussed in accordance with the literature.

A moderate-level and positive correlation was found between SRF and ARF. When previous studies that found similar results (e.g., Baştuğ & Akyol, 2012; Katzir et al., 2012; Yamaç & Çeliktürk Sezgin, 2018) are considered, it can be deduced that children who read faster (or who read more accurately) have better accuracy (or speed).

Findings about WF contradict the literature. No significant relationship was found between variables for WF; however, some researchers (Atasoy, 2015; Kent et al., 2014; Limpo, Alves, & Connelly, 2017) reported different correlations between different variables of WF. This may be due to the data collection methods, the difference between participants, or calculating various variables. In this study, students were given prompts and asked to write a text. Participants were 5th graders. In some other studies, however, children were younger or older and asked to write some words/letters which were delivered verbally. Divergence may occur in results because WF can be assessed by collecting different types of data (such as handwriting fluency, compositional fluency).

All except two variables in SF were significantly correlated both in positive and negative directions and these correlations had moderate and high levels. Although conducted in L2, Kormos and Dénes (2004) found similar correlations to the results of our study, while Park (2016) and Derwing, Rossiter, Munro, and Thomson (2004) generally found significant correlations with opposite signs. Thus, it can be concluded that SF has related subskills regardless of L1 or L2, but the direction of correlations may change.

Variables of RC had significant, positive and moderate relationships with each other and this was replicated in much research by Oslund et al. (2016), Palavuzlar (2009), Yıldırım et al. (2011). In light of the literature and our results, we can conclude that different comprehension levels (literal-inferential questions) and text types (narrative and informative) correlated each other generally at moderate or high levels.

SRF and ARF have moderate-level correlations with AWF. Findings of Kandel et al. (2006), Murphy (2016), and Palmer (2010) support this correlation, while Cragg and Nation (2006) reported different results. Although different results are available in the literature, research shows that significant relationships can help acknowledge the existence of relationships between fluencies in reading and writing. Some dimensions of these two skills may be correlated, if not all. Students who write more accurately read faster and more accurately, or vice versa. This finding supports researchers who claim that reading and writing are related to each other. But the relationship might only be for the accuracy dimension of writing. There was no relationship between speed in writing and RF variables. Similarly, children were also similar in D/E according to RF scores. We can conclude that readers who read more fluently don't write more quickly or with fewer errors than low-level readers, but they write more accurately. However, on the opposite side, children who write more accurately than those who write less accurately receive higher scores for all RF dimensions.

The variables of RF are generally not correlated with the variables of SF. ARF had no significant correlation with SF, where SRF had three. SRF had significant correlations with AR, PSR, and SR. It's interesting that only the dimension of speed in reading and dimensions of both speed and accuracy in SF are related. The relationship between reading and speaking was investigated by some researchers and diverse results which both support and contradict our findings were reported (Kent et al., 2014; Roberta, 1983; Rodriguez-Aranda, 2003). According to Tosto et al. (2017), research investigating the relationship between oral language skills and literacy showed strong correlations. Schulte (1967) asserted that spoken language is a component of learning to read. Speed and accuracy in SF and speed in RF may be related to each other and SF and RF may involve joint subprocesses.

The relationship between SRF and AR is much more interesting than the relationship of SRF with other variables of SF because these two variables (SRF-AR) are not generally mentioned together in the RF literature. This finding about the correlation of SRF-AR is worth investigating due to the fact that SRF may partially depend on AR because the speed of articulating decoded words logically depends on the speed of AR, though not completely. However, in studies about SRF, there is no explanation about the speed of articulation. Instead, studies focus on improving the ability to recognize words as soon as one sees them (automaticity in word recognition) (Rasinski, 2004). Therefore, the relationship between the variable of articulation speed in speaking fluency and speed in reading fluency is lacking in the literature. Considering that these two dimensions are related to each other, new exercises can be considered to improve both SRF and AR and improve RF and SF at the same time.

