

# Predictive Power of Attention and Reading Readiness Variables on Auditory Reasoning and Processing Skills of Six-Year-Old Children

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## Abstract

The aim of present research was to describe the relation of six-year-old children's attention and reading readiness skills (general knowledge, word comprehension, sentences, and matching) with their auditory reasoning and processing skills. This was a quantitative study based on scanning model. Research sampling consisted of 204 kindergarten children aged six. To collect research data, children answered "Auditory Reasoning and Processing Skills Test (TARPS) "(FTF-K) Attention Test for Five-Year-Old Children" and reading readiness sub-dimension of "Metropolitan School Readiness Test". Research data were analyzed by employing descriptive statistics, Pearson Correlation Coefficient, and multiple regression analyses. Research findings manifested that there was a positive, significant relation between children's attention, general knowledge, matching, sentences, word comprehension skills and their auditory reasoning and processing skills. It was ascertained that these variables were significant predictors of auditory reasoning and processing skills.

## Key Words

Auditory Reasoning and Processing Skills, Attention Skills, Reading Readiness Skills, Cognitive Development, Preschool Education.

Reasoning is described as the ability to think logically and consistent as well as making sense of known or assumed facts (Mansi, 2003). In relevant literature, it is possible to come across reasoning skills in a variety of fields such as verbal, numerical, analogical, relational, causal and mathematical reasoning (Kramarski, Mevarech, & Lieberman, 2001; Krawczyk, 2012; Perret, Bailleux, & Dauveir, 2011; Richland, Chan, Morrison, & Kit-Fong-Ku, 2010). One

of these reasoning skills is auditory reasoning and processing skills. Auditory reasoning and processing skills include skills on the way children perceive things they hear, the way they make sense of what they hear and the way they reach new information on the basis of available knowledge accumulation. Additionally, these skills are related to the way children interpret the information they gain, the way they order, comprehend, associate and solve problem situations, the way they reach new solutions and results through reasoning (Gardner, 1993).

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By means of auditory reasoning and processing skills, children can grasp the kind of information and experiences necessary for them and they can develop ideas on how to put all the information and accumulation they gained into practice in daily life (Erbay, 2009). General knowledge can be defined as information which is outside the scope of specific information related to a certain field and directly related to a specific topic (Ülgen, 1996).

Krulik and Rudnick (1999) claim that those who can form judgment on a specific topic are people who have sufficient level of knowledge on that issue and they can analyze new situations with all their dimensions, explore, draw logical assumptions and deductions, justify their ideas, reach certain conclusions, explain and advocate their conclusions (cited in Umay, 2003). Reasoning is making use of knowledge to reach a certain meaning and conclusion. Past experiences and existing information are crucial for reasoning processing. In order to gain reasoning skill children are expected to obtain new knowledge by interacting with other people, objects and events, to reach new meanings and conclusions by comparing what they gained with their past knowledge, to establish cause and effect relation between events, to question why and how they do what they do (İnal, 2010; Kandır & Orcan, 2010; Klauer, Willmes, & Phye, 2002; Thornton, 1998).

Another significant dimension in gaining reasoning skills to children is comprehension (Altıparmak & Öziş, 2005; Criner, 1992; Lohman & Hagen, 2003; Pilten, 2008; Umay, 2003). Mih and Mih (2011) report that comprehension is effective on reaching deductions. Comprehension can be defined as grasping what something means and signifies; by combining old information with new ones to obtain new, conclusive information. Comprehension which is related to monitoring the relations and solving social problems can also be defined as the skill of comprehending ideas and conceptualizing the topic. To improve comprehension skill in children the child is supposed to possess certain kind of experience with that particular object, situation, and event; in other words s/he should be able to observe, perceive, use and experience it so as to reach reasonable solutions (Gardner, 1993; Maviş, 2006). Gestalt psychologists too, by dealing with comprehension dimension throughout reasoning processing, have focused on comprehension-based reasoning which is a different form of induction-based reasoning. In comprehension-based reasoning form, a problem situation which seems difficult can all of a sudden be solved via “comprehension/grasp”. While the individual seeks after solutions during this processing s/he deliberately avoids developing induction-based solutions. On the contrary the solution simply evokes in one’s mind (İnal, 2010). On that account researchers underline that in order to gain reasoning skills to children their comprehension skills must also be stimulated (Criner).

