THE EDUCATIONAL LEVEL OF THE FAMILY AND THE COGNITIVE DEVELOPMENT IN CHILDHOOD

Denisa ARDELEAN * and Ionuț ERDELI **
*** Department of Educational Sciences, University of Oradea, Oradea, Romania**
**** Department of Educational Sciences, University of Oradea, Oradea, Romania**
denisab18@yahoo.ca

Abstract: *In this study we aim to analyze the influence which the educational level of a family has on the cognitive development, in general, and on the inductive reasoning in particular, during the early school years. In this regard, we selected 215 students whose parents have secondary education and 117 with higher education and we applied two tests to children from primary schools in order to test the level of cognitive development (TIR and PTONI). The results gathered prove that parents have a significant influence on the development of cognitive skills.*

Key words: *cognitive development; inductive reasoning; socioeconomic status; educational level*

Theoretical premises

The environment comprises on one hand the social economic, educative and cultural conditions and on the other hand the exterior requirements that are being manifested towards each person and towards the groups into which one is included.

Although the influence of heredity towards the cognitive abilities during childhood has already been studied ((McGue, Bouchard, Iacono & Lykken, 1993; Plomin, 1999, apud Turkheimer et al., 2003), the magnitude, mechanisms and implication of this theme are still opened for discussion. There are even contradictions among studies that use different methodologies in order to review the development of the cognitive abilities: correlational studies of twins or adopted children and biological or adoptive parents reveal pronounced effects of heredity and lower effects of the family environment, while other studies comparing the IQ of children of low economic status with the IQ of their parents identify major differences that can be attributable to the environment (Turkheimer, 1991, apud Turkheimer et al., 2003). A possible

solution to this paradox is that the effect of the family environment on cognitive abilities is not nonlinear.

From this point of view, the g factor is an essential target in genetic studies that aim to clarify how genes and environment contribute to the cognitive abilities. Studies on twins have highlighted the fact that the contribution of the environment and of genes vary in childhood and adolescence, the genetic influence having an ascent from 20% in the early childhood to 40% in the middle childhood, 60% during adulthood, and the environmental influences follow a decrease from 60% in childhood to an insignificant percentage in the case of adults (Boomsma, 1993; McGue, Bouchard, Iacono & Lykken,1993; Plomin, 1986; Thompson, 1993, apud Davis, Arden & Plomin, 2008). Yang, Q., Yang, J., Zheng, L., Song, W. & Yi, L., (2021) argued that there is a positive correlation between the family environment and the cognitive and motor development of children under the age of 5.

There is clear evidence of the link between the parents' education and the children's cognitive development. Research has shown that parental education moderates genetic and environmental contributions to the IQ.

The educational level of parents is strongly related to the intellectual level of children not only because of genes, but also because it is a significant measure of the quality of the family environment that parents provide for the children's development. The quality of the family environment is important because it is associated with the availability of intellectual stimulation and financial resources. Hereditary traits are enhanced when there are favorable environmental conditions (Bronfenbrenner & Ceci, 1994; Scarr, 1992, apud Sidhu, Malhi & Jerath, 2009). In a recent study, Kremen et al. (2005, apud Sidhu, Malhi & Jerath, 2009) examined variations in word recognition in 347 adult male twin pairs and demonstrated that family environmental factors in association with poor parental education have a long-term effect in word recognition ability.

The socio-economic status (SES) describes the position of individuals and families in a hierarchy, based on the control of certain elements (wealth, power and social status) (Mueller & Parcel, 1981, apud Sirin, 2005). It seems that there is an agreement regarding the operationalization of this concept, which includes three important elements: the income of the parents, the educational level and their occupation. Among these, the parents' educational level is considered the most stable element of the SES because it tends to remain constant.

The socio-economic status of the parents is seen as a predictor of intellectual performance because it is an indicator of the cultural transmission of information and because it is related to the ability to process the genetically transmitted information.

The objectives and hypotheses of the research

The study aims to highlight the influence of the socioeconomic status of the child's family on some cognitive abilities, especially on the ability of inductive reasoning.

We have postulated the following hypothesis:

We assume that the parents' educational level significantly influences cognitive abilities of the child

The present study is a comparative one (quasi-experimental), the independent variable is of a classificatory type, its modes being: a_1 - higher education and a_2 - secondary education. The cognitive abilities were operationalized through the scores obtained at TIR and PTONI.

Method:

The participants

In this study, we have included 559 young schoolchildren, selected from the Secondary School no. 11, Oradea, the "Iosif Vulcan" National College, Oradea and "Batăr "Secondary School, Bihor County. The average age is 8.68 years and the standard deviation is 0.95. The distribution of the participants according to the class attended, gender and the area of origin is shown in table no. 1.