SRF has important relationships with variables of RC, whereas ARF had a significant correlation only with PSIT. This finding suggests that speed is more correlated with RC than accuracy. The relationship of RF and RC was investigated many times and similar results were found (Fasano, 1985; Murphy, 2016; Palmer, 2010; Shanahan, 1984; Yamaç & Çeliktürk Sezgin, 2018; Yeo, 2008; Yıldırım et al., 2017). The relationship of RC and RF is widely accepted.

ARF had no significant relation with VC but SRF had. Students with improved productive vocabulary read faster than students with weak productive vocabulary. Other studies (Bandini et al., 2017; Cook, 2010; Katzir et al., 2012; Kent et al., 2014; Murphy, 2016; Rountree, 2006; Shanahan & Lomax, 1986; Yazanoğlu, 2011) reported significant correlations between reading and vocabulary. The results of our study lead to the consideration that vocabulary is important for speed in relatively older students (5th graders), but not for accuracy.

The only variable of WF that had a significant relation with SF is AWF. Our results showed both significant and insignificant correlations in different dimensions of SF and WF. Some researchers found significant correlations between speaking and writing (Berninger et al., 2006; Kent et al., 2014; Loban, 1963). Some (e.g., Brand & Brand, 2006; Grugeon, Dawes, Smith, & Hubbard, 2005) say that oral language forms a basis for literacy and improves WF. According to Cain and Oakhill (2011), writing and speaking have a common basis. When considering our study and early studies together, it can be concluded that speaking and writing involve shared processes and they may have an impact on each other. We can infer that the accuracy of writing and variables of speed and of accuracy in SF are important in the relationship between writing and speaking. So, not all dimensions, but accuracy in writing and accuracy and speed in speaking seem to be related to each other.

Similarly, only AWF had significant positive relationships with RC variables. This finding supports some general correlational findings for RC-writing (Ağın Haykır, 2012; Ahmed, 2011; Berninger et al., 2006; Cragg & Nation, 2006; Murphy, 2016; Shanahan, 1984), whereas some findings contradict ours (Abbott & Berninger, 1993; Abbott et al., 2010; Hudson, 2002; Palmer, 2010; Roberta, 1983). In our study, AWF was correlated with PTS, PSIT, and PSIQ. There was no significant correlation between AWF and PSNT and PSLQ. Thus, we can conclude that accuracy in writing correlates to relatively harder comprehension skills such as understanding informative texts and inferential questions. Especially for inferential questions, the correlation advanced from low-level to moderate-level (r=.32). Narrative text and literal questions weren't correlated to any of the WF variables. This finding suggests that children with different comprehension skills are similar to each other in writing speed and in writing disfluencies such as deleting or changing written text. But accuracy may be a differentiative measurement to assess comprehension skills. Students with higher accuracy in writing were better comprehenders in understanding informative text, inferential questions, and generally on the reading comprehension test. In the same manner, students with higher comprehension skills wrote more accurately.

In WF, only AWF had a significant relationship with VC and the correlation was positive and small. This relationship was investigated before and results contradict each other. Kent et al. (2014), Murphy (2016), Rodriguez-Aranda (2003), Shanahan (1984), Shanahan and Lomax (1986), and Yazanoğlu (2011) found significant correlations, while Shanahan and Lomax (1986) found no relationship in data from second graders. Vocabulary is a base for language skills but it has different dimensions such as productive-perceptive or oral-written. Different levels of measurements may show variable results. However, it is logically acceptable that expanding vocabulary (especially productive vocabulary) has the power to improve accuracy in writing, but our results indicate that this relationship may get weaker when students are relatively older (5th grade).

We found significant correlations between RC and SF. Many studies (Berninger et al., 2006; Nellenbach, 2010; Roberta, 1983; Tosto et al., 2017) found significant correlations between RC and oral language/speaking. In our study, PSR which may be accepted as accuracy in speaking had the highest

number of correlations with RC. PSR had two moderate- and two low-level positive correlations with variables of RC. This finding shows accuracy in speaking has an important relationship with RC. Students who speak more accurately and smoothly comprehend better, or vice versa. Similarly, SR, MLR, and MLP each had three significant correlations with variables of RC. These variables of SF may be considered to comprise the speed dimension. Accordingly, speed in speaking seems to be related to RC, if not in all RC dimensions. AR had no significant relationship with any of the RC variables.