Another factor researchers analyzing reasoning skills in children highlights is matching. Piaget

underscores that in children the period between ages four to seven is the era of transition to logical thinking and to accomplish this transition, matching skill plays crucial role. Matching mostly corresponds to one-to-one matching concept. The processing of matching each object in a group with an object in a different group is termed one-to-one matching (Altıparmak & Öziş, 2005). To put this differently matching is described as realizing the difference between equal numbers of objects in separate groups irrespective of the similar qualities of the object (Görmez, 2007). Piaget argues that during pre-school period if certain concepts such as matching, classification and ordering are not established truly there may be some problems in future related to logical-thinking since these concepts act as bridge in the transition to logical thinking (Altıparmak & Öziş). The process of thinking about some things via logic is described as reasoning (Pilten, 2008).

Another skill deserving attention in enhancing children’s reasoning skills is attention. Attention is a person’s conscious skill to focus his/her attention on a certain issue. In other terms, it is the skill that focuses one’s perception and thought on the exact moment by disregarding abstraction and disarray, ignoring all internal and external disturbing factors and pushing one’s attention for long on a certain object (Kaymak Özmen, 2006, 2011). In order for children to realize appropriate relations between objects they should simultaneously ignore distracting elements and also exercise their selective attention. Components of attention are necessary to expose relational situations between objects and events (Weatherholt, Harris, Burns, & Clement, 2006). Auditory reasoning and processing skills on the other hand are skills that are also about the way children relate to the information they obtained (Tepeli, 2011). In relevant literature, it has been reported that attention and attention are multi-dimensional cognitive features and effective in cognitive domains such as learning, remembering, communication, problem solving, perception (Kaymak Özmen, 2006, 2011). One of these cognitive domains is auditory processing skills. Auditory processing is the ability of fluently perceiving and grasping auditory stimulus. By virtue of auditory processing skill, people can predict an auditory form that shall be synthesized from different sounds heard suddenly and in distracting situations they can make sense of the speech (İnal, 2010).

In terms of cognitive approach, it is argued that actions of an organism can be understood only if rea-

soning and other cognitive skills are analyzed and construed (Ari, 2005; Atkinson, Atkinson, Smith, Bem, & Nolen-Holeksema, 2008; Deniz, 2012). Therefore, it is believed that in order to better understand children's behaviors, it is necessary to explore components of reasoning skills, to detect the way these skills develop in children, and to uncover the factors effective on such skills. A better grasp of behaviors shall enable preparing training programs and environments that shall support children in early stage. It is suggested that findings that shall be obtained in this research will lead the path in preparing these programs and environment. Furthermore, present research is unique compared to the rest of reasoning studies in literature since it deals with auditory reasoning and processing skills amidst pre-school children. That is another differentiating factor of current research. Based on all these features, it is believed that research findings shall provide a different outlook to pre-school education instructors and researchers and analyzers of cognitive development and reasoning topics.

Within that context, the primary objective of this research was to detect if six-year-old kindergarten children's attention and reading readiness skills (general knowledge, word comprehension, sentences and matching) were predictors of their auditory reasoning and processing skills.

To achieve this main objective, below-given questions were sought;

1. Is there a significant relation between six-year-old children's reading readiness (general knowledge, word comprehension, sentences and matching) and attention skills and their auditory reasoning and processing skills?
2. Are reading readiness skills (general knowledge, word comprehension, sentences and matching) significant predictors of children's auditory reasoning and processing skill?
3. Are attention skills significant predictors of children's auditory reasoning and processing skill?

