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A Structural Equation Model to Explain the Effect of Fluent Reading, Literal Comprehension and Inferential Comprehension Levels of Elementary School 4th Grade Students on Success in Problem Solving

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Abstract

Structural equation model was used in this study to determine the effect of fluent reading, literal comprehension and inferential comprehension levels of elementary school 4th grade students on success in problem solving. The sampling of the research is composed of 279 students at elementary school 4th grade. In the research, in order to figure out reading accuracy percentage and reading rate, total 5 scales were used: a reading text, prosodic reading scale, literal comprehension scale, inferential comprehension scale and problem solving scale. As a result of the research, when the factors among the reading comprehension skills were analyzed, it was seen that fluent reading affects literal comprehension directly and inferential comprehension both directly and through literal comprehension and that fluent comprehension explains 31% of the variance in literal comprehension while both fluent reading and literal comprehension together explain 58% of the variance in inferential comprehension. When the research results were analyzed in terms of the effect of reading comprehension skills on problem solving skills, it was found that fluent reading skills do not affect problem solving skills directly, but through literal and inferential comprehension; that literal comprehension affects problem solving success both directly and through inferential comprehension; and that inferential comprehension skill affects problem solving success directly. As a result of the research, it was also determined that the variance of fluent reading, literal comprehension and inferential comprehension skills explains 54% of the variance in problem solving success. The relation between these interrelated skills reveals that rather than only as a part of mathematics lesson, problem solving exercises should be used interactively with language skills.

Keywords

Elementary school
Fluent reading
Literal comprehension
Inferential comprehension
Problem solving
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Introduction

Problem solving process is defined as a complicated process requiring multiple skills together. The constituents of this process are listed as problem comprehension, choosing the required information among the data, converting this information into mathematical symbols and reaching a solution through required operations. Although these constituents do not follow a linear path (Olkun & Toluk, 2004), it is thought that the first and key step of problem solving is reading comprehension problem and that when reading comprehension process doesn't occur, meaningless results arise by using the numbers given in the problem randomly (Mayer, 1985; Polya, 1990; Artzt & Armour-Thomas, 1992; Hong, 1995; Morales, 1998; Goos, Galbraith, & Renshaw, 2000).

In this context, the independent variables of the research were introduced as fluent reading and reading comprehension concepts.

Fluent Reading

Fluent reading is defined as reading a text at accurately a proper speed as if speaking. (Bashir & Hook, 2009; Wilger, 2008; Klauda & Guthrie, 2008; Akyol, 2006; Rasinski, 2004)**.** In the literature, subcomponents of fluent reading skill are accepted as word recognition (accuracy), automaticity (reading rate) and prosody (Wilger, 2008; Allington, 2006; Kuhn 2005; Rasinski, 2004) and fluent reading levels of students is measured upon these constituents (Baştuğ & Keskin, 2012; Başaran, 2013).

Faultless articulation of the words in a text is defined as word recognition (reading accuracy) (Başaran, 2013; Akyol, 2006). Logan (1997) referred to the importance of repetitive reading to increase word recognition level and stated that a student who meets a word he previously read difficultly later can read it more easily; in other words, s/he recognizes the word. In the studies of Ehri and McCormick (1998), Hudson, Lane and Pullen (2005), it was determined that word recognition (reading accuracy) level affects automaticity (reading rate). In a study of Baştuğ and Keskin (2012), it was found that word recognition is correlated with literal comprehension at .46 level and to inferential comprehension at .56 level. In a study of Başaran (2013), it was determined that word recognition level predicts literal comprehension skills at .52 level while it doesn't predict inferential comprehension.

Automaticity is defined as recognition of each word in the text read and following the constructed meaning mentally by comprehending the text fast and sleekly (Stahl & Kuhn, 2002). It was stated that when automaticity and word recognition aren't achieved, syllabication, pausing, turnabouts and falsely-read words during reading will hinder forming comprehension units. It was determined that when comprehension units aren't formed, it will be difficult to form a relation both between the sentence constituents themselves and between the sentences (Kuhn, Schwanenflugel, & Meisinger, 2010). It was also seen that individuals who haven't been able to get word recognition (accuracy) and automaticity (reading rate) skills spend most of their cognitive energy during reading on accurate articulation and thus might put the main objective of reading, that is comprehension process, on the back burner (Wilger, 2008; Rasinski, 2004; Samuels, 1979). It was found in a study of Baştuğ and Keskin (2012) that reading rate is correlated with literal comprehension at .37 level and to inferential comprehension at .45 level. It was determined in a study of Başaran (2013) that reading rate doesn't predict literal comprehension, but affects inferential comprehension at .21 level.

In order to focus attention on comprehension while reading, students are supposed to have acquired word recognition and automaticity skills, but this is not enough because students are also supposed to have acquired the last constituent of fluent reading skill, which is prosodic reading. Prosody can be defined as reading the text by paying attention to intonation, stress and punctuation and adjusting volume with reference to the meaning in the text (Zutel & Rasinski, 1991; Kuhn & Stahl, 2003). According to Schwanenflugel, Hamilton, Kuhn, Wisenbaker, and Stahl (2004), prosody is what gives meaning to reading because prosody can only be felt when meaningful reading is achieved. It was also revealed in the study that prosodic reading is a significant predictive variable for comprehension (r=0.58) and that prosody is correlated with automaticity and word recognition skills. It was found in a study of Baştuğ and Keskin (2012) that prosody is correlated with literal

comprehension at .55 level and with inferential comprehension at .66 level. In Başaran's study (2013), it was determined that prosody predicts .79 of inferential comprehension.

It was found in the studies of Jenkins and Jewell (1993) that there is a .38 relation between fluent reading and comprehension of 4th grade students. In their study Vilenius-Tuohimaa, Aunola, and Nurmi (2008) determined that fluent reading skill affects comprehension skill at .47 level and that fluent reading skill explains 23% of the variance in comprehension skill. In a study of Yıldız (2013), it was revealed that fluent reading skill affects comprehension skill at .48 level.

Comprehension

According to Akar, Başaran, and Kara (2016) and Akyol (2006), whatever its definition is, reading is done to comprehend and this objective is divided into two: comprehending explicit expressions in a text (literal comprehension) and configuring the meaning from the implicit messages in a text (making an inference) (Baştuğ & Keskin, 2012; Başaran, 2013; Yıldırım, 2012; Fabrikant, Siekierski, & Williams, 1999)

According to Kintsch (1988), literal comprehension process consists of two steps: making out the apparent meaning and making out the text-based meaning. While comprehension of the words and phrases in a text lets us see that the apparent meaning has been grasped, a case, person, place, information or a fact given explicitly in the text should be remembered to grasp text-based meaning. In a way, text-based comprehension lets us find answers for WH-questions (e.g. who, what, where, when, how) in the text. Kintsch stated that because students won't know the meaning of some words or phrases if apparent meaning hasn't been revealed, text-based meaning cannot be grasped either. On the other hand, Perkins, Allen, and Hafner (1983) found that only perception of the explicit information in a text isn't enough for comprehension, but rather, the implicit message the author is trying to convey through the text should also be perceived. In order to reveal this message, it is thought that inferential comprehension should occur (Perkins et al., 1983; Mcgee & Johnson, 2003.)

Inferential comprehension aims to establish empathy between the character in the text and the reader and to determine why the event in the text is being told, what its effects are on the reader, what the motives of the main character in the text are, what the main idea the author is trying to convey in the text is and the cause and effect relations between the events (Keene & Zimmermann, 1997). Kintsch (1988) expresses inferential comprehension as a situational model and states that establishing a situational model during comprehension will activate the background information of the reader about the event and thus richer information units will be reached which are inclined to real life and whose connection with the background information has been established. It is stated that the main purpose in reading a text is thought to be inferential comprehension (Wh-questions) but literal comprehension is a prerequisite for inferential comprehension to occur (Allen, 1985; Kintsch, 1988; Suk, 1997; Vacca et al., 2006).