There were low- and moderate-level correlations between VC and SF. There are partial similarities between our results and other research (de Jong & Bosker, 2013; Rodriguez-Aranda, 2003) which investigated the relationship between SF and vocabulary. Fillmore (1979) pointed out the importance of vocabulary to be able to speak fluently. Kopf (2013) and Woodardi (2015) also found that vocabulary instructions improved oral language skills in children. Vocabulary, therefore, seems to be an important part of SF in L1 and L2. Our findings showed that MLR had the strongest correlation with vocabulary. MLR shows a child's average speaking rate between pauses. Children with richer productive vocabulary have higher averages for MLR. Because the correlation is at the intermediate level, it may be considered important. Though correlations don't provide cause-effect relationships, this finding may guide experimental research to find out whether vocabulary instructions improve SF. Vocabulary also had moderate-level correlations with SR, PSR, and MLP. SR and MLP show speed, where PSR shows both speed and accuracy. So, vocabulary has significant correlations with speed and accuracy in speaking. Also, PTR had a significant and positive correlation with vocabulary but at low level. The only variables in SF not correlated with vocabulary are AR and RFD. AR can be considered as a muscular activity. Therefore, it is not logically linked to vocabulary. However, RFD is expected to be associated with vocabulary. According to our findings, disfluencies are common among all students who have low- or high-level productive vocabulary. Vocabulary, thus, is not a differentiative variable for disfluency ratios. But, when speed and accuracy in speaking are considered, vocabulary has the potential to differentiate children according to proficiency in SF.

All variables of RC had significant and moderate-level correlations (between r=.33-.46) with VC. Many reports (Beck et al., 1982; Cook, 2010; Murphy, 2016; Oslund et al., 2016; Quinn, 2012; Rountree, 2006; Shanahan, 1984; Shanahan & Lomax, 1986; Yıldırım et al., 2011) showed the relationship between vocabulary and RC. All variables in RC had significant correlations, but vocabulary had the highest level of correlation with PTS, PSIT, and PSIQ. When both literal and inferential questions and both narrative and informative texts are considered together, the correlation reaches the highest level. Therefore, we can conclude that general comprehension skill has the strongest correlation with vocabulary. However, PSNT and PSLQ have the lowest correlations with vocabulary, though correlations are still significant, positive and at moderate level.

When we evaluate all the variables for all skills according to significant correlation numbers, we can make some inferences about the importance of these variables. In RF, accuracy had two significant correlations with variables other than SRF but SRF had 10. Thus, we can say that SRF involves more joint processes with other skills than ARF. This importance of SRF may make it possible to predict/improve other skills by using SRF or to predict/improve SRF by using other correlated skills.

NTS and D/E in WF had no significant relationships with variables of other skills, but AWF had 11 significant correlations. Speed in writing and deleting/editing written text are not distinctive components for children with different levels of skills. AWF, however, seems to have substantially common processes with other subskills and is a distinguishing subskill.

In SF, variables with the largest number of significant correlations were PSR (7), SR (6), MLP (5), PTR(4), MLR (4), AR (2), and RFD (0). Therefore, PSR, which we can call accuracy in SF, is the variable that had the largest number of significant correlations. Subsequently, SR and MLP are the most correlated variables in SF. Thereby, it can be inferred that these variables involve more joint processes than other variables of SF.

In RC, PTS and PSIT each have eight significant correlations with variables of other skills, where PSIQ has 7, PSLQ has 4, and PSNT has 2. So, PTS and PSIT have more discriminative power in differentiating students according to various skills. The scores for PSNT were similar among students with different levels of other skills. In other words, the difference in success in other skills disappears in PSNT. RC has different levels like literal and inferential questions. Similarly, different types of texts such as narrative and informative have various comprehensibleness. It seems that comprehending narrative texts and literal questions are easier than comprehending informative texts and inferential questions because correlations of scores for narrative text and literal questions were lower almost in all other skills, which means that students have similar comprehension of narrative text and literal questions. However, when understanding an informative text and inferential questions are considered, correlations began to rise. Therefore, comprehending informative text and inferential questions may be considered as harder which make it possible to differentiate students according to their various skills such as RF, SF, WF, and vocabulary.