## Method

### Research Model

Dependent variable of this research was six-year-old kindergarten children's auditory reasoning and processing skill; independent variables were attention and general knowledge, word comprehension, sentences and matching which could be listed amongst reading readiness skills. The research was conducted in survey model so as to demonstrate the effects of independent variables on dependent variable.

### Sample

Research universe consisted of 60-72 month-old kindergarten children attending nursery classes of state and private elementary education schools of Ministry of National Education and independent kindergartens within Konya city, Selçuklu, Meram, and Karatay central districts. On the total 250 children selected via random sampling method from these kindergartens, the researcher conducted data gathering tools. However 46 children, since they got bored and failed to attend regularly, could not receive all three data gathering tools collectively thus the number of children constituting the sampling fell to 204; 97 girls and 107 boys. Age average of participant children was 67,3 months.

### Instruments

In this research, instruments were "Auditory Reasoning and Processing Skills Test", "Attention Test for Five-Year-old Children" and reading readiness sub-dimension of "Metropolitan School Readiness Test".

**Test of Auditory Reasoning and Processing Skills:** (TARPS) was used as the data collection tool in the study. TARPS, which was developed by Gardner (1993), provides information about issues such as how children think, comprehend, generate ideas, draw inferences, solve problems obtain information, about how they list, comprehend, interpret and relate what they have perceived aurally.

The adaptation of the test to Turkish for 60-72 month children was conducted by Erbay (2009). The test involved 31 open ended items. Test measured skills of general information, comprehension, similarities, analogical completion, finding reasons, arithmetical reasoning and verbal absurdities but as it was done in the original test, they were evaluated on a single dimension as auditory reasoning and processing skills. When scoring the test each correct answer was given 1 point and false answers and "do not know" answers were given 0 point. For all of the test minimum score was 0 and maximum score was 31. Nine field experts were received for content validity of the test. Internal consistency coefficient, KR-20 value and the split half-test correlation value for Auditory Reasoning and Processing Skills Test were calculated to be 0.86, 0.87, and 0.83, respectively (Erbay).

**Attention Test for Five-Year-Old Children (FTF-K):** In order to designate attention levels of children (FTF-K) Attention Test for Five Year old Chil-

dren was employed. The test required the children to find and select the pears in a group mixed with apples and pears in 90 seconds. There were collectively 42 pears in the test. The same test was applied on 5;0-6;3 year old children (n=266) in 1968. In 1970, the same test was applied to 5,0-6,0 year old children (n=1170). In the last application age, gender, and socio-economic level were also taken into consideration. Finally test-re-test (n=100) was performed in Frankfurt with thirty minute intervals (n=29) in Nordschein-Westfalen with three-week intervals (n=66) seven month intervals. In Turkey, this test was performed by Ankara University Faculty of Educational Sciences senior students in Clinical Psychology Applications course on 30 children aged between five-six years old in order to make sense of instructions and conduct the tests. Reliability of FTF-K was verified via test-re-test method. In 1971, the test was performed in two kindergartens (n=29) on four-year-old children with three week intervals. Correlation between two applications was found as  $r=0.85$ . In the test, pears that the child drew within 90 seconds made up raw score. Since age and gender may be influential on result, corrected score is computed. In order to compute corrected score of the child, calendar age of the child at the time s/he took the test was determined and by adding to raw score the score corresponding to the table of corrected score the test was evaluated (Kaymak, 1995).

