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Cognitive Ability of Reasoning among Preschool and Early Primary School Students: The Proper Psychometric Test and Some of the Influencing Factors

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Abstract: School education is crucial for personal/social development. To confirm the demand for special education any child is required to be assessed. Instruments that measure children's intellectual abilities aid teachers to adapt their teaching environments once pupils with special needs are recognized. This correlational study's intention was developing, validating and implementing a psychometric test to assess reasoning skill among children. Some of the influencing factors such as age, gender and parents' educational level were meanwhile investigated. Hence, three subtests that assess abstract, quantitative, nonverbal, matrix and visual reasoning were selected under the supervision of scholars of the field to develop a psychometric test whose internal consistency was calculated through Pearson Coefficient Correlation by giving the test to 150 volunteer participants. All the calculated values declared high internal consistency. Then, 222 male and female preschool, first grade and second grade students were selected through multiple stage stratified sampling to participate in the study. Their reasoning ability was compared based on age, gender and parents' educational level using ANOVA and tukey tests in SPSS22. The findings regarding age and parents' educational level were controversial: younger children had better reasoning skills also children of fathers with lower academic degrees outperformed their peers. No statistically significant difference was observed regarding gender. Such findings could help educational policy makers and scholars of educational psychology to fill the gaps of educational contents and environments specifically during early school education. The developed instrument assists teachers modify teaching methods and environments to help weaker children flourish cognitively.
Keywords: Cognitive ability, Reasoning, Primary school education, Children.

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Introduction

Reasoning or rationality is the distinct human ability of making sense of things based on new/ existing information (Surgėlienė & Bankauskienė, 2015). People deduce and conclude using their logic. Traditionally, logic was merely studied in the fields of mathematics and philosophy. Yet, it has recently been also investigated in cognitive science, which has overlap with other fields such as psychology and linguistics. Reasoning skills have been widely the center of attention in education to the degree that some scholars consider education as the process of equipping people with reasoning skills in order to gain a rational society and culture (Mingchang Wu, Greenan, & Tseng, 2003). Besides a significant factor for human civilization, reasoning is considered a key component for learning and taking advantage of knowledge. Therefore, improving this cognitive skill has

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been the common interest of educators and psychologists for decades in an attempt to aid people lead a meaningful life (Shu, 2000). In this sense, while different educational programs worldwide have decided to flourish students' reasoning skills, clarifying how this skill is assessed, influenced and improved is worth consideration (Bhat, 2016). Some scholars claim that since reasoning skills are affected by cultural backgrounds (Medin, Unsworth, & Hirschfeld, 2007), their assessment should not be based on globally standardized psychometric tests. Localized tests ought to be developed that consider personal characteristics and personal differences (Mingchang Wu et al., 2003). Hence, it would be wise to make effort to develop localized psychometric tests that assess different cognitive skills, which are culturally influenced, such as reasoning.

Although there has been attempts to include critical thinking and logical thinking in educational programs and schooling since years ago (Birdsong & Molis, 2001; Scriven & Paul, 1996), there still seems to be a gap as studies keep reporting current insufficient intellectual skills among students (Birdsong & Molis, 2001). One of the main reasons proposed by scholars for this insufficiency would be that such programs that are developed for promoting students to think logically, do not immerse the participants in any particular academic content (Willingham, 2008). Other researchers acknowledge that lack of emphasis on thinking logically, analyzing, comparing, questioning and evaluating are what underlie improper programs which fail to teach students think critically (Domitrovich et al., 2010).Moreover, scholars such as Strauss in his book, Handbook of Child Psychology, stressed the communication gap between cognitive developmentalists and science educators (Strauss, 1998). In order to fulfill the common goals and interests of both groups such interaction must take place which in turn benefits researchers and teachers and will eventually shed light on the educational contents (Zimmerman, 2000).