Productive vocabulary seems to be the most important variable among all variables measured because it had 12 significant correlations with other variables. It can be inferred that vocabulary – especially productive vocabulary- is very important for other skills and it distinguishes children according to success in language skills. Students with better results for RF, WF, SF, and RC had better scores in VC. Vocabulary has correlations with speed dimension in reading, accuracy dimension in writing, both speed and accuracy dimensions in speaking, and with all dimensions in RC (especially with more complex ones such as inferential questions and informative text).

This result suggests that productive vocabulary can signal the language development in children. If a child has relatively small productive vocabulary, we can expect that they will be behind in fluencies in reading, writing, and speaking compared to students with improved productive vocabulary. Similarly, improving vocabulary may help ameliorate fluency aspects of language skills.

In sum, speed in reading, accuracy in writing, and both speed and accuracy in speaking are relatively more distinctive aspects in fluency. These dimensions have more significant correlations with other components than other fluency dimensions. In RC, all except PSNT, had substantial relationships with other skills. But vocabulary is the most correlated variable among all 18 variables for all skills, which is evidence about the importance of vocabulary instruction. It can be concluded that disfluencies in writing and speaking are common in students who have different levels of WF and SF skills. If we consider these disfluencies as important difficulties in writing and speaking, then we can accept that disfluencies involve rather different and independent processes that the processes for other skills because they have almost no significant correlation with any of the other variables.

Suggestions

Results showed interesting correlations; thus, we suggest researchers investigate correlations between variables that are relatively less investigated (such as correlations between fluency dimension of skills). A sufficient number of correlational findings may make it possible for us to use skills to estimate other skills. This opportunity is very important because early diagnosis of underdevelopment in language skills is critical. When diagnosis is delayed, the intervention delay becomes inevitable, making it difficult for a less developed student to close the gap with more advanced students.

Correlations show us statistical links but not cause and effect relationships. So, experimental research is needed to see whether there are causal relationships between skills and subskills. If causal relationships can be found, then it will be possible to design new exercises that can improve more than one skill at a time. For instance, a causal link between vocabulary and WF may allow us to focus more on vocabulary to improve writing skills.

Limitations

This study is limited to 94 students from 5th grade. Therefore, the results of the study may not be valid for other grade levels. In addition, sampling was not used to adequately represent the population. Instead, we worked with a study group. Therefore, there may be drawbacks to generalizing based on the findings. In addition, the data in the study were collected once. In other words, data collection was carried out once for each skill. Collecting more than one data about the same skill will yield more valid results.

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Appendix 1. Results of Item Analysis of Reading Comprehension Test

Item no	pj	sj	rjx	rj	*t**	Effect size**	Item no	pj	sj	rjx	rj	*t**	Effect size**
1	.61	.23	.54	.13	6.35	1.61	16	.33	.22	.50	.11	5.34	1.37
2	.51	.24	.47	.12	6.02	1.53	17	.55	.24	.39	.10	3.94	1.00
3	.65	.22	.45	.10	5.34	1.35	18	.52	.24	.54	.14	8.57	2.18
4	.56	.24	.43	.11	4.77	1.21	19	.63	.23	.59	.14	9.79	2.49
5	.50	.24	.50	.13	6.54	1.66	20	.64	.22	.49	.11	6.13	1.56
6	.46	.24	.40	.10	4.28	1.08	21	.48	.24	.51	.13	6.69	1.70
7	.73	.19	.34	.07	3.35	0.85	22	.37	.23	.58	.14	7.81	1.98
8	.51	.24	.40	.10	4.28	1.08	23	.43	.24	.41	.10	5.09	1.29
9	.28	.20	.38	.08	4.14	1.05	24	.60	.23	.47	.11	6.54	1.66
10	.48	.24	.37	.09	4.39	1.11	25	.58	.24	.48	.12	7.61	1.93
11	.55	.24	.51	.13	6.54	1.66	26	.57	.24	.38	.10	4.96	1.26
12	.40	.24	.45	.11	4.39	1.11	27	.56	.24	.59	.15	7.87	2.00
13	.49	.24	.62	.16	13.8	3.51	28	.56	.24	.36	.09	3.73	0.95
14	.43	.24	.39	.10	3.57	0.90	29	.54	.24	.34	.09	3.98	1.01
15	.58	.24	.60	.15	9.28	2.36							