**Metropolitan School Readiness Test:** Developed by Hildreth, Griffiths, and McGauvran (1965) Metropolitan Readiness Test aimed to measure success levels and features which enabled kindergarten students to comprehend elementary school first-year instructions. The original form was in English language and R form of the test was adapted into Turkish by Oktay (1980). The test demanded no verbal answer from the child. Almost all figures constituting test items belonging to objects Turkish children were familiar. The test which consisted of a 16-page booklet had six separate subtests. There were collectively 100 items. Each subtest was made of figures that the child could select or copy according to verbal instruction of researcher. Test reliability was verified by computing the correlations between parallel forms of the test applied on 195 elementary education first grade children with several day intervals and obtained reliability coefficients varied between .53 - .83. Additionally, standard error scores computed separately for each subtest varied between 1.35 and 2.02. Validity of the test was compared with American norms and Istanbul norms; similarities were detected between average and

standard deviations of children selected from the most developed regional schools in Istanbul and also average and standard deviations of American children (Kayılı, 2010; Yazıcı, 1999).

According to scoring scale, each correct answer corresponded to one score in this test. The test had total six subtests. The total of these six subtests were designated as overall readiness. Scores obtained from word comprehension (19 items), sentences (14 items), general knowledge (14 items), matching (19 items) subtests determined reading readiness; numbers (24 items) subtest indicated number readiness; total score of word comprehension, sentences, general knowledge, matching, numbers and copying (10 items) subtests indicated general readiness level (Kayılı, 2010; Yazıcı, 1999). In present study, reading readiness sub-dimension of the test was utilized.

**Data Gathering and Analysis**

Data gathering tools was applied on children by researcher one by one and with one week interval so as not to bore them. Auditory reasoning and processing skills test lasted for about 20 minutes, attention test was around 2 minutes and metropolitan school readiness test reading readiness sub-dimension lasted approximately 25 minutes on each child.

Arithmetic means and standard deviation values of obtained data were provided and relation between variables were analyzed via Pearson correlation coefficient. Additionally, independent variables' predictive power on dependent variable were tested via multiple regression analysis. In the statistical analysis of data SPSS 15 program was utilized.

**Results**

**Table1.**

Mean and standard deviation values of children's auditory reasoning and processing skills, attention and reading readiness skills

Variables	N	X	SS
Attention	204	25,67	9,85
General Knowledge	204	11,12	1,94
Word Comprehension	204	14,67	3,65
Sentences	204	8,25	2,41
Matching	204	13,40	3,70
TARPS	204	17,88	5,53

As demonstrated in Table 1, children's arithmetic mean values for variables were; 25,67 for atten-

tion skills; 11,12 for general knowledge; 14,67 for word comprehension; 8,25 for sentences; 13,40 for matching and 17,88 for auditory reasoning and processing skills.

The lowest score children could receive from all scales was 0. The highest scores were 31 for İMİB, 42 for attention, 14 for general knowledge, 19 for word comprehension, 14 for sentences, 19 for matching. Based on these score intervals it could be argued that children were in medium level in İMİB, sentences, attention skills and high level in general knowledge, word comprehension, matching skills.

**Table 2.**  
Relation between Children's Auditory Reasoning and Processing Skills, and their Attention and Reading Readiness Sub Skills

	Tarps
Attention	,47 <sup>***</sup>
General Knowledge	,40 <sup>**</sup>
Word Comprehension	,55 <sup>***</sup>
Sentences	,31 <sup>**</sup>
Matching	,52 <sup>**</sup>

Note: Pearson correlation between İMİB and attention, reading readiness skills \* $p < .05$  \*\* $p < .01$

As evidenced in Table 2, there was positive, significant, and medium level relation between children's auditory reasoning and processing skills and their attention, general knowledge, word comprehension, sentences and matching skills ( $p < .01$ ). It could thus reasonably be argued that the higher children's attention, general knowledge, word comprehension, sentences and matching skills, the higher their auditory reasoning and processing skills' scores were.