In a study conducted by Allen (1985) to determine how inferential comprehension is affected by literal comprehension, inferential comprehension questions were formed out of three texts and applied to students. The source texts were each student's own story, a story of the student's friend and a story from the literature respectively. It was seen that the students were more successful in inferential comprehension questions for their own texts whereas they weren't in the other two texts. The follow-up interviews revealed that students' own texts seemed more realistic to them and that they didn't have any difficulty in deep comprehension and were more successful because they had better command of the words and events in their own stories. This finding was interpreted as that inferential comprehension will be easier when word recognition and literal comprehension occur.

It was found in a study conducted by Samuels (1979) that cognitive energy is primarily spent on reading accuracy during the first years when reading skill is acquired while it was determined in Başaran's (2013) study that reading accuracy skill predicts literal comprehension skill but doesn't predict inferential comprehension skill. In this context, it can be said that inferential comprehension occurs when sub-skills required for literal comprehension have been acquired. It was found in Jeanne's study (1983) that there isn't a significant difference between individuals who acquired word recognition skills at early ages and who acquired it at advanced ages in terms of literal comprehension, but there is a significant difference in favor of those who acquired word recognition skills at early ages in terms of inferential comprehension. This finding is interpreted as that literal comprehension skill is affected by word recognition skill but word recognition skill is not adequate for inferential comprehension skill. On the other hand, Jeanne states that there is a critical age threshold in acquiring inferential comprehension skill and if not acquired at early ages, it becomes harder to acquire inferential comprehension skill at advanced ages. Vacca et al. (2006) state that students learn how to read in the first years of primary education and read to learn in the following years and that comprehension starts with literal understanding (wh-questions) and later improvements in literal comprehension skill enhance inferential comprehension. This finding helps us to see that mental processes at literal comprehension level later serve to construct inferential meaning.

Conceptual Relation Between Reading Comprehension Skills and Problem Solving Skills

Reading comprehension is defined as the fact that the reader reaches a new thought by synthesizing what s/he has learnt from the text with her/his background knowledge (Akyol, 2006). Problem solving is defined as doing conscious research to solve any arising problem (Altun, 2005). Polya (1990) states that research process is a systematic process comprising of comprehending the problem, planning for solving, applying the plan and backward-looking steps and that the first step, reading comprehension, affects the other processes.

It was seen in a study conducted by Prakitipong and Nakamura (2006) that comprehension levels of students with higher problem solving success is high, but there isn't a big difference between students with high and low problem solving success in terms of possessing the basic skills of mathematics. It was found in a study conducted by Wijaya, van den Heuvel-Panhuizen, Doorman, and Robitzsch (2014) that students with lower problem solving performance make more comprehension and transformation-based errors than those with higher problem solving performance and that there is no difference between students with high and low problem solving performance in terms of mathematical operation based error rates.

In a study conducted by Kroll and Miller (1993) on elementary school students, when questions were first asked as four operations and the same questions were asked again as problem texts; it was determined that some students could do four operations but couldn't solve the problems. It was found in Tertemiz's (1994) study that besides four-operation skills, problem comprehension levels were also higher in students with medium and high problem solving skills, but in contrast, four-operation skills of students with low success was sufficient.

It was seen in the longitudinal studies of Andersson (2010), Grimm (2008), Jordan, Hanich, and Kaplan (2003) that the effect of reading comprehension skills on problem solving success increases over the years. In their study, Jordan et al. (2003) observed the improvement in problem solving success of students with only comprehension difficulty (AG), only mathematics difficulty (MG) and normal improvement (NG) from the start of 2nd grade to the end of 3rd grade. At the end of the study, it was observed that although at the start of 2nd grade, problem solving success of students with AG was the same with that of students with NG but higher than that of students with MG, at the end of 3rd grade, it leveled up with that of students with MG, but dropped behind that of students with NG. Andersson (2010) observed students with MG, AG and NG in terms of problem solving skills from the start of 4th grade to the end of 5th grade and determined that the difference between students with NG and students with AG and MG continued incrementally. The reason put forward for this case was that in parallel with the grade level, both problems got harder and the need for

reading comprehension increased. These studies reveal that in terms of improving mathematical skills, reading comprehension skills should be developed at early ages.

In Pape's (2004) study, students were divided into two groups in terms of problem solving approaches: those who solve it directly and those solve it with a meaning-based approach. It was determined that students- who could write the mathematical equation without reading the problem again, making sense of it in their own ways, forming connections between what was given and what was wanted, who used the text just to determine the required calculations and who were poor in reading and understanding- preferred directly solving approach whereas students who saved their data, absorbed the text content, put forward the solution with its reasons by crosschecking the operations used meaning-based approach. It was seen at the end of the research that students who used meaning-based approach could structure the problem better than those who directly solving approach and reached more meaningful and consistent results. It was observed in the study that students who used directly solving approach could only use rereading strategy but those who used meaning-based solving approach took notes, diagrammatized, double checked, adapted the problem to real life and expressed the result as a sentence.

In the studies conducted by Panasuk and Beyranevand (2010), Moreno and Mayer (1999), Hegarty, Mayer, and Monk (1995), success of students who used word-based and action-based solving was analyzed. In word-based strategies, such key words in the problem sentence as *"more, less, times"* are chosen and the operations are decided upon these key words (e.g.: if "more" is wanted, addition, if "less" is wanted subtraction, if "times" is stated multiplication is done). It is accepted in action-based interpretation that rather than the words, the plot and the relation between the events are analyzed and the whole problem text is focused on. At the end of the study, it was seen that students with action-based interpretation were more successful than those with word-based interpretation.

As a result of a study conducted by Verschaffel and De Corte (1993), it was seen that students with higher success spent 67% of their time interpreting sentences and 33% analyzing the numbers while students with lower success spend 43% of their time interpreting words and 57% analyzing the numbers. This finding was interpreted as the fact that sentence-focused solutions were more effective than sentence and word-focused solutions.

In a study conducted by Hite (2009), it was tried to enhance problem solving skills of elementary school 5th grade students by providing reading comprehension education. In the study, the teacher felt that his/her students couldn't solve four-operation problems and thinking that this might have resulted primarily from reading comprehension deficiency, s/he also evaluated their reading comprehension levels and determined that their reading comprehension levels were also low. Students whose reading level was low were made to listen to a voice recording in which the teacher was reading the problem and so they were enabled to go to the solution under equal conditions with the students whose reading comprehension level was high. In another activity, the students were made to read the problem sentence, their reading was recorded and they were made to listen to it to underline and correct the parts they misread and then to solve the problem. In another activity, posters were prepared showing the critical words in the problem and it was aimed to help students choose the correct operation with reference to these words. At the end of the study, it was seen that the number of correct answers of the students who had reading comprehension difficulties rose. In an experimental study conducted by Ulu (2011), it was observed that elementary school 5th grade students' problem solving success rose as a result of a 22-hour reading comprehension education without problem solving activities.

In a study conducted by Grimm (2008), students' improvements in mental calculation, prediction, calculation on paper, problem solving, comprehension and learning areas (numbers, geometry, data, probability) from the beginning of 3rd to the end of 8th grade. At the end of the study, it was seen that the comprehension skills acquired at 3rd grade predicted the improvement in problem solving success most followed by improvements in learning areas and calculation skills.

In a study conducted by Vilenius-Tuohimaa et al. (2008) on elementary school 4th grade students, the relation between students' fluent reading (speed, accuracy, word association), comprehension (cause and effect relation, making an inference, finding the main idea, idiomatic knowledge) and problem solving skill was researched. At the end of the study, it was found that when fluent reading skill was involved in the model, there was a .67 correlation between comprehension skill and problem solving skill, but when fluent reading scores were checked, the correlation between comprehension skill and problem solving skill decreased (r=.47) and fluent reading skill explained 18% of problem solving variance. This allows us to see the effect of fluent reading on comprehension and problem solving success.

In the light of the information above, two different models were structured and tested. In the first of these models (Model 1) fluent reading skills were composed of word recognition (accuracy), automaticity (reading rate) and prosody (Wilger, 2008; Rasinski, 2004; Kuhn, 2005; Allington, 2006) dimensions. Comprehension process was analyzed at two levels: literal and inferential comprehension (Baştuğ & Keskin, 2012; Başaran, 2013; Fabrikant et al., 1999; Yıldırım, 2012; Calvo, 2004). Because fluent reading skills were seen to predict literal and inferential comprehension in a study of Baştuğ and Keskin (2012), Başaran (2013), paths were drawn from fluent reading to literal and inferential comprehension that defined the relations.