Since long ago Reasoning is considered as a process of mind passing from the premises to a new judgment called the conclusion (Burt, 1922). Development of reasoning has been conventionally pursued separately among children and adults. The literature has been dominated by Piagetian approach that is concerned with age related changes. Piaget states that Preschoolers, aged 2-7, are in the preoperational stage or pre-logical period. This means that they rely solely on the concrete appearance of objects rather than ideas, they focus on only one relationship at a time, and they often see things from only one point of view—their own (Piaget & Inhelder, 1969). Piaget explains that this discrepancy is due to the fact that children's logic at this age is founded by their perceptions rather than reasoning.

Being motivated by the dissatisfaction from the assumptions of the traditional models of development, later scholars moved on for further investigations of children's perception and cognition. They mostly tried to highlight the cognitive strengths rather than the shortcomings (Bullock, 1985).

Studies on children's basic scientific reasoning abilities have indicated that 5-year-old preschoolers can evaluate patterns when they are promoted to expect no causal relationship and to ignore their preexisting causal beliefs. This was also reported that their performance was not by chance (Koerber, Sodian, Thoermer, & Nett, 2005).

Through browsing over a great number of studies with their focus on evaluating Piaget's view, it could be asserted that his theory regarding children's reasoning ability is not a psychological but an epistemological one that does not take into account variations at all (Markovits & Barrouillet, 2002). Therefore, later studies attempted to come to an understanding of the situations and conditions which lead to such variations that affect the process of reasoning.

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Research has indicated that socioeconomic status (SES) influences children's language and cognitive development(Calvo & Bialystok, 2014). Regarding the socioeconomic status, it has been reported that families with more financial resources and educated parents obtain higher scores on cognitive measures compared with children suffering from these advantages(Bradley & Corwyn, 2002; Sirin, 2005).The difference in IQ scores between high and low SES groups is reported to be about one standard deviation (Bradley &Corwyn, 2002; Seifer, 2001). In addition, it has been argued that life experiences have a larger effect on cognitive performance than genetics for low SES children, but the reverse is true for higher SES children (Turkheimer, Haley, Waldron, d'Onofrio, & Gottesman, 2003).

According to all above, young children do have a sense of logic, yet the surrounding variations would restrict them from reasoning properly at times. Therefore, this is worth reconsideration, as bearing in mind that devoting more time and energy to help children flourish their reasoning abilities, leads to future personal, social, political, and occupational advantages.

In this regard, this Correlational research intended to initially develop a localized psychometric test for the assessment of reasoning ability of Iranian children during preschool and early primary school years; with an attempt to investigate children's reasoning ability at an early stage and promote it for future achievements. Then,explore some of the influencing factors of reasoning such as age (based on school grade), gender and parents' educational level (as a socioeconomic factor).

Material and Method

Research Design: This was a correlational research with two phases. The first phase was to develop and validate a psychometric test for the assessment of the cognitive ability of reasoning among children. Considering the standardized psychometric tests from which the subtests were purposefully selected, this test would be appropriate for 5- 16 year old children. However, according to the intention of the study, which was to investigate the reasoning ability of children during early primary school years in order to promote this cognitive ability for future accomplishments, the developed psychometric test was implemented for 5- 8 year old participants. In other words, the developed psychometric test was implemented for children at preschool, first grade and second grade of primary school.Hence, once the test was developed and validated, the participants were selected through multiple stage stratified sampling and cluster samplingfrom the list of all the preschools and primary schools of the city.The written consent was gained from the deputy of education, head of the schools and the parents. Then, each trained research assistant gave the psychometric test to one participant at the most appropriate school time; Participants had nothing more pleasing to do at that time, for instance physical education or art class. Making a good rapport with the participants before giving them the test to reduce anxiety was considered significant. The results were kept confidential and the test was implemented anonymously.

Participants and Setting: From each educational region in the city, a primary school which also provides preschool education was selected through multiple stage stratified sampling and cluster sampling. Ultimately, the students whose parents had signed a written consent for participating in the research project took part in the study. On the whole,222 students participated,in the way that there were twenty nine female and thirty four male preschoolers; forty four female and forty two male first graders; and forty six female and twenty seven male second graders. The demographic information of the participants, including the exact date of

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birth, gender and parents' educational level was recorded anonymously in order to examine their reasoning ability along with the potential influencing factors of age (based on school grade), gender and parents' educational level as a socioeconomic factor.