**Table 3.**  
Multiple regression results of the prediction of auditory reasoning and processing skills

Variable	B	SH <sub>B</sub>	Beta	t
Constant	-4,34	1,79	-	-2,43*
Attention	,19	1,79	,33	6,33 <sup>***</sup>
General K.	,43	,16	,15	2,68 <sup>**</sup>
Word C.	,41	,09	,27	4,42 <sup>***</sup>
Sentence	,29	,13	,13	2,31*
Matching	,33	,09	,22	3,70 <sup>***</sup>
R=	,719	R <sup>2</sup> =	,516	
F=	42,288	p=	0,000	

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

As regression model exhibited in Table 3 was analyzed with respect to significance level it displayed that independent variables were strongly correlated with auditory reasoning and processing skills ( $R = 0.719$ ;  $R^2 = 0.516$ ;  $p < 0.001$ ). Five variables collectively explained 52% of the variance related to children's auditory reasoning and processing skill scores. Accordingly, it was feasible to claim that analyzed variables all together were effective on children's auditory reasoning and processing skills. It was clear that other variables account for the unexplainable 48% part of these skills.

According to standardized regression coefficient, relative order of importance of predictor variables on children's auditory reasoning and processing skills was; (1) attention skill, (2) word comprehension, (3) matching, (4) general knowledge (5) sentences. As t test results on the significance of regression coefficients were examined it showed that attention skill, general knowledge, word comprehension, sentences and matching skills were significant predictors of auditory reasoning and processing skills.

## Discussion

Research findings manifested that there was a significant relation between children's auditory reasoning and processing skills and their general knowledge, word comprehension, sentences and matching skills sub- dimensions of reading readiness and it was also ascertained that these skills were significant predictors of auditory reasoning and processing skills.

In similar literature studies, parallel conclusions were obtained. Ni (1998) in his study demonstrated that children's reasoning skills on classification were positively affected by their knowledge level on the topic and their cognitive development levels. Richland, Morrison and Holyoak (2006) analyzed the effect of relational knowledge levels of children aged 3 to 14 years old from different groups on these children's analogical reasoning skills. They concluded that relational knowledge in children was effective on their analogical reasoning. These findings are parallel to the results of current research. As manifested by these findings too knowledge is a crucial concept for reasoning skills. It can be argued that the higher knowledge level is the better reasoning skills are.

Another concept closely related to reasonable thinking and reasoning skills is matching skill. Matching which corresponded to one-to-one pair-

ing constructs the basis of reasonable thinking (Aktaş Arnas, 2004; Ünal, 2010). Reasoning is a thinking skill which enables logical deductions thus it is only natural that there is a positive relation between matching and reasoning skills.

Gardner (1993) on the other hand underscored that there could be no reasoning without comprehension. Sofo (1986) argued that a good reasoning education should cultivate children's reading, writing and comprehension skills (cited in Criner, 1992). In this study, comprehension was analyzed together with word comprehension and sentences sub-dimension of reading readiness skills. Word comprehension and sentences grade comprehension and grasp of language on the basis of word and sentence. Comprehension equals terminologically to fully understanding what something is. Without understanding what something is the person can obtain no knowledge and draw deductions from this knowledge. On that account as manifested in this research too comprehension and reasoning skills are interrelated concepts. In a similar study Klein (1984) emphasized that the ability of children to construe problems was positively influential on their mathematical reasoning.

As seen there is a significant relation between children's reading readiness skills and their reasoning skills. Şimşek (2007) likewise reported that auditory perception, generalization, setting cause and effect relation and thinking skills were concepts related to children's state of readiness for reading. Van der Sluis, De Jong, and Van der Leij (2007) in their research covering 172 children between ages nine-twelve detected high and significant relation between updating and nonverbal reasoning and reading; transfer and nonverbal reasoning and reading. Theoretical information and research findings in relevant literature are supportive of the findings of current study.