pj: item difficulty index; sj: Standart deviation of item; rjx: index of item discrimination; rj: reliability coefficient of item

*: All *t* values are significant at .05.

**: All effect sizes show that the items are quite good at discrimating the upper and lower groups. (Cohen, 1988).

Appendix 2. Descriptive Statistics of Inter-Skill Correlations

Variables	*n*	$\bar{x}$	*s*
NTS	75	28,6	7,3
ARF	75	95,4	2,3
NTS	91	28,6	7,4
SRF	91	86,2	16,7
AWF	73	95,7	3,9
ARF	73	95,4	2,8
AWF	87	95,3	4
SRF	87	86,2	16,8
D/E	75	,6	,5
ARF	75	95,3	2,8
D/E	90	,6	,4
SRF	90	86	16,7
ARF	73	95,4	2,9
RFD	73	5,93	3,8
ARF	76	95,4	2,9
SR	76	226,2	60,4
ARF	75	95,4	2,9
AR	75	317,2	35,1
ARF	76	95,4	2,9
PSR	76	196,4	58,2
ARF	75	95,4	2,9
PTR	75	68,4	13,8
ARF	66	95,3	3
MLR	66	11,2	2,2
ARF	76	95,4	2,9
MLP	76	23,2	9,4
SRF	88	86,2	17
RFD	88	6	3,7
SRF	91	86,2	16,7
SR	91	221,8	59,6
SRF	91	86,2	16,7
AR	91	314,5	38,7
SRF	91	86,2	16,7
PSR	91	191,3	57,4
SRF	90	86,4	16,7
PTR	90	67,6	13,9
SRF	88	85,9	16,9
MLR	88	11,4	2,9

Variables	*n*	$\bar{x}$	*s*
SRF	91	86,2	16,7
MLP	91	23,6	9,3
ARF	74	95,5	2,8
PTS	74	71,4	13,9
ARF	76	95,4	2,9
PSIT	76	66,1	18,8
ARF	72	95,5	2,8
PSNT	72	76,8	13
ARF	74	95,5	2,8
PCALQ	74	75,6	13,8
ARF	76	95,4	2,9
PSIQ	76	66,1	19,6
SRF	91	86,2	16,7
PTS	91	68,5	15,2
SRF	91	86,2	16,7
PSIT	91	63,7	18,8
SRF	86	87,1	16,3
PSNT	86	75,4	13,7
SRF	91	86,2	16,7
PSLQ	91	72,7	16
SRF	89	86,9	16,1
PSIQ	89	64,9	18,5
VC	75	,6	,1
ARF	75	95,3	2,9
VC	91	,6	,1
SRF	91	86,2	16,7
NTS	90	28,2	7,6
RFD	90	6	3,7
NTS	93	28,4	7,6
SR	93	221,5	59,5
NTS	92	28,5	7,6
AR	92	312,7	38,1
NTS	93	28,4	7,6
PSR	93	191	57,1
NTS	92	28,4	7,6
PTR	92	67,7	13,8
NTS	90	28	7,3
MLR	90	11,3	2,9