Instrument: Initially, it was intended to design two questionnaires, one filled out by parents and the other one by teachers on children's daily reasoning ability. A set of activities, such as puzzles, that specifically test kids' reasoning skills were also proposed to be done by children to assess their reasoning performance nonverbally. The three sets of results about a child's reasoning ability, that were obtained from parents, teachers and the given child, would predict the child's reasoning skill in a psychometric pack.

Different steps had to be taken to develop the instrument: Since reasoning skill is intimately linked with critical thinking, all the available tests for reasoning along with critical thinking skill were investigated thoroughly. The ones that were standardized for Iranian population were bought from reliable psychometric centers and clinics (Karami Psychometrics Center;Aren Comprehensive Center for Psychological Rehabilitation). On the whole, there were five tests: California critical thinking skill test(Facione, 1990), Saso(Siavoshifar, 2016), Watson (El Hassan & Madhum, 2007), Kernel (Lun, Fischer, & Ward, 2010) and Rickets (Wallace & Jefferson, 2013).Each test is in the format of a questionnaire for adults, including 24-33 questions (depending on the test) on different scopes: creativity, cognitive maturity and mental involvement.

The tests were studied fully under the supervision of the expert advisor of the project. After the first phase of investigation, three scales of California, Watson and Kernel were totally excluded from the study due to their inappropriate content, which mostly focus on financial issues and investment, for children.The questions that were suitable to be asked from the parents and teachers of the intended age group of children (5-8 years of age) were extracted and revised from Saso and Rickets questionnaires. Some of the extracted questions were revised to be suitable for this age group. A group of researcher made questions were also added to the list of the extracted questions. Please see the Appendix. The questions which shared repeated content were intended to be eliminated after final check with the specialists in the field of educational psychology. Therefore, a letter containing the modified questionnaires along with the intention of the studywas sent to three professionals in the field. They uniformly acknowledged that since the questions were extracted from adult Critical Thinking Assessment scales, they would not be suitable for children. They also believed that parents' and teachers' ideas would have bias which leads to inaccurate results. Therefore, under the supervision of the advising educational psychologist of the project, the questionnaires were excluded from the instrument.

The second phase for developing the psychometric test was to find the most appropriate material that could be included in an activity pack that examines test takers' performance. Since it has been reported scientifically that linguistic processes involved in problem solving would restrict children's reasoning skill (Chomsky, 2014; Clark & Begun, 1968; Mehler, 1963; Miller, 1962), it was decided to test this cognitive ability nonverbally.

In this regard, the most appropriate scales for this intention and age group were selected under the supervision of three experts in educational psychology. Wechsler Preschool and Primary Scale of Intelligence (David Wechsler, 2003) and Raven (Kail, 2007; Richardson, 1991) were regarded proper. It is worth specifying that Wechsler scale of intelligence holds five indices including Working Memory Index, Processing Speed Index, Verbal Comprehension Index, Fluid Reasoning Index and Visual Spatial Index; from which the Fluid Reasoning Scale was selected to test the ability of logical thinking apart from preexisting knowledge.The two subtests that constitute this index are Matrix Reasoning, that measures reasoning with continuous and discrete visual

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patterns and may be influenced by concentration, attention, and persistence, along with Figure Weights that focus on quantitative reasoning, nonverbal reasoning and the ability to analyze and synthesize abstract visual stimuli (D Wechsler, 2008). Raven scale of intelligence was used completely to assess abstract reasoning.

In order to make the scoring process straight forward, prevent the complications and make the test more attractive for the test takers, the original paper and pencil format of the scales were changed to digital format in a software program that can record the time and calculate the exact date of birth to change the raw scores to standard ones. The title of each subtest was also changed to be more tangible.