Table no. 1. The distribution of the participants according to the class attended, gender and the area of origin

	Class				**Gender**		**Area of origin**	
	first grade	second grade	third grade	fourth grade	feminine	masculine	Urban	Rural
Number of participants	176	147	158	78	283	276	484	75
TOTAL	559				559		559	

Instruments

We applied TIR (Test of Inductive Reasoning) and PTONI (Primary Test of Nonverbal Intelligence).

Procedure

The tests were applied in the pencil-paper version. The TIR test was applied to small groups, and the PTONI test, individually. In the case of TIR, the answers were filled in on the answer sheet, and for PTONI, the participants had the task of indicating the correct answer.

The effect size was calculated based on the following establishment formula (Popa, 2008):

$$\omega^2 = \frac{t^2 - 1}{t^2 + n_1 + n_2 - 1}$$

Results

The hypothesis was verified on the basis of several quantitative indices.

In order to check the normality of the distribution for the scores obtained at PTONI depending on the parents' education, we used the Kolmogorov-Smirnov test. Significance thresholds lower than 0.05 were found, which means that the distribution does not respect the symmetry criteria, therefore, we will use non-parametric comparison techniques such as the Mann-Whitney U test.

A similar algorithm was followed to verify the normality of the distribution of the TIR scores. We obtained significance thresholds higher than 0.05, thus, the results allow the approximation of Gaussian curves, which allows the assumption of symmetric distribution. Consequently, we will resort to the use of parametric comparison techniques (*t* for independent samples).

To test the equality of variances, we will consider Levene's test values and the related significant threshold. For the results obtained for similarities and differences, the probability associated with the Levene test is greater than 0.05, which means that the variances are equal, and the value of the t-test is read on the first line. For the other subscales, the Levene's test significant threshold values are lower than 0.05, thus the condition of homogeneity of the variance of the two groups is not respected. Consequently, we will read the value of *t* on the second line. The values of the Levene test are shown in the following table:

Table no. 2. Values of the Levene test for TIR

Subscale	Levene test	p
Generalization	1.854	0.174
Discrimination	2.817	0.094
Transversal classification	10.104	0.002
Series	29.349	0.000

Disrupted series	5.228	0.023
System formation	15.976	0.000
Total TIR	7.162	0.008

Table nr.3. Comparison of the scores obtained in generalization according to the educational level of the parents

The educational level of the parents	**N**	**m**	**a.s.**	**t**	**df**	**p**	**Average of differences**	**ω^2**
Higher education	117	5.051	2.812	2.716	330	0.007	0.916	0.018
Secondary education	215	4.134	3.002					

In the items that measure the ability to establish similarities, children who come from families with higher education obtain a higher means than the other children. The calculated value t (330) = 2.716 corresponds to a p-threshold lower than 0.01. Thus, we find the existence of strongly significant differences at the level of this ability depending on the educational level of the parents. To establish the size of the effect, we resorted to ω^2 (omega-squared). This coefficient is interpreted by analogy with the correlation coefficient, in accordance with Cohen's recommendation. Thus, 0.01 indicates a low magnitude of association, 0.06 represents a medium association, and 0.14 or more indicates a large association (Popa, 2008). The obtained ω^2 coefficient of 0.018 highlights a low effect size.

Table no. 4. Comparison of the scores obtained for discrimination according to the educational level of the parents

The educational level of the parents	**N**	**m**	**a.s.**	**t**	**df**	**p**	**Average of differences**	**ω^2**
Higher education	117	5.427	1.904	4.081	330	0.000	0.962	0.045

Secondary education	215	4.465	2.128

The calculated value t (330) = 4.081 corresponds to a significance threshold lower than 0.01, thus, we accept the specific hypothesis, we reject the null hypothesis, the environment of origin has a significant influence on the ability to discriminate. The average scores obtained by children from families with higher education is higher than the means obtained by children with parents with secondary education. The coefficient ω^2 has a value of 0.045, which means that the size of the effect is towards the average.

Table no. 5. Comparison of the results obtained in the transversal classification according to the educational level of the parents

The educational level of the parents	**N**	**m**	**a.s.**	**t**	**df**	**p**	**Average of differences**	**ω^2**
Higher education	117	4.692	1.380	3.998	292.843	0.000	0.706	0.043
Secondary education	215	3.986	1.791					

Analyzing the table no. 5, we find that children with parents with higher education obtained higher scores compared to the second sample, represented by students with parents with secondary education. The average of the differences is 0.706 points. Comparing the two samples, we notice highly significant differences in the ability to simultaneously establish similarities / differences, since the value t (292,843) = 3,998 corresponds to a threshold lower than 0.01. The size of the effect is average, since the value of the ω^2 coefficient is 0.043, thus there is an average association between the two measured variables.