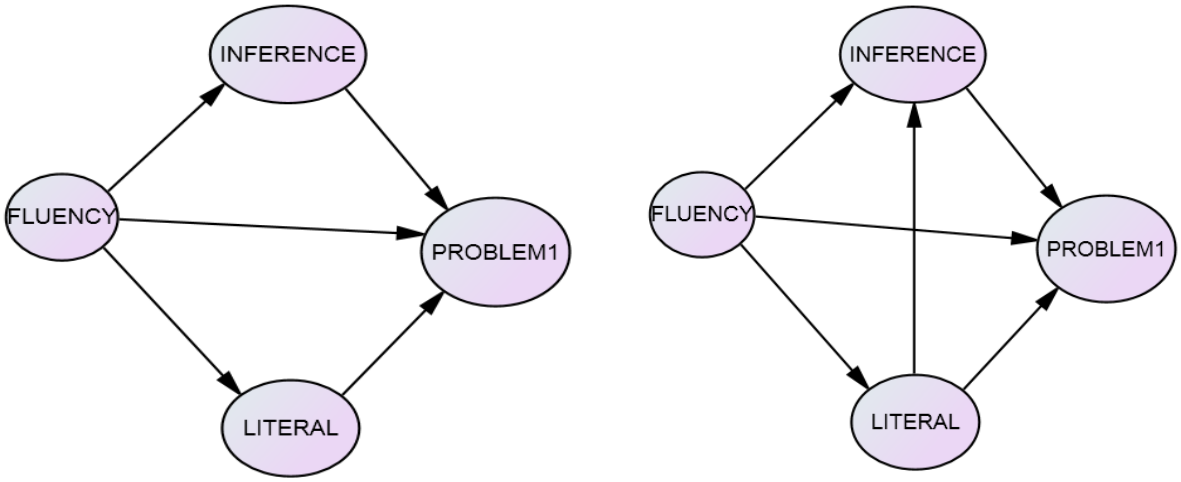
It was determined that confirmatory factor analysis was used to define the relation between fluent reading and problem solving skill in another study (Vilenius-Tuohimaa et al., 2008). Moreover, fluent reading skills entered the above-mentioned study not as a numeric but as a categorical variable (good reader, poor reader) and while it was determined that fluent reading had an effect on problem solving skill, whether this effect was direct or indirect wasn't determined. In this context, in order to test the relation between fluent reading skills and problem solving skill by using structural equation model, a path was drawn from fluent reading to problem solving that defined the relation.

Kispal (2008) defined the skill to make an inference as using two or more explicit data in a text to reach the third datum not given explicitly in the text whereas Pressley (2000) defined it as revealing the mental models staying in the background of the information in the text. Chikalanga (1992) and Zwiers (2004) stated that the propositions in the text and priori knowledge of the reader should be integrated in order to actualize the skill to make an inference. Kispal (2008), Chikalanga (1992), Zwiers (2004), Pressley (2000) and Kintsch (1988) stated that an individual who made an inference during reading comprehension was at the same time reasoning. The role of reasoning during problem solving was defined as reaching a solution by integrating every proposition in the problem text in a logical consistency (Leighton & Sternberg, 2004). With reference to the definitions above, significant resemblances are seen between inferential comprehension during reading comprehension and reasoning skill during problem solving. Background information should be activated other information should be reached with reference to the explicit information in the text both in inferential comprehension during reading comprehension and in reasoning during problem solving. Literature shows that a positive relation exists between problem solving and reasoning skills (Barbey & Barsalou, 2009; Çelik & Özdemir, 2011; Çetin & Ertekin, 2011; Umay, 2003; Yurt & Sünbül, 2014). Also, in the studies conducted by Polat and Keşan (2013), Grimm (2008), Vilenius-Tuohimaa et al. (2008), Plomin and Kovas (2005), because comprehension skills were seen to have a relation with problem solving skill, a path that defines the relations was drawn from literal and inferential comprehension to problem solving skill.

Although no relational study has been found in literature that says literal comprehension skill predicts inferential comprehension skill, a strong opinion occurred in the studies carried out on students that literal comprehension affects inferential comprehension (Allen, 1985; Kintsch, 1988; Suk, 1997; Vacca et al., 2006). In this context, with a reference to the assumption that literal comprehension predicts inferential comprehension, Model 2 was obtained by adding a path -from literal comprehension to inferential comprehension- to Model 1 that defined the relation.

In the studies conducted by Wijaya et al. (2014), Ulu (2011), Singh, Rahman, and Hoon (2010), Clements and Ellerton (1996), Clarkson (1991), Marinas and Clements (1990), Clements (1982), Clarkson (1980), it was found that elementary school students made reading comprehension-based errors during problem solving between 25% and 75%. On the other hand, in a study conducted by Jordan, Kaplan, and Hanish (2002), it was determined that reading comprehension difficulty predicts mathematical difficulty but mathematical difficulty doesn't predict reading comprehension difficulty. However, it was determined that some dimensions weren't examined in the studies analyzing the relation between reading comprehension and problem solving skill. For example, Polat and Keşan (2013), Grimm (2008), Plomin and Kovas (2005) looked into the relation between comprehension skills and problem solving skills but no evaluations were done about reading dimension. Although Vilenius-Tuohimaa et al. (2008) looked into reading dimension, it was seen that prosodic reading dimension wasn't included in the model. In this mentioned study, reading skills entered the model not as a numeric but as a categorical variable (good reader, poor reader), whether the effect of fluent reading on problem solving skill is direct or through comprehension wasn't determined. Comprehension skill wasn't categorized as literal and inferential comprehension and problems were only composed of routine problems. Also, the model wasn't tested as a structural equation model but a confirmatory factor analysis.

In this context, both for Turkey and for the foreign literature, there is a need to set up and test a structural model showing the effect sub-dimensions of fluent reading skills and sub-dimensions of comprehension skills on problem solving skills. Thus, the hierarchical relations between fluent reading and comprehension types, between fluent reading and problem solving skills, and between comprehension types and problem solving skills will be seen. When the relations are determined, which skills contribute to the development of problem solving skill more, which skills affect problem solving skills directly and which skills affect problem solving skills indirectly, how much of the change in problem solving skill is explained by the change in language skills will be determined. Diagram 1 shows Model 1 and Model 2 tested in the research.



Model 1: The model in which the direct effects of literal meaning on problem solving success.

Model 2: The model in which the direct and indirect effects of literal meaning on problem solving success.

Diagram 1. Hypothesis Model

H1: Fluent reading affects literal comprehension skill directly and positively.

H2: Fluent reading affects inferential comprehension skill directly and positively.

H3: Literal comprehension has a partial intermediary role in the effect of fluent reading on inferential comprehension skill (constructed within the scope of 2nd model).

H4: Literal comprehension affects inferential comprehension skill directly and positively (constructed within the scope of 2nd model).

H5: Fluent reading affects problem solving skill directly and positively.

H6: Literal and inferential comprehension has a partial intermediary role in the effect of fluent reading on problem solving skill.

H7: Literal comprehension affects problem solving skill directly and positively.

H8: Inferential comprehension has a partial intermediary role in the effect of literal comprehension on problem solving skill (constructed within the scope of 2nd model).

H9: Inferential comprehension affects problem solving skill directly and positively.

Method

This research questioning the existence of the effect of fluent reading (word recognition, automaticity, prosody) and comprehension (literal comprehension and inferential comprehension) skills on problem solving skill and the effect level was conducted as predictive screening model. In predictive correlational research, relations between two or more variables are analyzed and the other variable is tried to predict with reference to the variables (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2011, p. 277).

Population and Sampling

The population of the research is composed of 4th grade students at 26 state schools during 2015/2016 education period in the city of Kütahya. Because it would be difficult to reach them all, using proportional sampling method, a study group was formed. Karasar (2005) suggests choosing a study group using cluster sampling method when the elements in the population cannot be selected one by one. In cluster sampling method, the fair chance of being chose is not for the elements but for the clusters with all their elements. In proportional cluster sampling, while choosing the clusters, a

variable considered important for the population is categorized and by classifying the groups in the population according to this variable, they are divided into sub-populations. While choosing clusters out of these sub-populations, the ratio of the sub-population in the population is taken into account.