In sum, this psychometric test, which is developed in a software program, has the potentiality to assess reasoning ability of children aged 5- 16. It includes three tests under the headings: Functional intelligence (from Raven Scale), Putting the pieces together/Figure weight and Arranging the stories/Matrix reasoning (from Wechsler Scale).Functional intelligence measures abstract reasoning, Putting the pieces together focuses on quantitative and nonverbal reasoning and Arranging the stories examines matrix and visual reasoning. The scoring process and how to interpret the data was followed based on the standard instructions that come along with each scale. In the Instructions section of the software, the scoring process and how to interpret the data is clarified and explained.

The internal consistency of the test was calculated to confirm that the three subtests assess the same construct through applying Pearson Coefficient Correlation between the subtests, in the way that the subtestswere initially given to 150 volunteer participants of the intended age group. The correlation between their obtained scores in the three subtests was recorded as follow: the significant relationship between Functional intelligence and Putting the pieces together was r= 0.31 (P>0.01); between Functional intelligence and Arranging the stories was r= 0.33 (P>0.01); between Putting the pieces together and Arranging the stories was r= 0.18 (P>0.05). All the values declare high internal consistency of the test. This psychometric test is easily utilized since the timing process, calculation of the exact date of birth and standardization of the raw scores are all computerized. This process saves time and energy and hence the test could be extensively used in psychiatry clinics for the diagnosis of intellectually disordered children, in psychology clinics and schools for educational purposes.

Data collection and Analysis: Once the psychometric test was developed and validated, the research assistants were instructed on how to use the test and record the raw scores. Then, the scores obtained by the participants were standardized, using the exact date of birth of the participants, based on the standard instructions that come along with each subtest. The standard scores were then compared using different statistical tests such as One-way ANOVA and Tukey Post Hoc Multiple Comparison test to elucidate the statistically significant differences between the participants regarding the influencing factors of age (based on school grade), gender and parents' educational level.

Results

The first research question addressed the potential influence that age could have on the reasoning ability of children aged 5-8. Normally, children's cognitive abilities develop over time. The standard manuals for the interpretation of psychometric tests consider the age of the participants as a significant factor. For instance, the interpretation of the same intelligence score differs with the interval of six months. Therefore, the scores obtained in the three psychometric tests were compared with one another, under the influence of the independent variable of age based on the participants' school grades. Therefore, they were separated to three groups

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of preschoolers, first graders and second graders whose obtained scores were standardized and compared with one another under the influence of the independent variable of age. Table 1 displays the comparison of the obtained mean scores and the potential significant difference between the three groups, using ANOVA. study involved 120 students of disciplines of foreign languages, including Arabic, Russian, and English. The mean age of students was 24.90 years with a standard deviation of 8.59. The participants included 80 female and 40 male students. The distribution indices of the variables are shown in Table 1.

Table 1. Comparison of reasoning ability under the influence of the participants' age using ANOVA

Variable	Academic level	N	Mean	Source	SS	DF	MS	F	Sig.
Functional intelligence	preschool	63	117.3	Between groups	717.8	2	358.9	1.8	0.164
	First grade	86	114.2	Within groups	43183.5	219	197.1		
	second grade	73	112.8	Total	43901.4	221			
	total	222	114.6						
Putting the pieces together	preschool	63	15.8	Between groups	267.5	2	133.7	17.4	0.000
	First grade	86	13.7	Within groups	1681.9	219	7.6		
	second grade	73	13.2	Total	1949.4	221			
	total	222	14.1						
Arranging the stories	preschool	63	10.6	Between groups	140.4	2	70.2	6.9	0.001
	First grade	86	9.5	Within groups	2208.5	219	10.08		
	second grade	73	8.6	Total	2348.9	221			
	total	222	9.5						

As it is evident in the table, the difference between the groups for functional intelligence (abstract reasoning) is not statistically significant (P= 0.16). However, statistically significant differences are evident for the subtests of Putting the pieces togetherthat focuses on quantitative andnonverbalreasoning(P= 0.000) and Arranging the stories with focus on matrix reasoning and visual reasoning (0.001). In order to clearly find where the difference derives from, Tukey test was applied as the post-hoc test and the results indicated thatin the subtest of Putting the pieces together, preschoolers outperformed first graders and second graders; First graders were also better than second graders. These findings could indicate that younger children are better and faster at doing puzzles. Besides, in the subtest of Arranging the stories, preschoolers and second graders differed in the way that preschoolers were superior with the effect size of 0.05, which in Cohen's (1988,pp.284-7) terms would be considered a medium effect size.

