THE CONNECTION OF CHESS KNOWLEDGE WITH THE INDICATORS OF PROGRESS IN MATHEMATICS AND NATIVE LANGUAGE IN PRIMARY SCHOOLS

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In the paper are presented the social-psychological foundations and the attitudes of the stakeholders of "Republican Research of Chess Knowledge Assessment", that has been conducted by "Chess" Scientific Research Institute (CSRI) in 2021. The results of the analysis of collected data disclosed the connection of chess knowledge with primary school pupils progress in mathematics and native language.

Key words: Chess knowledge, social-psychological analysis, semi-annual grade, chess achievement, evaluation, proportional complication of chess tasks.

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The urgency of the issue is conditioned by the fact that although chess has been introduced as a compulsory subject in the field of general education of the Republic of Armenia since 2011, the role and interaction of this subject with other subjects have not been revealed yet. From a practical point of view, years of conversations with chess, elementary school teachers, and schoolchildren's parents have shown that disagreements often arise over the subjects traditionally considered to be the main subjects: native tongue, mathematics, and chess grades. There were many complaints especially about low grades of the chess subject. Chess teachers, on the other hand, often associated these issues with the objectivity or impartiality of their assessment. It can be considered obvious that these disagreements often had objective reasons, as the subject was not yet sufficiently integrated into the subjects of secondary schools, many of the chess teachers did not have higher pedagogical education and experience, which directly or indirectly affected the assessment process. The importance of the issue raised by us is justified by the fact that, in the context of chess education, the main question was often to identify the factors influencing the subject of chess. Such a question is very important, but in our opinion, such an approach slightly ignores the need to solve systemic educational problems with other

subjects. Therefore, in this context, the influence of the knowledge and abilities developed within other general education subjects, or in other words, the interaction of different subjects, comes to the fore. The difficulties in resolving the issue were given that although national studies have been conducted regularly since 2015 [1, p. 39], [2, p. 9], they were initially test based.

The aim of the research is to reveal the connection between chess knowledge in elementary grades and indicators of progress in mathematics and mother tongue subjects.

The hypothesis of the research. It is assumed that the chess achievements of elementary school students, among other factors, are influenced by the achievements of students in the native language, mathematics.

Research questions. The following questions arise from the purpose of this study:

1) What are the connections and interactions between chess, native language and mathematics grades and chess achievement indicators?

2) To what extent do the chess achievements reflect the main indicators of the school curriculum, how complex is each task of the chess test?

3) To what extent do the semester grades of the chess subject correspond to the real chess knowledge and abilities?

The methodology and process of the research

Immediately after chess was introduced as a compulsory subject in Armenian schools, the Chess Research Institute of the Armenian State Pedagogical University (formerly the Center for Chess Educational Research) initiated and continued to regularly conduct national "Chess Knowledge Assessment" surveys. It aims to find out the level of chess knowledge and to reveal the impact of chess on the emotional and other spheres of primary school students, as well as the totality of the main and contextual factors influencing it. The survey included questionnaires for students, teachers and parents, which included questions about the child's chess experience, his / her parents 'attitude towards the subject of chess, and the teacher's effectiveness in teaching chess. Psychologists, chess players and teachers took part in compiling the questionnaires, who clarified and discussed each task in order to get a definite version. The survey was conducted by random sampling so that all regions of the Republic of Armenia, including the capital Yerevan, participated. The selected schools were 42 in advance, of which 3 schools from Aragatsotn region, 3 from Ararat region, 3 from Armavir region, 4 from Kotayk region, 3 from Gegharkunik region, 2 from Shirak region, 2 from Tavush region, 3 from Lori region 2 schools from Syunik region, 2 from Vayots Dzor region, 15 schools from the capital Yerevan. Within the frames of research internship, the students of the Kh. Abovyan Armenian State Pedagogical University joined the research, who had the opportunity to choose more than 10 schools and conduct research there. Totally, more than 500 students, more than 500 parents and more than 50 teachers from 52 schools participated in the national survey.

Students' learning styles, such as reflective and deep learning styles, appear more frequently during chess lessons in comparison with math and native language lessons.

Chess lessons provide necessary learning facilities for developing students' deep and reflective learning styles.