After 4+4+4 education system, elementary schools were divided into two: elementary and secondary schools, which made choosing the clusters to be included into the sample difficult because there wasn't a standard scale to evaluate elementary schools. This challenge was tried to be sorted out by taking TEOG YEP (the exam to pass from elementary to secondary school) results as a scale. In this context, if the secondary school in the sampling had an elementary school, the clusters were chosen from these schools, but if not, the clusters entering the sampling were chosen from the elementary school which sent the most number of students to that secondary school.

While doing proportional sampling method, in order to be able to divide 26 state secondary schools in the city of Kütahya (the schools in the villages weren't included because it would have caused difficulties in applying the assessment tools), which constituted the research population, 2014/2015 education period TEOG YEP results were taken as a scale. In this context, to form the sampling, with a reference to TEOG YEP average success scores of each of the 26 state schools, TEOG YEP standard deviation value was computed for the city of Kütahya. Later, with a reference to TEOG YEP averages, these 26 schools were divided into sub-populations. Diagram 2 gives the findings.

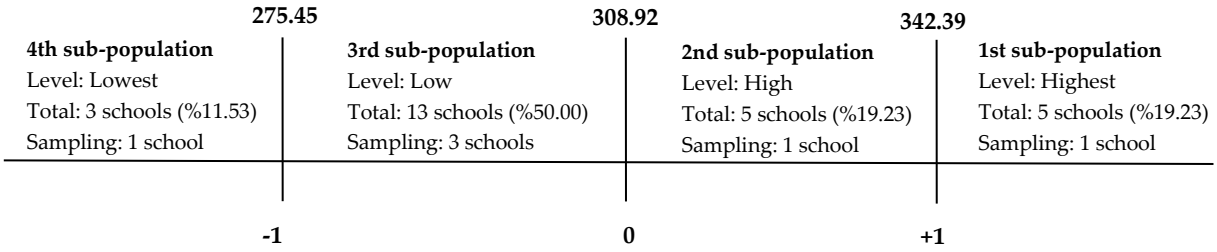


Diagram 2. Dividing the 26 State Schools in the city of Kütahya Forming the Research Population According to 2014/2015 TEOG YEP Results

According to Diagram 2, the mean 2014/2015 TEOG YEP score of the city of Kütahya is 308.92 and standard deviation is 33.47. While dividing these 26 schools into sub-populations, mean and standard deviation scores were regarded as a scale. The schools whose mean scores were higher than 2014/2015 TEOG YEP Kütahya mean score were considered successful and those with lower scores were considered unsuccessful. The schools among the successful ones with standard scores between 0 and +1 were classified as with "high" success and those with standard scores over +1 were classified as with "highest" success. The same classification was done for unsuccessful schools as those with standard scores between 0 and -1 as with "low" success and those with standard scores over -1 as with "lowest" success. With a reference to this classification, the 26 secondary schools in the city of Kütahya were divided into sub-populations as 5 with "highest" success (19.23%), 5 with "high" success (19.23%), 13 with "low" success (50%) and 5 with "lowest" success (11.53%). After this, the research sampling as chosen out of these 26 schools divided into sub-populations.

Sampling

According to Diagram 2, it is seen that the overall of the schools in the sub-populations accumulated in the area with -1 mean and 0 standard deviation, while proportionally fewer schools remained between 0 and +1 and over +1 and below -1. While choosing the school to be included into the sampling, this system was taken into account and the number of schools representing each sub-population was determined by proportioning it to the number of schools in the population. Table 1 shows the schools constituting the research sampling, their departments and number of students.

Table 1. Success Level of the Schools Constituting the Study Group and Student Distribution in the Chosen Departments

School Success Level	Schools	2014/2015 TEOG YEP	2014/2015 TEOG YEP	Department	f	%
Highest	School A	361.98	3	A	24	8.60
				B	22	7.88
High	Elementary school sending students to school B	333.01	8	A	26	9.31
				C	19	6.81
Low	School C	297.13	14	C	24	8.60
				D	25	8.96
	Elementary school sending students to school D	292.85	17	B	23	8.24
				D	21	7.52
	School E	286.07	20	A	27	9.67
				D	24	8.60
Lowest	School F	260.86	25	B	28	10.03
				C	16	5.37

According to Table 1, 6 schools were determined using unbiased appointment method: 1 school from 5 schools with "highest" success rate, 1 school from 5 schools with "high" success rate, 3 schools from 13 schools with "low" success rate and 1 school from 3 schools with "lowest" success rate. The chosen schools represent 23.07% of the schools in the city of Kütahya. In terms of the 4th grade department numbers of these schools, some schools had 5, some had 4 and some had 3 departments, so the study group was composed choosing 2 departments from each of the 6 schools because the number of departments wasn't equal. While choosing the departments, in the light of the information gathered from the school administrators, great care was taken to choose the departments that represented the category of the school best. For example, 1 out of 5 schools with "highest" success level was chosen using unbiased appointment method and became "School A". While choosing 2 departments from this school, since the school was in the category of school with "highest" success, in the light of the opinions of its administrator, 2 departments with the highest success level among the 4th grades at this school were included into the sampling. The names of the schools in the sampling and the 4th grade departments weren't given and instead, codes 1 and 2 were used. Because five different data gathering tools were applied on different days, it was seen that some students didn't attend one or more tests and so these students were excluded. Also, it was seen that some classes had inclusive students and so these students were excluded as well. As a result, the sampling was composed of 6 schools 12 departments and 279 4th grade students. Streiner (1994) emphasizes that in structural equation model studies, sampling size should be at least 10 times the variable number. Since 23 variables exist in this study, it can be said that the research sampling bears this criterion. In the study, 54.12% (151) of the students are male and 45.88% (128) are female.

Data Gathering

Evaluating fluent reading skill: Fluent reading skill was evaluated in three dimensions: word recognition (accuracy) dimension, automaticity (rate) dimension and prosody dimension.

While evaluating word recognition and automaticity dimensions, a reading text comprised of 182 words and called *"Ödül"*, which had been used by Keskin (2012) to evaluate fluent reading skills of 4th grade students, was used. Each student was made to read the text and it was recorded to determine word recognition levels of the students. Before reading, students were reminded that "it wasn't a speed reading contest; they were supposed to read as fast as possible but the main purpose

was to comprehend the text". Later, the video recordings were analyzed using the Informal Reading Inventory developed by Harris and Sipay (1990) and adapted to Turkish by Akyol (2006) and with a reference to the inventory, repetitions during reading, omissions, insertions, reversals, substitutions and mispronunciations were regarded as reading errors. In this context, the number of words read accurately and the total number of words (inaccurately read words included) read by each student per minute were found. According to Caldwell (2008) and Rasinski and Hamman (2010), word recognition (reading accuracy) percentage is found using "the number of words read accurately per minute/total number of words read per minute x 100" formula. Automaticity (reading rate) is obtained with the number of words read accurately per minute. With a reference to these formulas, reading accuracy percentage and reading rate of each student were determined.

In order to evaluate the third dimension of fluent reading, prosody, a reading text comprised of 150 words and called *"Tiyatro"* used by Keskin (2012) to evaluate fluent reading skills of 4th grade students, was used. In order to determine prosodic reading levels of the students, prosodic reading scale comprised of 15 items and developed by Baştuğ and Keskin (2011) was used. The scale with minimum score 0 and maximum score 60 was one-dimensional with Croncbach alpha coefficient .98. In this context, each student was made to read the text and it was recorded to determine word prosodic reading levels of the students. The video recordings were scored by three experts who had completed their PhD on reading comprehension in elementary school teaching using prosodic reading scale. In order to see the reliability of the scoring done by using prosodic reading scale Weighted Kappa coefficient was checked. The data obtained from Kappa coefficient are interpreted as "Poor agreement=< 0.20; Acceptable agreement=0.20-0.40; Medium agreement=0.40-.60; Good agreement=0.60-0.80; Absolute=0.80-1.00" (Şencan, 2005, p. 485). Accordingly, concordance among the scorers was found .68, which can be said to be good agreement. Prosodic reading score of each student was obtained by taking the mean of the scores which scorers gave to prosodic reading scale. In order to determine validity of the scale with a reference to the mean scores, confirmatory factor analysis (DFA) was done and it was seen that the fit indices of the model set up with the one-factor structure of the scale (χ^2/sd=0.698, RMSEA=0,038, TLI=0,93, IFI=0,95, GFI=0.97) were sufficient.