The second research question investigated the potential influence of gender on the reasoning skill of children aged 5-8. Therefore, the mean score obtained for each subtest was compared to investigate how they differed from one another using ANOVA. The results are presented in tables 2. results showed that the variables of academic satisfaction with a mean of 29.65 and a standard deviation of 3.18, cooperative learning with a mean of 36.43 and a standard deviation of 3.12, and learning variable with a mean of 27.57 and a standard deviation of 3.59 have appeared in the students. In the following, the Pearson correlation coefficients of the variables are discussed.

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Table 2. Comparison of reasoning ability under the influence of the participants' gender using ANOVA

Variable	Academic level	N	Mean	Source	SS	DF	MS	F	Sig.
Functional intelligence	Male	103	116.5	Between groups	699.9	1	699.9	3.5	0.060
	Female	119	112.9	Within groups	43201.5	220	196.3		
	Total	222	114.6	Total	43901.4	221			
Putting the pieces together	Male	103	14.3	Between groups	4.8	1	4.8	0.5	0.459
	Female	119	14.0	Within groups	1944.6	220	8.8		
	Total	222	14.1	Total	1949.4	221			
Arranging the stories	Male	103	9.3	Between groups	10.9	1	10.9	1.0	0.311
	Female	119	9.7	Within groups	2337.9	220	10.6		
	Total	222	9.5	Total	2348.9	221			

According to the table 2, for the three subtests of Functional intelligence, Putting the pieces together and Arranging the stories, the mean grades obtained by girls were 112.9, 14 and 9.7 while the mean grades obtained by boys were 116.5, 14.3 and 9.3 respectively. Considering the significant level of smaller than 0.001, it was then detected that there was no statistically significant difference between boys' and girls' reasoning skills.

It has been scientifically reported that parents' educational level as an indicator of socioeconomic status, could influence cognitive abilities. Therefore, the last research question intended to investigate the potential impact of mothers' and fathers' educational level on the cognitive ability of reasoning among the participants.

From the list of the mothers of the 222 participants, 63 (28.4%) had high school diploma or lower degrees; 123 mothers (55.4%) had graduate or under graduate degrees; 23 (10.4%) had higher education and the educational information about 13 mothers (5.9%) was missing. The means obtained from each subtest by the children of the above mentioned mothers were compared for statistically significant differences using ANOVA. The results are presented in table 3. According to the table 3, the significance level for Functioning intelligence is 0.853; for Putting the pieces together is 0.079 and for Arranging the stories is 0.813. All the values indicate no statistically significant difference. Therefore, it is concluded that maternal education does not affect the cognitive ability of reasoning among children.

Regarding fathers' level of education, 70(31.5%) fathers had high school diploma or lower degrees; 110 (49.5%) had graduate or under graduate degrees; 36 (16.2%) had higher education and the educational information about 6fathers (2.7%) was missing.

The mean grades for each subtest, obtained by the children of these fathers were compared for statistically significant differences using ANOVA, the results of which are presented in table 4.

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Table 3. Comparison of reasoning ability under the influence of maternal education using ANOVA

Variable	Academic level	N	Mean	Source	SS	DF	MS	F	Sig.
Functional intelligence	High school diploma/lower	63	113.8	Between groups	157.5	3	52.5	0.26	0.853
	graduate/under-graduate	123	114.6	Within groups	43743.8	218	200.6		
	higher education	23	116.9	Total	43901.4	221			
	missing	13	114.6						
	total	222	114.6						
Putting the pieces together	High school diploma/lower	63	13.7	Between groups	59.5	3	19.8	2.29	0.079
	graduate/under-graduate	123	14.4	Within groups	1889.9	218	8.6		
	higher education	23	14.7	Total	1949.4	221			
	missing	13	12.6						
	total	222	14.1						
Arranging the stories	High school diploma/lower	63	9.7	Between groups	10.2	3	3.4	0.31	0.813
	graduate/under-graduate	123	9.4	Within groups	2338.7	218	10.7		
	higher education	23	9.7	Total	2348.9	221			