In present research another variable of which relation with auditory reasoning and processing skills is investigated is attention skill. Research findings indicated that attention was a significant predictor of auditory reasoning and processing skills. By means of attention skills, children can perceive and make sense of surrounding events thus they can provide contribution to knowledge level. As indicated in the findings of this research too comprehension and knowledge are required factors of reasoning. The relation between auditory reasoning and processing skills and attention can be attributed to these reasons. Weatherholt et al. (2006), in their study covering 48-71 month-

old children reported that attention and analogical reasoning skills were interrelated. Richland et al. (2006), in a similar study analyzed the effect of relationally complex situations and distracting factors on analogy based reasoning skill of three-four year old children. They emphasized that the rise in distracting factors as well as quantity of relational quality complicated children's skills of solving analogy problems. Based on these findings it can be claimed that in situations children cannot truly concentrate they experience difficulty in reasoning. As evidenced relevant researches in literature have parallel findings to this research. In relevant literature there are also some research findings emphasizing that aside from attention, reasoning skills are connected to different cognitive skills and abilities as well. These studies manifested that there was a positive direction significant relation between cognitive skills such as intelligence, imagination, intuitive thinking and reasoning skills in different domains (Güven & Aydın, 2006; Klauer & Phye, 2008; Richards & Sanderson, 1999).

Another finding obtained from this research was that 52% of auditory reasoning and processing skills could be construed via general knowledge, word comprehension, sentences, matching and attention skills. One of the limitations of current research is that not all variables that might affect children's auditory reasoning and processing skills could be included in research. In literature different, variables that might be related to reasoning skills are mentioned. Age, gender, education, senses, affective skills, culture, environment are some of the variables whose connection with reasoning skills is evident (Blanchette & Richards, 2010; Erbay, 2009; Goel & Vartanian, 2011; İnal, 2010; Laupa & Becker, 2004; Raver, Garner, & Smith-Donald, 2007). Caropreso and White (2001) in their research demonstrated that there was a statistically significant relation between otherwise children's analogical reasoning and their ethnic origins. Richland et al. (2010) explored pre-school Hong-Konger and American children's analogical reasoning with respect to cultural factors. At the end of research, Hong-Konger and American children achieved similar performance in analogy problems; however, they reported that Hong-Konger children's performance in complex relational situations was far better than American children. Tian and Huang (2009) accentuated that spatial reasoning skill developed far rapidly in five year six month- five year eleven months, numerical reasoning skill on the other hand improved fast in age seven- seven year five months. Kidd,



Pasnak, Gadzichowski, Ferral-Like, and Gallington (2008) developed a mathematical education program to be applied on children and reported that this program improved children's reasoning skills positively. Strand, Deary, and Smith's (2006) research pointed that boys' numerical and nonverbal reasoning scores were higher than girls while girls obtained better verbal reasoning scores than their male counterparts. Tepeli (2011) in his study accentuated that preschool age children's auditory reasoning and processing skills were open to the effects of age, gender, socioeconomic level, and educational level of parents. As pictured, different variables accounted for reasoning skills in different domains. Thus it was assumed that these variables explain 48% part of auditory reasoning and processing skills which could not be clarified via findings of current research.

Based on research findings it could be argued that children with low levels of attention skill in particular and general knowledge, word comprehension, sentences, matching skills shall be inclined to face difficulty in reasoning or their reasoning skills shall be affected negatively. Therefore to the end of improving children's auditory reasoning and processing skills, activities that can develop all these skills together can be prepared with the cooperation of field specialists and teachers and these activities can be implemented in preschool education institutes. Preschool teachers' competency in supporting attention, reading readiness and reasoning skills of children can be determined. Teachers who fail to be satisfactory can be trained via seminars and training on the way to support these skills further. Additionally, supplementary information can be provided to these teachers on the potential distracters in home and school environments. In that way teachers shall eliminate these distracters from education environment thus in school environment children's attention shall not be distracted with futile details.

It can be suggested to researchers who shall focus on this subject that they compare the relations between different age group preschool children's attention and reading readiness skills and their reasoning skills and contrast the findings with the results of current research. Besides in other studies the rest of variables such as perception, memory, problem solving that might be connected to children's reasoning skills might be identified and the relation of these variables with reasoning skills can be put forth.

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