Variables	*n*	$\bar{x}$	*s*
NTS	93	28,4	7,6
MLP	93	23,6	9,2
AWF	86	95,4	3,9
RFD	86	6,1	3,7
AWF	89	95,3	4
SR	89	220,1	59,3
AWF	88	95,2	4
AR	88	312,2	37,1
AWF	89	95,3	4
PSR	89	189,7	57
AWF	88	95,4	3,9
PTR	88	67,3	13,9
AWF	84	95,2	4
MLR	84	11,2	2,7
AWF	89	95,3	4
MLP	89	23,8	9,3
D/E	90	,6	,4
RFD	90	6	3,7
D/E	93	,6	,4
SR	93	220,9	59
D/E	92	,6	,4
AR	92	312	37,4
D/E	93	,6	,4
PSR	93	190,7	56,9
D/E	92	,6	,4
PTR	92	67,7	13,8
D/E	89	,6	,4
MLR	89	11,3	2,8
D/E	92	,6	,4
MLP	92	23,3	8,8
NTS	92	28,4	7,6
PTS	92	68,3	15,2
NTS	93	28,4	7,6
PSIT	93	63,1	19,1
NTS	87	28,2	7,6
PSNT	87	75,2	13,7
NTS	92	28,4	7,6
PSLQ	92	72,8	15,9
NTS	93	28,4	7,6
PSIQ	93	63,3	19,8

Appendix 2. Continued

Variables	*n*	$\bar{x}$	*s*	Variables	*n*	$\bar{x}$	*s*	Variables	*n*	$\bar{x}$	*s*
AWF	89	95,3	4	PSIT	91	63,8	19	PSLQ	93	73	15,9
PTS	89	68,6	15,2	RFD	91	6	3,7	MLP	93	23,6	9,2
AWF	89	95,3	4	PSIT	94	63,3	19,2	PSIQ	89	64,9	18,7
PSIT	89	64	18,3	SR	94	221,8	59,2	RFD	89	6	3,7
AWF	84	95,3	3,9	PSIT	93	63,4	19,2	PSIQ	94	63,4	19,7
PSNT	84	75,3	13,8	AR	93	312,8	37,9	SR	94	221,8	59,2
AWF	89	95,3	4	PSIT	94	63,3	19,2	PSIQ	93	63,2	19,8
PSLQ	89	73,2	15,9	PSR	94	191,3	56,8	AR	93	312,8	37,9
AWF	89	95,3	4	PSIT	93	63,7	18,9	PSIQ	94	63,4	19,7
PSIQ	89	63,6	19,9	PTR	93	67,8	13,7	PSR	94	191,3	56,8
D/E	92	,6	,4	PSIT	91	62,9	19,3	PSIQ	93	63,7	19,5
PTS	92	68,5	15,2	MLR	91	11,3	2,9	PTR	93	67,8	13,7
D/E	93	,6	,4	PSIT	94	63,3	19,2	PSIQ	91	63,1	20
PSIT	93	63,4	19,2	MLP	94	23,6	9,1	MLR	91	11,3	2,9
D/E	87	,6	,4	PSNT	85	75,6	13,7	PSIQ	94	63,4	19,7
PSNT	87	75,2	13,7	RFD	85	6	3,5	MLP	94	23,6	9,1
D/E	92	,6	,4	PSNT	88	75,2	13,7	VC	91	,6	,1
PSLQ	92	72,9	15,9	SR	88	225,3	57,6	RFD	91	6	3,7
D/E	93	,6	,4	PSNT	88	75,2	13,7	VC	94	,6	,1
PSIQ	93	63,6	19,7	AR	88	314,3	38,3	SR	94	221,8	59,2
VC	93	,6	,1	PSNT	88	75,2	13,7	VC	93	,6	,1
NTS	93	28,4	7,6	PSR	88	194,4	55,8	AR	93	312,8	37,9
VC	89	,6	,1	PSNT	88	75,2	13,7	VC	94	,6	,1
AWF	89	95,3	4	PTR	88	68	13,8	PSR	94	191,3	56,8
VC	93	,6	,1	PSNT	85	75,1	13,8	VC	93	,6	,1
D/E	93	,6	,4	MLR	85	11,5	2,9	PTR	93	67,8	13,7
PTS	90	68,9	15,1	PSNT	88	75,2	13,7	VC	91	,6	,1
RFD	90	6	3,7	MLP	88	23,1	8,8	MLR	91	11,3	2,9
PTS	93	68,4	15,1	PSLQ	90	73,3	16	VC	94	,6	,1
SR	93	222,5	59,2	RFD	90	6	3,7	MLP	94	23,6	9,1
PTS	92	68,4	15,2	PSLQ	93	73	15,9	VC	93	,6	,1
AR	92	313,7	37,1	SR	93	222,5	59,2	PTS	93	68,4	15,1
PTS	93	68,4	15,1	PSLQ	92	73	15,9	VC	94	,6	,1
PSR	93	191,8	56,9	AR	92	313,7	37,1	PSIT	94	63,3	19,2
PTS	92	68,9	14,7	PSLQ	93	73	15,9	VC	88	,6	,1
PTR	92	67,8	13,8	PSR	93	191,8	56,9	PSNT	88	75,2	13,7
PTS	90	68,1	15,2	PSLQ	91	73,9	14,7	VC	93	,6	,1
MLR	90	11,4	2,9	PTR	91	67,7	13,8	PSLQ	93	73	15,9
PTS	93	68,4	15,1	PSLQ	90	72,6	15,9	VC	94	,6	,1
MLP	93	23,6	9,2	MLR	90	11,4	2,9	PSIQ	94	63,4	19,7