Table 4. Comparison of reasoning ability under the influence of paternal education using ANOVA

Variable	Academic level	N	Mean	Source	SS	DF	MS	F	Sig.
Functional intelligence	High school diploma/ lower	70	110.4	Between groups	2110.3	3	703.4	3.66	0.013
	graduate/undergraduate	110	115.7	Within groups	41791.1	218	191.7		
	higher education	36	118.1	Total	43901.4	221			
	missing	6	121.5						
	total	222	114.6						
Putting the pieces together	High school diploma/ lower	70	14.03	Between groups	17.7	3	5.9	0.66	0.572
	graduate/undergraduate	110	14.33	Within groups	1931.7	218	8.8		
	higher education	36	14.22	Total	1949.4	221			
	missing	6	12.67						
	total	222	14.17						
Arranging the stories	High school diploma/ lower	70	8.60	Between groups	124.1	3	41.3	4.05	0.008
	graduate/undergraduate	110	9.78	Within groups	2224.7	218	10.2		
	higher education	36	10.28	Total	2348.9	221			
	missing	6	12.00						
	total	222	9.55						

Since it was not evident where the difference between the groups derive from, tukey test was applied, the results of which are presented in table 5. As the tables illustrate and considering the level of significance, the values indicate a statistically significant difference between the groups of fathers with high school diploma or lower and the fathers who have higher education. The results of the data analysis indicate that the children of fathers who have high school diploma or lower degrees express better reasoning skills specifically in the subtest of Functional intelligence that specifies abstract reasoning. Such controversial results are worth being investigated more accurately in future studies.

To sum up, the findings of the present study regarding the potential impact of age, gender and parents' educational level on the cognitive ability of reasoning among children aged 5-8 indicated that age of the participants had a controversial relationship with their reasoning ability, in the way that younger children had better reasoning skills.

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Table 5. Multiple comparison test of differences of reasoning based on paternal education

Dependent variable	Paternal education (I)	Paternal education (J)	Mean difference (I-J)	Std. Error	Sig.
Functional intelligence	high school diploma or lower	graduate or undergraduate	-5.362	2.117	.058
		higher education	-7.710+	2.840	.036
		missing	-11.071	5.890	.240
	graduate or undergraduate	high school diploma or lower	5.362	2.117	.058
		higher education	-2.348	2.659	.814
		missing	-5.709	5.805	.759
	higher education	high school diploma or lower	7.710+	2.840	.036
		graduate or undergraduate	2.348	2.659	.814
		missing	-3.361	6.105	.946
	missing	high school diploma or lower	11.071	5.890	.240
		graduate or undergraduate	5.709	5.805	.759
		higher education	3.361	6.105	.946
Putting the pieces together	high school diploma or lower	graduate or undergraduate	-.299	.455	.913
		higher education	-.194	.611	.989
		missing	1.362	1.266	.705
	graduate or undergraduate	high school diploma or lower	.299	.455	.913
		higher education	.105	.572	.998
		missing	1.661	1.248	.544
	higher education	high school diploma or lower	.194	.611	.989
		graduate or undergraduate	-.105	.572	.998
		missing	1.556	1.313	.637
	missing	high school diploma or lower	-1.362	1.266	.705
		graduate or undergraduate	-1.661	1.248	.544
		higher education	-1.556	1.313	.637
Arranging the stories	high school diploma or lower	graduate or undergraduate	-1.182	.488	.076
		higher education	-1.678	.655	.054
		missing	-3.400	1.359	.062
	graduate or undergraduate	high school diploma or lower	1.182	.488	.076
		high school diploma or lower	-.496	.613	.850
		missing	-2.218	1.339	.350
	higher education	high school diploma or lower	1.678	.655	.054
		graduate or undergraduate	.496	.613	.850
		missing	-1.722	1.409	.613
	missing	high school diploma or lower	3.400	1.359	.062
		graduate or undergraduate	2.218	1.339	.350
		higher education	1.722	1.409	.613