Table no. 6. Comparison of the results obtained in the series depending on the educational level of the parents

The educational level of the parents	N	m	a.s.	t	df	p	Average of differences	ω^2
Higher education	117	4.230	1.510	3.320	288.510	0.001	0.635	0.029
Secondary education	215	3.595	1.918					

At the level of the ability to complete a series, the average score of students from families with higher education is higher than the average score of students from families with secondary education. The standard deviation is smaller for the results obtained by those from the first sample, the data have a smaller spread around the means. The comparison of the means of the two samples highlights strongly significant differences regarding the serialization ability, t(288,150) = 3,320 has a threshold lower than the critical threshold of 0.05. In contrast, we have a low effect size.

Table no. 7. Comparison of the results obtained in the disturbed series depending on the educational level of the parents

The educational level of the parents	N	m	a.s.	t	df	p	Average of differences	ω^2
Higher education	117	5.367	1.878	4.333	274.613	0.000	1.000	0.050
Secondary education	215	4.367	2.229					

Analyzing the table no. 7, we can observe that students with parents with higher education obtained higher means, compared to the second sample, represented by students with parents with secondary education. The average difference is 1,000 points. The comparison of the two means allows highlighting some highly significant differences at the level of the ability to identify the improperly placed element within a series, since the value t(274,613) = 4,333 corresponds to a threshold lower than 0.01. The size of the effect is average, since the value of the coefficient ω^2 is 0.050, there is thus an average association between the two measured variables.

Table no. 8. Comparison of the means obtained during the formation of the system according to the educational level of the parents

The educational level of the parents	N	m	a.s.	t	df	p	Average of differences	ω^2
Higher education	117	5.059	1.688	3.237	288.546	0.001	0.692	0.027
Secondary education	215	4.367	2.144					

In the items that measure the ability to identify the right element, simultaneously identifying similarities and differences, the children who come from families with higher education obtain a higher mean than the other children. The average of the differences is 0.692 points. The calculated value t (288,546) = 3,237 corresponds to a p-threshold lower than 0.01. Thus, we find the existence of strongly significant differences at the level of this ability depending on the educational level of the parents. To establish the effect size, we calculated ω^2, this coefficient having a value of 0.027, which indicates a low effect size.

Table no. 9. Comparison of means obtained at TIR depending on the educational level of the parents

The educational level of the parents	N	m	a.s.	t	df	p	Average of differences	ω^2
Higher education	117	29.726	7.962	4.886	277.961	0.000	4.814	0.064
Secondary education	215	24.911	9.605					

Regarding the inductive reasoning, the average score of students from families with higher education is higher than the average of students from families with secondary education. The standard deviation is smaller for the results obtained by those from the first sample, the data have a smaller spread around the means. Comparing the means of the two samples highlights strongly significant differences at the level of inductive reasoning, t(277.961) = 4.886 has a threshold lower than the critical threshold of 0.05. The coefficient ω^2 has a value of 0.064, thus, the size of the effect is average thus the results obtained have a good practical value.

Table no. 10. Comparison of the results obtained at PTONI depending on the educational level of the parents

Measured variable	The educational level of the parents	N	Rank average	Sum of ranks	z	p
Total score	Higher education	107	133.87	14324.00	-4.308	.000
	Secondary education	120	96.28	11554.00		
Score specific items	Higher education	107	131.03	14020.00	-3.694	.000
	Secondary education	120	98.82	11858.00		
Score abstract items	Higher education	107	134.40	14381.00	-4.429	.000
	Secondary education	120	95.81	11497.00		

From table no. 10., it is highlighted that, for all three measured dependent variables (specific item scores, abstract item scores, PTONI total score), the average ranks are higher for students whose parents have higher education. The values of the Mann-Whitney test for these variables have significance thresholds lower than 0.05, thus, the educational level of the parents has a significant influence on the reasoning ability of the children.

Discussions and conclusions

This study aimed to verify the existence of significant differences in the cognitive abilities, depending on the parental education. The previously presented results confirm the formulated hypothesis. We chose to analyze only this element of SES, as studies confirm that parents' educational level is the most "popular indicator of social classes" (Liberator et al., 1988, apud Bornstein & Bradley, 2003). The educational level is a factor related to the level of parents' knowledge in the field of child development. Parents are the ones who can favor an environment that facilitates cognitive development, implicitly reasoning.