Summarizing the results, we can make the following conclusions: 1. There is a strong correlation between chess grades and pupils' reflective and deep styles of learning. Based on these results, we may infer that children are very "pragmatic" and they have to develop those skills which could be assessed better by teachers. Therefore, this fact can be indirectly interpreted as evidence of chess as a subject which promotes thinking and reflection. We can state that these students are more likely to set their own learning goals trying to understand the meaning of learning material. They are more motivated and likely to build their own learning path giving meaning to what they need to remember. 2. The fact that the directive and active learning strategies have been detected as the second and third correspondingly most frequently applied ones allows inferring that an active learning strategy has not been fully implemented yet by schoolteachers of chess. On the other hand, if we consider cognitive teaching strategy as a way of developing students' problem solving, decision making, and critical thinking skills, we can conclude that teachers are likely to share these ideas having implemented it. 3. The correlation links with high significance allow the conclusion that deep and reflective styles are also correlated. This can be interpreted as additional empirical evidence of conceptual meaning and closeness of these categories. 4. Although the research has not found any significant correlations between teaching strategies and learning styles, the detailed analysis revealed that reflective (0.23) and deep (0.24) styles are considered as better ways of learning, are more connected with cognitive teaching strategy, and less with directive strategy (0.21). It is important to emphasize that in several studies conducted in previous years, the authors were interested in the issues of interaction and interdependence of mathematics, native language, and chess subjects. In one of these researches, the authors analyzed the textbooks and teacher's manuals of the mentioned three subjects, identifying the qualities and capabilities that the content of those subjects is aimed at developing, as well as the proportion they are formed (the influence factor of each subject) [3, p. 9].

The authors singled out the qualities and features that are reflected in the content of the textbooks of the 2nd, 3rd and 4th grade native language, mathematics and chess subjects, and analyzed the proportions of the influence of these three subjects on their formation.

As part of our nationwide research, a chess knowledge test was developed covering 8 tasks, in which, in addition to chess knowledge, revealed the following cognitive qualities: prediction, prevention, alternative thinking, algorithmic thinking, the ability to compare and assess the situation, critical thinking, hence, we will emphasize the indicators of the impact of the three

subjects on these qualities and will combine them with the quantitative data obtained as a result of our research.

Thus, the abilities of prediction and prevention are manifested in the qualities of "Reading the thoughts and feelings of the other person", "Limiting the mobility of the opponent", "Predicting". Therefore, the development of prediction and prevention capabilities by subjects and grades (see V. Karapetyan, chart 1, 2, 3) has the following proportion.[1*]

Chess: 24. 4%, Native language: 9.4%, Mathematics: 8.3%

The content aimed at shaping alternative thinking is expressed as follows:

Chess: 3.2%, Native language: 2.7%, Mathematics: 4%

The task of algorithmic thinking is largely related to the ability to plan, expressed as follows:

Chess: 4.1%, Native language: 4.4%, Mathematics: 4.2%

The ability to compare and assess the situation by subjects is developed in the following proportions (the qualities of "Consideration of efforts and resources", "Drawing conclusions", "Making comparisons" are included):

Chess: 21.1%, Native language: 11.3%, Mathematics: 19.3%

Critical thinking is seen in the abilities to "Compare" and "See cause-and-effect relationships", which are expressed in the following proportions:

Chess: 6.2%, Native language: 21%, Mathematics: 12.3%

The combination of the results of these two studies allows us to record that these three subjects taught in elementary school have a certain proportion of influence on the development of different cognitive qualities. It also provides an opportunity to interpret in more depth the results obtained by combining the data of the chess knowledge test with the data of semester grades of the native language and mathematics subjects.

The results of the research.

As we can see from Table 1, learners in native language, chess, and math find that they get the most excellent grades.

Grades	Chess	Native Language	Mathematics
Excellent	74.1%	69.8%	65.7%
Good	24.4%	28.9%	31.0%
Sufficent	1.5%	1.3%	3.3%
Total.	100.0%	100.0%	100.0%

Table 1 . *"What grades do you mainly get from these subjects?"*

[1*] The content share aimed at building the given capacities in% is presented in the textbooks of the 2nd, 3rd and 4th grades.

It should be noted that, in fact, the real semester assessments generally reflected those tendencies.

Grading semester.	Chess	Native language	Mathematics
0	1.7%	1.0%	1.3%
1	1.0%	0.0%	0.0%
4	0.6%	0.0%	0.4%
5	0.4%	0.4%	1.7%
6	1.9%	2.5%	4.6%
7	7.5%	7.1%	9.2%
8	14.4%	22.4%	20.5%
9	65.5%	64.2%	56.3%
10	6.9%	2.3%	6.1%
Total.	100.0%	100.0%	100.0%

Table 2. Pupil's semester grades

Among other questions, the parents were asked how satisfied they thought the chess lessons were in terms of knowledge exchange.