Discussion

Such findings are contrary to scientific claims of developmental psychology as spatial and visual perceptions, that are responsible for reasoning abilities, develop and increase through school years by aging, (Farroni & Menon, 2008; Peretz et al., 2011; Saj & Barisnikov, 2015). Yet, educational psychology clarifies this discrepancy by explaining that children are better at visual and spatial perception compared with adults (Day, 1975; Lane & Pearson, 1982). As was mentioned, children are more competent than adults, but different age groups

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of children need to be investigated more accurately to confirm such controversies. As for the independent variable of gender, no statistically significant difference was observed between the groups of male and female participants. Therefore, it could be concluded that both girls and boys are capable of learning strategies during school education for the promotion of their reasoning skills. Parents' educational level as an influencing factor of socioeconomic status of the family (Bradley & Corwyn, 2002) was also under investigation. Scholars uniformly acknowledge that better socioeconomic status promotes cognitive development (Calvo & Bialystok, 2014; Locke, Ginsborg, & Peers, 2002; Qi, Kaiser, Milan, & Hancock, 2006). The present findings were quite controversial though. That is, children of fathers with lower academic degrees, and supposedly lower socioeconomic status, outperformed their peers in reasoning abilities. However, mothers' educational level did not have any statistically significant impact on the reasoning skill of children. Such controversial findings regarding the relationship between fathers' educational level and families' socioeconomic status are worth reinvestigation.

School education is considered the key element of personal and social development (Lebedev, 2017). Primary school education undoubtedly assists children's development. It provides wider perspectives for looking at life. In order to provide proper education to children, every child is needed to be assessed to ensure whether special education is required or not. Therefore, instruments that measure children's intellectual abilities seem invaluable (Koegel, 2012). Such instruments would aid general education teachers to recognize students with special needs and adapt their teaching environment based on the pupils' demands (Pivik, 2002). In order to be able to teach higher order thinking and reasoning skills, as a crucial cognitive ability for personal and social growth, it is suggested that teaching environments where " memorization, drill, homework and quiet classrooms" are rewarded and "inquiry, reflection and the consideration of alternatives are frowned upon" must be renewed (Birdsong & Molis, 2001; Carr, 1988).

Reasoning is considered a critical constituent of career accomplishments. However, during school education, some notified strategies seem to hinder reasoning skills enhancement and in turn strict future occupational success. A cursory mention would highlight relying too much on textbooks, lack of logical thinking training in contemporary school education, students' deficiency of analyzing skills and logical communication(Ming-chang Wu et al., 2003).

In order to develop any educational system, the quality and effectiveness of the provided programs along with the necessity of the recommended ones are worthy of consideration (Lebedev, 2017). This study's main intention was developing, validating and implementing a psychometric instrument for the assessment of reasoning skills among children. Such instrument could help teachers modify their teaching methods and environment to help weaker children develop cognitively. Moreover, potential deficiencies of children's reasoning skills could promote educational policy makers to focus more on educational contents that flourish such cognitive abilities.Meanwhile, some of the influencing factors of reasoning such as age, gender and parents' educational level were investigated.

Our findings regarding the potential influence of age on the cognitive ability of reasoning, was quite controversial. The results indicated that aging did not affect abstract reasoning, yet younger children outperformed their older peers in visual, matrix, quantitative and nonverbal reasoning. There is a gap in the literature that cannot justify this finding. Such a claim is kind of contrary to developmental hypothesis as spatial and visual perceptions develop and increase through school years by aging, which opposes our finding (Farroni & Menon, 2008;

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Peretz et al., 2011; Saj & Barisnikov, 2015). On the other hand, from the field of educational psychology, it has long been accepted that children are better at visual and spatial perception compared with adults (Day, 1975; Lane & Pearson, 1982). Visual- spatial perception is what accounts for reasoning and doing puzzles. This is worth noting that the participants of this study were children and were not compared with adults. Besides, most recent research focus on neonates' visual and spatial perception up to age six. They mostly try to clarify the developmental milestones of this age group, not older ones (Adolph & Franchak, 2017; Celeste, 2002; Thelen, 2000). So they would not be suitable resources to rationalize the findings of this study about the potential impact of age on the reasoning ability of 5-8 year old children.