Appendix 3. Descriptive Statistics of Intra-Skills Correlations

Variables	n	$\bar{x}$	s
ARF	75	95,4	2,9
SRF	75	89,4	15,9
NTS	88	28,6	7,6
AWF	88	95,3	4
NTS	92	28,3	7,6
D/E	92	,6	,4
AWF	88	95,2	4
D/E	88	,6	,4
RFD	91	6	3,7
SR	91	220,6	59,6
RFD	90	6	3,7
AR	90	313,8	36,9
RFD	91	6	3,7
PSR	91	190,9	57,5
RFD	90	6	3,6
PTR	90	67,5	13,8
RFD	88	5,9	3,7
MLR	88	11,3	2,9
RFD	91	6	3,7
MLP	91	23,8	9,2
SR	93	220,2	57,7
AR	93	312,8	37,9
SR	94	221,8	59,2
PSR	94	191,3	56,8
SR	93	223,4	57,3
PTR	93	67,8	13,7
SR	91	218,7	57,6
MLR	91	11,3	2,9
SR	94	221,8	59,2
MLP	94	23,7	9,1
AR	93	312,8	37,9
PSR	93	190	55,8
AR	92	312,6	38,1
PTR	92	67,6	13,7
AR	90	311,6	37,4
MLR	90	11,3	2,8

Variables	n	$\bar{x}$	s
AR	93	312,8	37,9
MLP	93	23,7	9,1
PSR	93	192,7	55,4
PTR	93	67,9	13,7
PSR	91	187,9	54,5
MLR	91	11,3	2,9
PSR	94	191,3	56,8
MLP	94	23,6	9,1
PTR	90	67,1	13,5
MLR	90	11,4	2,8
PTR	93	67,8	13,7
MLP	93	23,3	8,8
MLR	91	11,3	2,9
MLP	91	24	8,9
PTS	93	68,4	15,1
PSIT	93	63,7	18,8
PTS	88	70,4	13,1
PSNT	88	75,2	13,7
PTS	93	68,4	15,1
PSNT	93	73	15,9
PTS	93	68,4	15,1
PSIQ	93	63,6	19,7
PSIT	88	65,2	18,2
PSNT	88	75,2	13,7
PSIT	93	63,7	18,8
PSLQ	93	73	15,9
PSIT	94	63,3	19,2
PSIQ	94	63,4	19,7
PSNT	88	75,2	13,7
PSLQ	88	74,8	14
PSNT	87	75,6	13,2
PSIQ	87	66,2	17,6
PSLQ	93	73	15,9
PSIQ	93	63,6	19,7