"Do you think chess lessons at school are enough to give children consistent knowledge?"	Aragat	Arar	Arm.	Gegh	Kot.	Lo.	Shi.	Syun	V Dz	Tav.	Yer.	Total
Yes, it is enough	30.8%	57.4%	41.5%	49.0%	43.7%	44.0%	57.1%	63.6%	70.0%	50.0%	43.0%	**47.5%**
Partly	53.8%	37.0%	47.2%	45.1%	47.9%	52.0%	17.9%	36.4%	30.0%	50.0%	44.4%	**43.1%**
No, it is not enough	15.%	3.7%	7.5%	5.9%	5.6%	4.0%	10.%	0.0%	0.0%	0.0%	9.6%	**6.7%**
Total.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**

Table 3. "Do you think chess lessons at school are enough to give children consistent knowledge?"

Through the data of the research, it is possible to evaluate the effectiveness of teaching the subject of chess and the factors influencing it. For that, the results of the chess tasks given to the students during the research were used.

During the research, the students were given 8 test diagrams, which are numbered from 1-8. The number of students who correctly solved the diagram with this number is given in Figure 1.

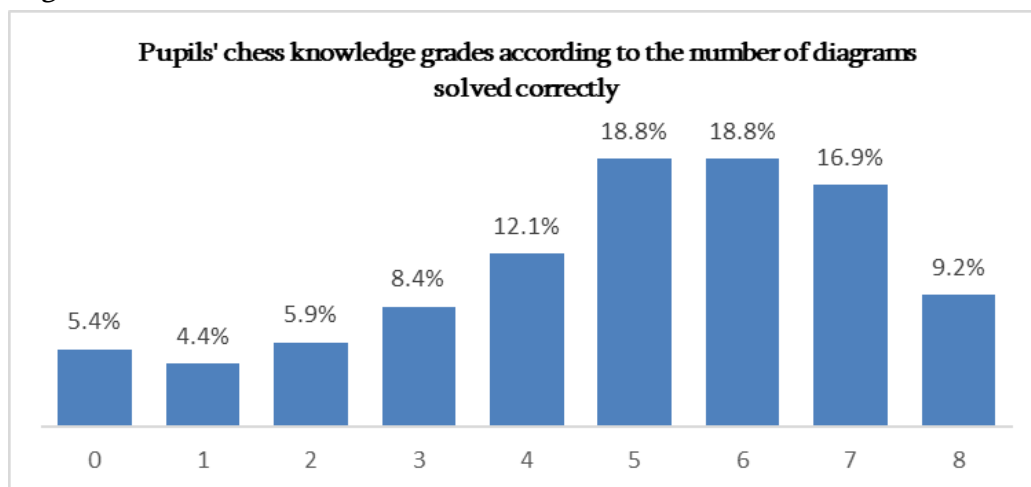*Figure 1. Number of students who solved the diagram correctly*

Number of students who solved the diagram correctly
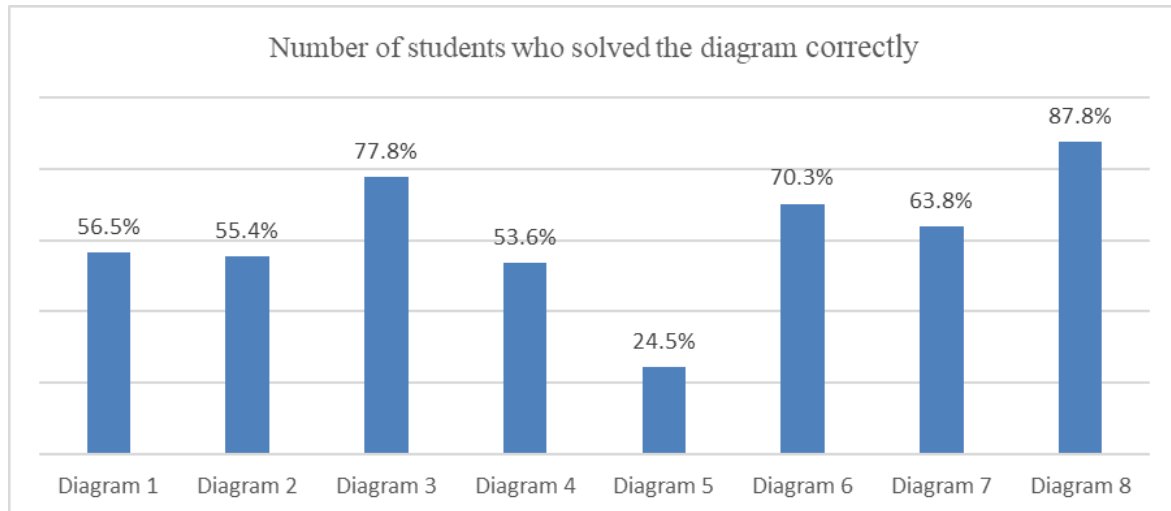
Based on the obtained data, two types of students' chess knowledge assessments were built.

Approach N1.