The other independent variable under study was the potential impact of gender on children's reasoning ability. It is widely asserted in the literature that gender differences are non-existent in general intelligence (Halpern, 2000). However, gender differences have been reported markedly about reasoning ability. These two findings are actually controversial (Kuhn & Holling, 2009) since reasoning ability is the basis of general intelligence (Carroll, 1993). Recent studies highlight males' improved reasoning as in the Raven test (Irwing & Lynn, 2005). This study concluded the same about Raven test and abstract reasoning. However, it did not detect any higher level of nonverbal reasoning among females, as was reported previously (Strand, Deary, & Smith, 2006). The present study found no significant difference between the performance of male and female participants in visual, quantitative and nonverbal reasoning.

Last but by no means least, the relationship between parents' educational level as a predicting factor of socioeconomic status(Bradley & Corwyn, 2002) and children's reasoning skill was estimated. Recent studies uniformly acknowledge that children who benefit from better socioeconomic status present enhanced cognitive abilities (Calvo & Bialystok, 2014; Locke et al., 2002; Qi et al., 2006). The findings of this study weresurprisingly in agreement with previous claims: It is surprising to report that fathers' educational level had a significant relationship with children's reasoning skill, but in an opposite direction; in a way that, the lower the fathers' educational level, the higher the child's reasoning skill.

At first sight, this seems in contrast with previous scientific findings but it could be justified and is absolutely in agreement with them. The schools from which the participants were selected, were private ones. A father who can afford choosing such a school for his child's education must be at a high socioeconomic level, no matter what his educational level is. Therefore, it is in agreement with previous works which state that higher socioeconomic levels promote cognitive development of children. However, our findings are in contrast with the studies that consider parents' educational level as a predictor of socioeconomic status. Parents could benefit from a good socioeconomic status while they don't have higher education.

Regarding mothers' educational level, no matter how educated a mother is, she would do her best to assist her child flourish and promote optimally. Therefore, no relationship was found between a mother's educational level and her child's reasoning skill.

Since educational contents and research priorities are constantly adapted based on recentinvestigations, the findings of this research could help educational policy makers and the ones interested in educational psychology to fill the gaps related to proper educational contents and environments specifically during early school education. Therefore, educational contents that help students learn logical thinking or the ones that aid the development of this cognitive skill are recommended to be incorporated to school education curricula. This is note signifying that flourishing school education aids the promotion of a prosperous nation.

It is also suggested that the discrepancies regarding the variables of parents' educational level and participants'

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age be investigated more thoroughly in future works.

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Appendix

Researcher made questionnaire for parents and teachers

Modified items from Rickets Questionnaire

3. The child willingly solves the problems.
5. The child tries to have a deep perception of the issues around him.
7. The child asks many questions in a learning environment.
8. The child enjoys seeking the answers to challenging questions.
9. The child is interested in achieving rationale results.
13. The child tries to find the best way to carry out different activities.
21. The child asks proper questions in order to find a solution.
29. The child tries to find a way to solve the problems.

Modified items from Sasu Questionnaire

5. The child is interested in challenging discussions.
7. The child has an acceptable excuse for what he/she has done.
9. The child accepts whatever we tell him/her without asking the reason why.
10. The child considers the consequences of his activities prior to taking any steps.
11. The child tries to promote his actions.

Researcher made items

1. At home, the child recommends proper solutions for problems. (For parents)
2. The child has leadership abilities to direct his/her peers or younger ones.
3. The child asks for adult assistance if encountered with a problem.

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