Evaluating comprehension skill: Comprehension skill was evaluated in two dimensions: literal and inferential comprehension.

In order to evaluate literal comprehension skill (Wh-questions), a text- which was developed by Başaran (2013), consisted of 336 words and was called *"Kasabanın Kahramanı"*- and 5 short-answer questions- which were prepared with a reference to this text, evaluated directly the remembering level of the information and whose validity and reliability were checked by expert opinion- were used. Because it was seen during pilot scheme that 8 minutes was enough for text reading and 7 minutes was enough to answer the questions in the text, the implementation process were structured with a reference to these durations. During implementation, students were given two sheets of paper: one involving the reading text and the other 5 simple comprehension questions at remembering level about the text; when the time for reading (8 min.) was over, the first paper was collected and when the time for answering (7 min.) was over, the other paper was collected. The answers of the students were scored as 2, 1, 0 from precise answers to inaccurate answers. While loading the data statistically, replies to each question were coded and no scoring operation was done at this stage. Later, the codes were analyzed by experts who had completed PhD on reading comprehension in elementary school teaching; domain experts scored each code by reading the text. The codes on which statistical means were loaded were turned into scores with a reference to expert opinions and so literal comprehension score given by each expert to each student was obtained. In order to determine reliability of this scoring, the relation between the scores given by three experts to students was analyzed using Weighted Kappa test and the value thus obtained (r=.81) showed that there was a good agreement among scorers. Later, having the average of the scores given by the experts, literal comprehension score was obtained for each student. With a reference to the mean scores, in order to determine validity of the scale, confirmatory factor analysis (DFA) was conducted and it was seen that the fit

indices of the model with the one-factor structure of the scale (χ^2/sd=1.638, RMSEA=0,040, TLI=0,91, IFI=0,95, GFI=0.99) were sufficient.

In order to evaluate inferential comprehension skill, a text- which was developed by Başaran (2013), consisted of 226 words and was called "*Mantarlar"*- and a scale- which was prepared with a reference to the text, whose reliability and validity were assured upon expert opinion and which consisted of 5 questions- were used. The questions in the scale consisted of such implicit questions as finding the main idea, finding a title, lessoning, developing empathy, forming cause and effect relation. Because it was seen during pilot scheme that 15 minutes was enough to answer the test, the implementation process were structured with a reference to this duration. The answers of the students were scored as 3, 2, 1, 0 from precise answers to inaccurate answers. While loading the data statistically, replies to each question were coded and no scoring operation was done at this stage. Later, the codes were analyzed by experts who had completed PhD on reading comprehension in elementary school teaching; domain experts scored each code by reading the text. The codes on which statistical means were loaded were turned into scores with a reference to expert opinions and so inferential comprehension score given by each expert to each student was obtained. In order to determine reliability of this scoring, the relation between the scores given by three experts to students was analyzed using Weighted Kappa test and the value thus obtained (r=.64) showed that there was a good agreement among scorers. Later, having the average of the scores given by the experts, inferential comprehension score was obtained for each student. With a reference to the mean scores, in order to determine validity of the scale, confirmatory factor analysis (DFA) was conducted and it was seen that the fit indices of the model set up with the one-factor structure of the scale (χ^2/sd=1.467, RMSEA=0,052, TLI=0,95, IFI=0,96, GFI=0.98) were sufficient.

Problem solving scale: Problem solving scale was composed of 10 four-operation problems used in the studies of Ulu (2011), Altun (2005), Yazgan and Bintaş (2005), Altun and Arslan (2006), Liang (2007), Pantziara, Gagathis, and Elia (2009), Griffin and Jitendra (2008). Validity of the scale was assured through expert opinion. During scale set up, great care was taken to the fact that the selected questions would consist of such problems that would enable to use strategies as different as possible.

Reliability and validity studies of the scale were conducted on 124 4t grade students at schools in the city of Kütahya whose means were very close to one another according to 2014/2015 YEP scores. In order to determine reliability and validity of the scale, firstly, item difficulty and item discrimination indices of each question and later, reliability coefficient of the scale (KR20) were computed. According to Karaca (2006), Tekin (1997) and Yılmaz (1998), item difficulty index ranged from 0 to 1, items with difficulty indices ranging from 0.30 to 0.70 were at average difficulty level. Item difficulty indices of the questions in the scale ranged from 0.32 to 0.48, which showed that all the questions in the test were at medium difficulty. Discrimination index varied between -1 and +1. When this value is 0.40 and above, the items are considered discriminative (Karaca, 2006; Tekin, 1997; Yılmaz, 1998)**.** Discrimination indices of the items in the test ranged from 0.43 to 0.64, which showed that all the items were discriminative. KR20 value computed to determine internal consistency of the scale was found 0.84. When KR20 value is 0.70 and above, it means that internal consistency and reliability of the test are high (Büyüköztürk, 2006). According to Şekercioğlu, Bayat, and Bakır (2014), factor analysis of the scales scored as 0-1 should be conducted on tetrachoric correlation matrice. Because problem solving scale is scored as 0-1, construct validity (factor analizi) of the scale was done on tetrachoric correlation matrice. According to the analysis result, the fact that KMO value was .898 shows that the scale has sufficient sampling size for factor analysis and Barlett test results ($X^2_{(45)}$ =881.338; p<.01) show that the variables have equal variance (Büyüköztürk, 2006). As a result of analysis, factor loads of the scale items varied between .898 and .496 and since factor loads were sufficient, it was decided to keep all the items in the scale (Büyüköztürk, 2006). It was also seen that with its one-dimension structure, the scale explains 66.32% of problem solving variance.

Because it was seen during pilot scheme of problem solving scale that 40 minutes was enough for solving, the implementation process were structured with a reference to this duration. While determining the problem solving success scores of the students, 1 point was given to correct answer and 0 point was given to wrong answer.

Data Analysis

During the analysis of the findings, structural equation models, which have especially been increasingly important in social sciences, were used (Çetin & Fıkırkoca, 2010). To see compliance of the model acquired out of the analyses results, such compliance indices as "Chi-Square/ degrees of freedom (χ^2/sd), Root Mean Square Error of Approximation (RMSEA), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI)" were tested (Byrne, 2010; Schermelleh Engel, Moosbrugger, and Müller, 2003; Şimşek, 2007).

Findings

In this study, the effect of fluent reading skills [speed, word recognition rate (wrr), prosody], literal comprehension (LC) and inferential comprehension (IC) levels of elementary school 4th grade students on problem solving success in problem solving success was researched. Whether literal comprehension and inferential comprehension have an intermediary role in the effect of fluent reading on problem solving success and whether inferential comprehension has an intermediary role in the effect of literal comprehension on problem solving success were also researched. For this purpose, descriptive statistics and correlation values of the variables in the research were analyzed. Table 2 shows the relevant data.

Table 2. Correlation and Descriptive Statistics of the Variables in the Model

	Speed (Rate)	WRR	Prosody	LC	IC	Problem Solving
Speed (Rate)	1.00	.636**	.446**	.354**	.363**	.320**
WRR	.636**	1.00	.528**	.373**	.301**	.323**
Prosody	.446**	.528**	1.00	.448**	.549**	.249
LC	.354**	.373**	.448**	1	.519**	.427**
IC	.363**	.301**	.549**	.519**	1	.423**
Problem Solving	.320**	.323**	.249**	.427**	.423**	1
Mean	100.30	93.10	31.12	5.98	8.42	3.13
Standard Deviation	22.23	8.68	11.70	2.20	2.95	2.68
N	279	279	279	279	279	279

** Significant at 0.01 level.

Büyüköztürk (2006) states that a correlation of 0-0,29 between two variables is low, that of .30-0.69 is medium and that of 0,70-1.00 is high. According to Table 2, while there is a low relation between problem solving success scores and prosody scores, a medium level and positive relation between all the other variables. The mean scores obtained from the scale were found as 100.30 for speed, 93.10 for reading accuracy percentage, 31.12 for prosody, 5.98 for literal comprehension, 8.42 for inferential comprehension and 3.13 for problem solving.