Many of the studies considered the positive influence on the academic achievement and its effects on children and young people. Alexander, Entwisle and Bedinger (1994, apud Davis-Kean, 2005) concluded that the ability of the parents to have beliefs and expectations as realistic as possible regarding the school performance of their children are essential for structuring

the family and educational environment. Hall et al. (1997, apud Davis-Kean, 2005) found that mothers with higher education have higher expectations for their children's academic achievement and these expectations are related to later achievements in mathematics and reading.

Research on this topic has shown that the parents' education is associated with a suitable climate in the family. A favorable family climate will favor the development of a harmonious personality on all levels. Klebanoy et al. (1994, apud Davis-Kean, 2005) showed that the mothers' education and the family income are an important predictor of the physical environment and learning experiences.

Researchers have different views regarding the role of the family environment on the children's intellectual development. While some theories claim that the development stimulus is endogenous, it belongs to the child, other theories state that the child's development is strongly influenced by environmental factors and their interaction. The theoretical foundation of these two points of view can be illustrated by the theories of Piaget and Vygotsky. In the Piagetian theory of cognitive development, the child actively constructs his knowledge, which he manipulates and explores (Berk, 2000, apud Wade, 2004). Emphasizing the biological nature of cognition, Piaget's theory claims that the child adapts to the external world, adaptation that is innate and inevitable and appears as a need to maintain a balance between the child's internal structures and the information he acquires in the living environment. Research shows that parents who adopt an authoritarian style will have children who score higher on tests of intelligence and cognitive abilities, compared to others. Authoritarian parents tend to formulate realistic demands, setting limits and insisting on compliance with the rules. At the same time, they tend to express their affection when they set these limits, in a rational and democratic manner (Wade, 2004). The mechanisms and processes underlying these relationships are not clear enough, but one element seems to be the amount and style of verbal reasoning of such parents. This element will develop the children's reasoning and give them the opportunity to identify the cause-effect relationship. Many studies have examined the parenting style and concluded that parents who provide control and encourage independence have children who score high on the tests of intelligence and cognitive abilities. A study on families with 3-4-year-old children highlighted that positive discipline and control of mothers are directly related significantly to scores on intelligence tests.

The relationship between social factors (poverty, minority status, parents' education level) and the involvement of the family in education have been intensively studied. Parents with low levels of formal education are less involved in school activities (Dauber & Epstein, 1993, apud Wade, 2004). Economically disadvantaged students will achieve lower school performance

because their parents value education less. Another explanation for differences of this nature refers to the fact that the school uses the cultural resources of society unevenly and unfairly (Lareau, 1987, apud Wade, 2004). Disadvantaged parents have a different set of information than other parents, and schools lack the resources to effectively use their skills.

Educationally disadvantaged parents will not create an educational environment at home that supports their children's cognitive development and academic success, they will offer to a lesser extent stimulation and resources that act in the area of the child's proximal development. Parents with a high educational level will value education and have high expectations from their own child. Likewise, the child's involvement in school activities will be improved and an adequate partnership with the school will be maintained. School performance, especially in mathematics, of students from high SES families can be attributed, at least in part, to differences in early processing of mathematical problems from books, educational toys, and educational TV programs McNeil, Fuhs, Keultes & Gibson, 2011). The regression analysis carried out by Sidhu, Malhi and Jerath (2009) highlights that almost a third of the variance of the intelligence quotient is explained by three variables: the father's education, the child's age and the family's income.

Children acquire certain abilities through interactions inside their family and inside their group age. Families that benefited from school success during the school years will exercise a much more structured control, compared to those that are at the opposite pole. Socio-economic factors (educational level, parents' occupation and family income) are significantly associated with child development (Lata & Chhikra, 1995, apud Bimla & Singh, 2009). The family is the most important factor in the cognitive, emotional and social development of the child (Keith & Campbell, 2000, apud Bimla & Singh, 2009)

The study of the influence of SES on cognitive development favors the finding of effective methods to improve the parent-child relationship. School psychologists, teachers and other professionals who develop and implement educational programs aimed at increasing parental involvement must consider the results of studies in this field.

Educational policies should be oriented towards improving the cognitive abilities of children from economically disadvantaged families, through the implementation of educational programs that facilitate their development. Educational programs aimed at cognitive development should be designed to reduce the differences between students from families with higher education and those from families with secondary education, in terms of cognitive abilities. Parents are not only mediators of cultural influences, but contribute directly to the education of the child's cognitive abilities (Macsinga, 2007)

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