Results of the Research Hypotheses

Findings of Testing of Model 1

In the research, Model 1 was tested first and it was concluded that fluent reading skill doesn't affect problem solving skill directly. In this context, H1 was rejected. Testing of Model 1 continued by omitting the path between fluent reading and problem solving skill. Table 3 shows values of fit index of Model 1.

Table 3. Scale Values of Fit Indices and Values of Fit Index of Model 1

Fit Indices	Good Fit	Acceptable Fit	Values Obtained From Model 1
χ^2/sd	$0 \leq \chi^2/sd0 \leq 2$	$2<\chi^2/sd \leq 5$	1.35
RMSEA	0 ≤ RMSEA ≤ .05	.05 < RMSEA ≤ .08	.03
IFI	0.95 ≤ IFI< 1.00	0.90≤ <IFI<0.95	.95
TLI	0.95≤ TLI< 1.00	0.90 ≤ TLI<0.95	.94
CFI	0.95≤CFI<1.00	0.90≤CFI<0.95	.95
GFI	0.95≤GFI<1.00	0.90≤GFI<0.95	.92

According to Table 3, fit indices of Model 1 (χ^2/sd=1.35; RMSEA=0.03; IFI=0.95; TLI=0.94; CFI=0.95; GFI=.92) are good and acceptable. Table 4 shows the total, direct and indirect effects of dependent and independent variables in Model 1.

Table 4. Total, Direct And Indirect Effects Of Dependent And Independent Variables In Model 1

Independent Variable	Dependent Variable	Total Effect	Direct Effect	Indirect Effect	Standard Error	C.R.
Fluent Reading	Literal Comprehension	.448	.448		.012	4.518***
Fluent Reading	Inferential Comprehension	.571	.571		.006	3.774***
Fluent Reading	Problem Solving	.463		.463		
Literal Comprehension	Problem Solving	.421	.421		.069	3.424***
Literal Comprehension	Problem Solving	.480	.480		.033	3.729***

**significant at 0.01 level.

According to Table 4, fluent reading has direct effect on literal comprehension (β=0.45, c.r.=4.518, p<.01) and inferential comprehension (β=0.57, c.r.=3.774, p<.01) while literal comprehension (β=0.42, c.r.=3.424 p<.01) and inferential comprehension (β=0.48, c.r.= 3.729, p<.01) have direct effect on problem solving skill. It is also seen that fluent reading skill doesn't have a direct effect but an indirect effect (β=0.46) on problem solving skill; besides, literal comprehension and inferential comprehension is intermediary in this effect. In order to determine significance of the intermediary effect of literal comprehension and inferential comprehension, Sobel z test was conducted. The results show that the intermediary effects of literal comprehension (sobel z= 6.08, p<.01) and inferential comprehension (sobel z= 14.37; p<.01) in the effect of fluent reading on problem solving skill are significant. Variance rates in Model 1 show that fluent reading explains 31% of the variance in literal comprehension and 33% of the variance in inferential comprehension whereas fluent reading, literal comprehension and inferential comprehension explain 46% of the variance in problem solving. Diagram 3 shows Model 1.

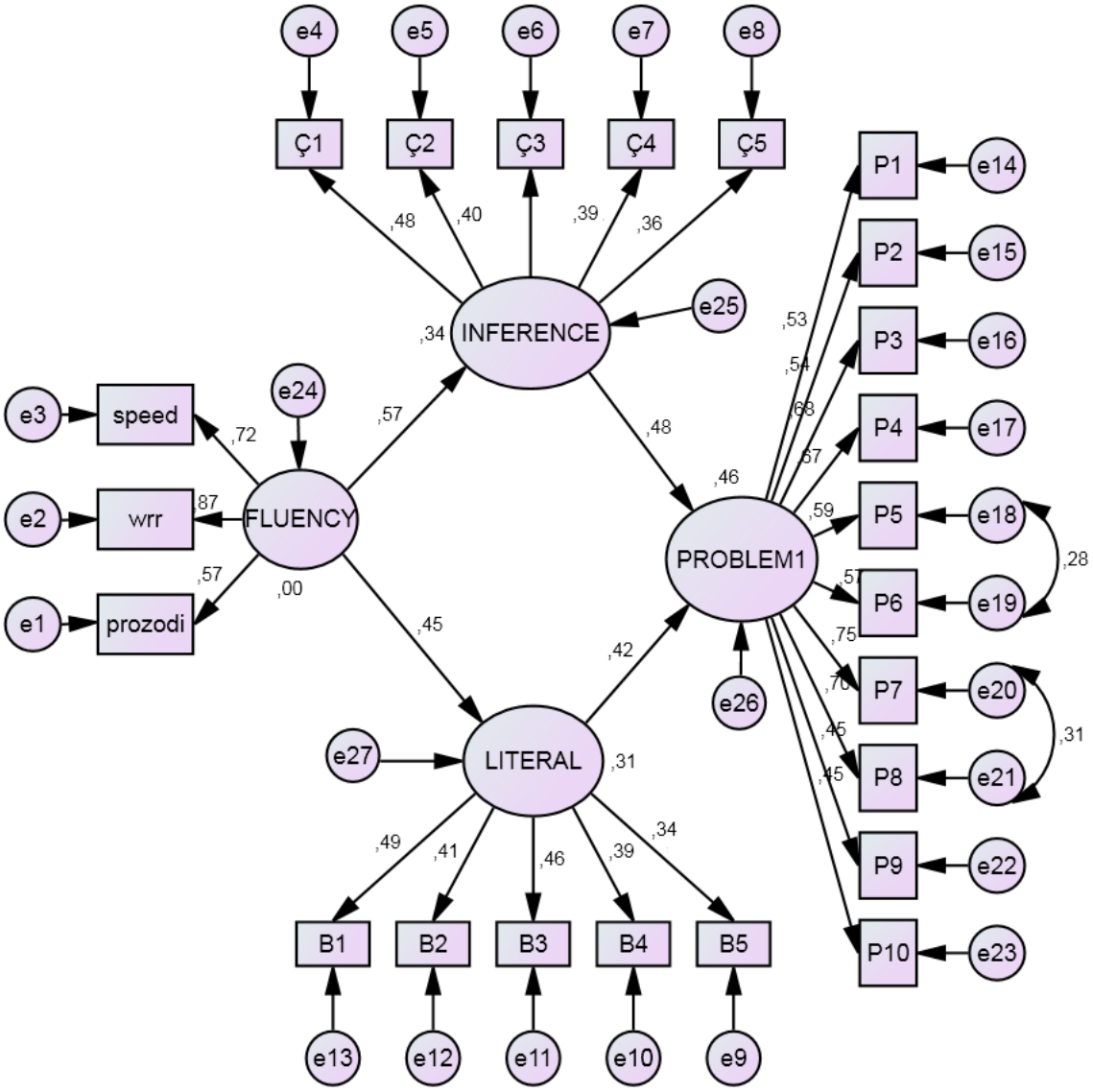


Diagram 3. Regression Values of Model 1

Findings of Testing of Model 2

Model 2 was developed to determine whether inferential comprehension has an intermediary effect in the effect of literal comprehension on problem solving success. Table 5 shows the findings.

Table 5. Scale Values of Fit Indices and Values of Fit Index of Model 2

Fit Indices	Good fit	Acceptable fit	Values obtained from Model 2
χ^2/sd	$0 \leq \chi^2/sd0 \leq 2$	$2<\chi^2/sd \leq 5$	1.29
RMSEA	0 ≤ RMSEA ≤ .05	.05 < RMSEA ≤ .08	.03
IFI	0.95 ≤ IFI< 1.00	0.90≤ <IFI<0.95	.96
TLI	0.95≤ TLI< 1.00	0.90 ≤ TLI<0.95	.95
CFI	0.95≤CFI<1.00	0.90≤CFI<0.95	.96
GFI	0.95≤CFI<1.00	0.90≤CFI<0.95	.92

Table 5 shows that fit indices of Model 2 (χ^2/sd=1.29; RMSEA=0.03; IFI=0.96; TLI=0.95; CFI=0.96; GFI=.92) are good and acceptable. Table 6 shows the total, direct and indirect effects of dependent and independent variables in Model 1.

Table 6. Total, Direct and Indirect Effects of Dependent and Independent Variables in the Model

Independent Variable	Dependent Variable	Total Effect	Direct Effect	Indirect Effect	Standard Error	CF
Fluent Reading	Literal Comprehension	.426	.426		.006	3.718**
Fluent Reading	Inferential Comprehension	.576	.343	.233	.011	3.474**
Literal Comprehension	Inferential Comprehension	.547	.547		.152	3.424**
Fluent Reading	Problem Solving	.416		.416		
Literal Comprehension	Problem Solving	.544	.251	.293	.135	2.691**
Inferential Comprehension	Problem Solving	.536	.536		.076	3.124**

** significant at 0.01 level.

Table 6 shows that fluent reading has a direct effect on literal comprehension (β=0.43, c.r.=3.718, p<.01) and inferential comprehension (β=0.34, c.r.=3.474, p<.01); that fluent reading also has an indirect effect on inferential comprehension (β=0.23) and that literal comprehension is intermediary in this effect. In order to determine significance of intermediary effect of literal comprehension, Sobel z test was conducted and the results showed that intermediary effect of literal comprehension (sobel z=3.61, p<.01) is significant. It was also found that fluent reading has an indirect effect on problem solving skill (β=0.42) and literal comprehension and inferential comprehension is intermediary in this effect. Sobel test showed that intermediary effects of literal comprehension (sobel z= 1.85, p<.05) and inferential comprehension (sobel z= 4.24, p<.01) are significant. The research results showed that literal comprehension (β=0.55, c.r.=3.424, p<.01) has an effect on inferential comprehension. Another finding was that literal comprehension (β=0.25, c.r.=2.691, p<.01) and inferential comprehension (β=0.54, c.r.=3.124, p<.01) have direct effects on problem solving skill, but literal comprehension skill also has an indirect effect (β=.29) on problem solving skill and inferential comprehension is intermediary in this effect. Sobel z test results conducted to determine significance of intermediary effect of inferential comprehension showed that intermediary effect of inferential comprehension in the effect of literal comprehension (sobel z= 3.22; p<.01) on problem solving skill. The variance rates in Model 2 show that fluent reading explains 31% of the variance in literal comprehension and fluent reading and literal comprehension explain 58% of the variance in inferential comprehension whereas fluent reading, literal comprehension and inferential comprehension explain 54% of the variance in problem solving. Model 2 is given in Diagram 4.

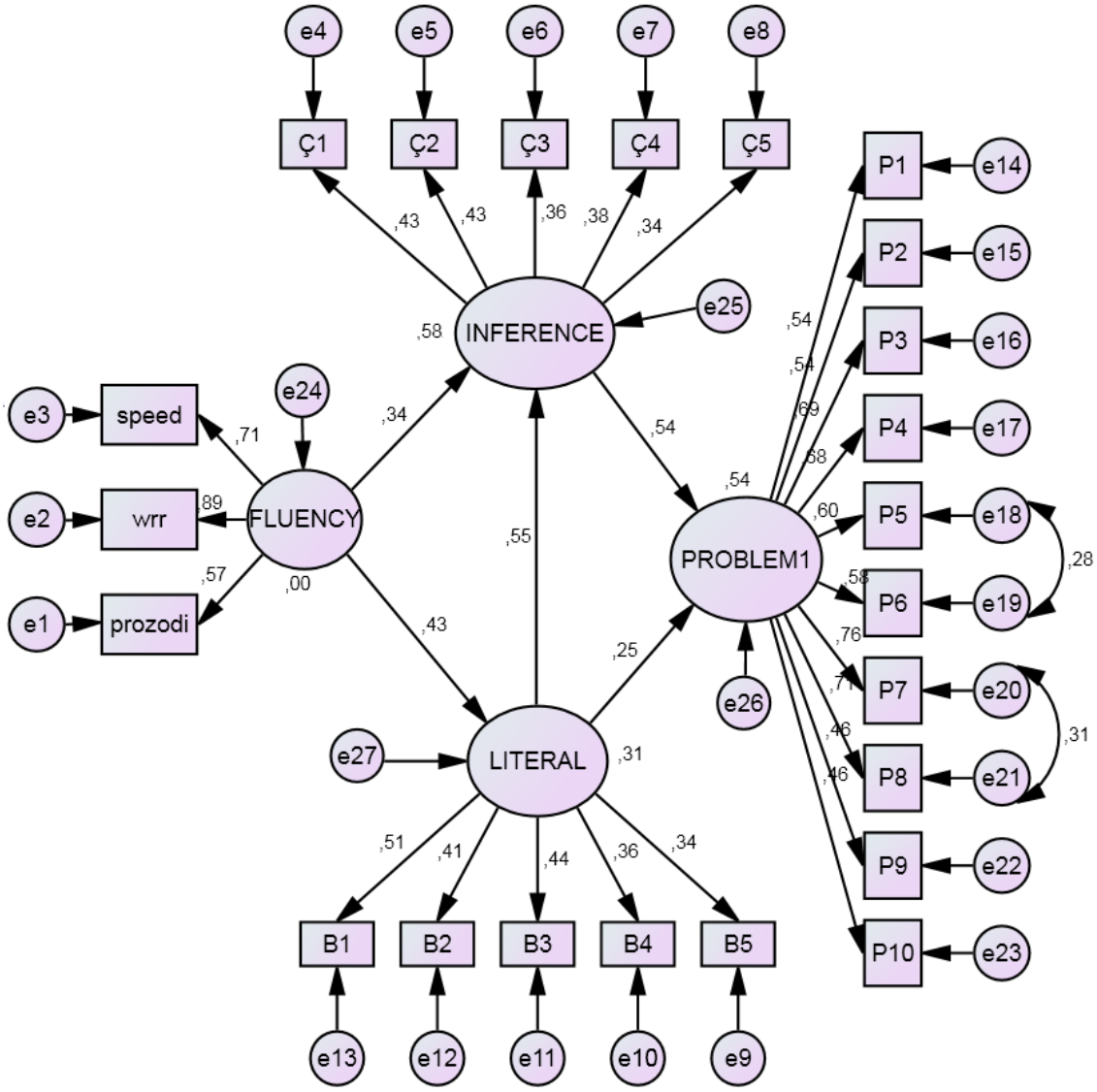


Diagram 4. Regression Values of Model 2

In this context, except for the fifth hypothesis of the research, all the others are accepted.

Discussion, Conclusion and Suggestions

In this research, the relations between fluent reading, literal comprehension and inferential comprehension variables and the effects of these variables on problem solving skill were researched using structural equation modeling. For this purpose, in the light of theoretical basis and the literature, two structural regression models (Model 1, Model 2) were set up and these models were tested with the hypotheses.

In the context of the first hypothesis, the effect of fluent reading skill on literal comprehension skill was analyzed and the hypothesis was accepted. No holistic research was found in the literature analyzing the effect of fluent reading skill on literal comprehension skill, but some researches were found analyzing the effect of the sub-dimensions of fluent reading on literal comprehension. Baştuğ and Keskin (2012) found a medium-level relation between literal comprehension and word recognition level and between reading rate and prosodic reading level. Başaran (2013) concluded that word recognition level predicts literal comprehension skill but reading rate and prosody don't. In this context, the research results- by going one step further than those obtained in the studies of Baştuğ

and Keskin (2012), Başaran (2013) revealed that fluent reading affects literal comprehension. Moreover, at the end of the study, it was concluded that fluent reading explains almost 31% of the variance in literal comprehension.

Within the context of the second hypothesis, the effect of fluent reading skill on inferential comprehension skill was analyzed and the hypothesis was accepted. In the first model developed within the scope of the research, it was seen that fluent reading skill affects inferential comprehension skill at .571 level. In the second model, this effect rate rose to .576 and showed just a little increase, but the path coefficient between fluent reading skill and inferential comprehension fell down to .343, the main reason for which was the intermediary effect of literal comprehension between fluent reading and inferential comprehension at .233 level. In the effect of fluent reading on inferential comprehension, the partial intermediary role of literal comprehension was considered significant and the third hypothesis developed within the scope of the second model was accepted. Also, since a significant effect of literal comprehension on inferential comprehension at .547 level, the fourth hypothesis of the research was accepted as well. It was seen in the first model in which the direct effect of fluent reading was observed on inferential comprehension skill that fluent reading skills explain 34%of the variance in inferential comprehension whereas it was seen in the second model in which both direct effects of fluent reading and its indirect effects through literal comprehension were analyzed that the variance explained by inferential comprehension rose to 58%. The fact that the intermediary effect of literal comprehension on inferential comprehension raised the variance in inferential comprehension 24% helped us to see the effect of literal comprehension on inferential comprehension. No relational study was found in the literature about the fact that literal comprehension has an intermediary role in the effect of fluent reading on inferential comprehension or that literal comprehension affects inferential comprehension directly. However, in the implementations conducted on students, there are strong opinions about the intermediary role of literal comprehension between fluent reading and inferential comprehension (Allen, 1985; Kintsch, 1988; Suk, 1997; Vacca et al., 2006), which are confirmed by these research findings. Samuels (1979), Vacca et al. (2006) stated that students spend their cognitive energy on reading accuracy during the first years of basic education and read to learn in the following years, comprehension first starts with literal comprehension (Wh-questions) and later improvements in literal comprehension skills develop inferential comprehension. Allen (1985) determined that students can easily set up inferential comprehension in stories in which they are able to handle literal comprehension questions, which helps to see that fluent reading and literal comprehension are prerequisite for inferential comprehension.

It was concluded in the studies of Jenkins and Jewell (1993), Vilenius-Tuohimaa et al. (2008), Yıldız (2013) that fluent reading skills affect comprehension skills. The fact that it was seen at the end of the study that fluent reading skill affects both literal comprehension and inferential comprehension shows that it also affects comprehension as a whole. In this context, it can be said that the research findings correspond to those in the studies of Jenkins and Jewell (1993), Vilenius-Tuohimaa et al. (2008), Yıldız (2013).

Within the scope of the fifth hypothesis of the research, the effect of fluent reading on problem solving skill was researched and it was seen that there wasn't a direct effect in either model and so the hypothesis was rejected. Within the scope of the sixth hypothesis of the research, whether there is an intermediary effect of literal and inferential comprehension in the effect of fluent reading on problem solving skill was researched and the hypothesis was accepted. This enabled to see that fluent reading affects problem solving not directly but through literal and inferential comprehension. While the amount of indirect effect was .463 in the first model, fell down to .416 in the second model due to the effect of literal comprehension on inferential comprehension. It was found in the study of Vilenius-Tuohimaa et al. (2008) that fluent reading affects problem solving skill, but since the model was tested with confirmatory factor analysis, whether the effect was direct or indirect couldn't be determined. Because it was seen at the end of the research that fluent reading affects problem solving skills not directly but through literal comprehension and inferential comprehension, it is thought that the research fills a gap in the literature.

Within the scope of the seventh hypothesis of the research, the effect of literal comprehension on problem solving skill was researched and the hypothesis was accepted because the effect was significant in both models. While the direct effect of literal comprehension on problem solving skill was .421i this number fell down to .251 in the second model, but compared to the first model, the total effect amount rose and reached .544. the main reason for this situation is that inferential comprehension has an intermediary role in the effect of literal comprehension on problem solving at .293 level. The eighth hypothesis set up to determine the significance of this intermediary role was tested and then accepted because the intermediary role was significant. This situation helps to see that the indirect effect of literal comprehension on problem solving skill is more than the direct effect. Literal meaning is defined as remembering the information given explicitly in the text and is thought to occur more at word recognition level and to be the prerequisite for inferential comprehension (Samuels,1979; Allen, 1985; Kintsch, 1988; Suk, 1997; Vacca et al., 2006; Başaran, 2013). In the light of these studies, the fact that the direct effect of literal comprehension on problem solving skill is significant reveals the necessity to find answers for Wh-questions in the problem text for solution. The reason for finding the direct effect low might be due to the fact that problem solving success of students who go for solutions upon such key words as "*more, less, times"* was found low in the studies of Panasuk and Beyranevand (2010), Moreno and Mayer (1999), Hegarty et al. (1995). The fact that literal comprehension affects problem solving skill through inferential comprehension reveals the necessity for students to reason with a reference to Wh-questions in the problem text.

Within the scope of the ninth and last hypothesis of the research, the effect of inferential comprehension on problem solving skill was analyzed and the hypothesis was accepted. While the effect of inferential comprehension on problem solving was .480 in the first model, this rate was seen to increase to .536 with the intermediary effect of literal comprehension in the second model. The variable that affects problem solving success most in both models was inferential comprehension. Kispal (2008), Chikalanga (1992), Zwiers (2004), Pressley (2000), Kintsch (1988) found that reasoning is done during structuring inferential meaning while Barbey and Barsalou (2009), Çelik and Özdemir (2011), Çetin and Ertekin (2011), Umay (2003), Yurt and Sünbül (2014) found that reasoning affects problem solving skill. In this context, the fact that both skills aren't independent of reasoning can be put forward as the cause of the fact that inferential comprehension affects problem solving success more than the other variables (fluent reading and literal comprehension). However, in terms of total effects of literal comprehension and inferential comprehension on problem solving success, it will be seen that the values are very close to one another. The fact that there is a small amount of intermediary effect of literary comprehension in inferential comprehension arouses the thought that literary comprehension contributes to the development of problem solving skill more both by affecting inferential comprehension and by affecting problem solving success.

In a study of Jeanne (1983), while there was no significant difference between individuals who gained word recognition skill at early ages and those gained it at advanced ages in terms of literary comprehension, a significant difference was found in favor of those who gained word recognition skill at early ages in terms of inferential comprehension. In the studies of Andersson (2010), Grimm (2008), Jordan et al. (2003), it was seen that reading comprehension skills increase their effects on problem solving success over the years. On the other hand, Jeanne stated that there is a critical age threshold in acquiring inferential comprehension skill and if not acquired at early ages, it becomes harder to acquire inferential comprehension skill at advanced ages. In this context, it is thought that inferential comprehension which is the variable that affects problem solving skill directly most is supposed to be developed at early ages.

As a result of the research, it is seen that fluent reading, literal comprehension and inferential comprehension explain 46% of the total variance in problem solving skill in the first model and 54% of it in the second model. The reason for the 8% variance between the two models is due to the intermediary effect of literary comprehension. In this context, it can be said that the second model is more acceptable. In the studies of Prakitipong and Nakamura (2006), Tertemiz (1994), Kroll and Miller (1993), it was determined that problem solving skill is more affected by comprehension skills than mathematical operations. It was determined in the studies of Ulu (2011), Hite (2009) that comprehension training increased problem solving skill. It was found in the studies of Wijaya et al. (2014), Ulu (2011), Singh et al. (2010), Clements and Ellerton (1996), Clarkson (1991), Marinas and Clements (1990), Clements (1982), Clarkson (1980) that elementary school students mostly suffer from high incidence of reading comprehension errors during problem solving. Both the above-mentioned studies and the findings of this research reveal the importance of reading comprehension in problem solving skill.

It is thought that inferential comprehension, the variable that directly affects problem solving skill most, should developed at early ages. In this context, teachers need to emphasize classroom activities to improve inferential comprehension skills to develop both language skills and problem solving skills. However, it must be taken into consideration that these skills cannot be improved without fluent reading and literal comprehension. In this context, the effect of reading comprehension strategies on problem solving success can be researched by developing reading comprehension strategy programs to improve fluent reading, literal comprehension and inferential comprehension.

This research was carried out on elementary school 4th grade students, so further studies can be conducted on different age groups with different samplings. Moreover, experimental and longitudinal researches can also be carried out to analyze the effect of reading comprehension skills on problem solving success. Finally, by adding problem solving strategies, mathematical operational skills or different affective features- all of which have effects on problem solving skills- to the model, we can contribute to increasing the variance.

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