Suppose the "difficulty" of all problems is the same. In that case, we can consider that the number of correctly solved diagrams of the student approximates his chess knowledge well. The change range for this rating will be [0; 8], where 0 means that the student has not solved any of the diagrams, and 8 means that the student has solved all 8 diagrams. The distribution of that score is given in Figure 2. Kolmogorov – Smirnov's test showed the obtained distribution is not a normal one, D (478) = 0.158, p = 0.000.

Figure 2.

Pupils' chess knowledge grades according to the number of diagrams solved correctly

However, the data in Diagram 3 show that the difficulties of the 8 diagrams are not equal.

It is possible that the assessment of a student's chess knowledge has formed taking into account the degree of difficulty of the diagrams he/she has solved.

Approach N2.

Let's name the percentage of students who solved the diagram correctly: probability of solving the diagram - *Pi*. Let's call the inverse of this probability the weight of the diagram- *Wi*. The higher the weight of the diagram, the more difficult it is to solve. Normalize the weights of the diagrams so that their sum is equal to 8 (Table 4 and Figure 3).

	The probability of solving ` P_i	The weight of the diagram ` $W_i = 1/P_i$	Normalized weight of the diagram ` $WN_i = (W_i / \sum W_i) * 8$
Diagram 1	0.878	1.139	0.611
Diagram 2	0.638	1.567	0.841
Diagram 3	0.730	1.370	0.735
Diagram 4	0.245	4.082	2.190
Diagram 5	0.536	1.866	1.001
Diagram 6	0.778	1.285	0.690
Diagram 7	0.554	1.805	0.968
Diagram 8	0.556	1.799	0.965
Total		-	8

Table 4 . *Probability of solving diagrams, weights, and normalized weights*

The distribution of the semester chess grade is given in Figure 4, and the average values of the chess test depending on the semester chess grades are given in Figure 5.
The minimum possible semester grade is 6.

Figure 3. *Estimates of relative difficulty of chess charts (normalized weights)*
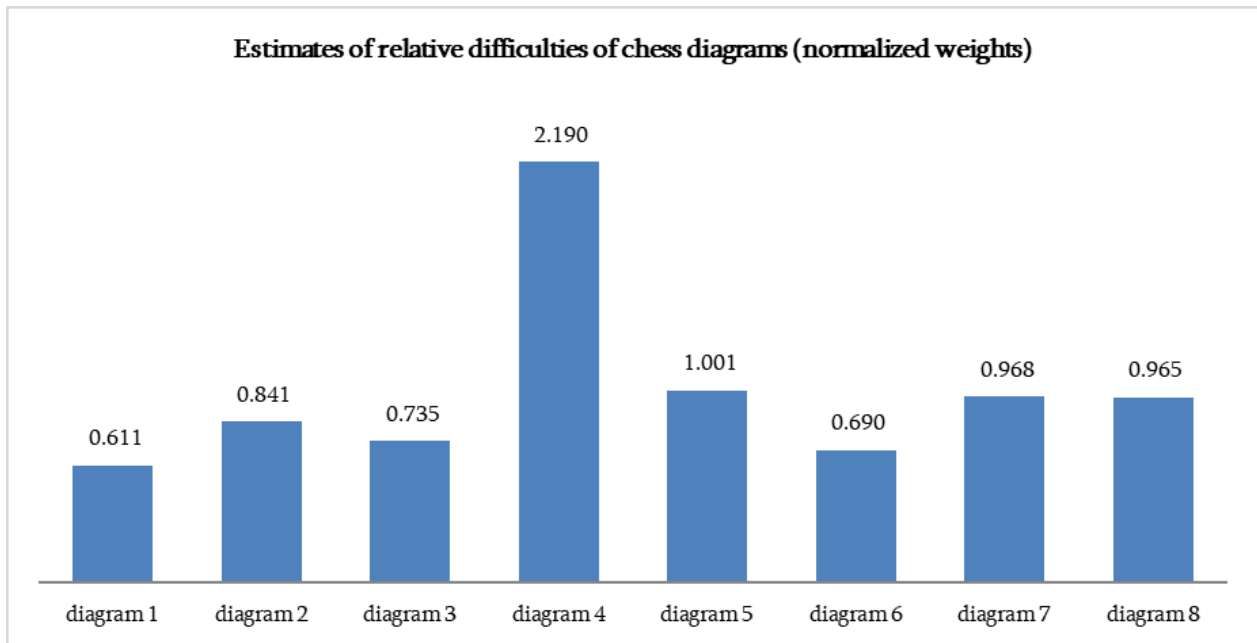

Estimates of relative difficulties of chess diagrams (normalized weights)

Figure 4. Average chess test scores

The distribution of the semester grade of the subject "chess"

Figure 5.

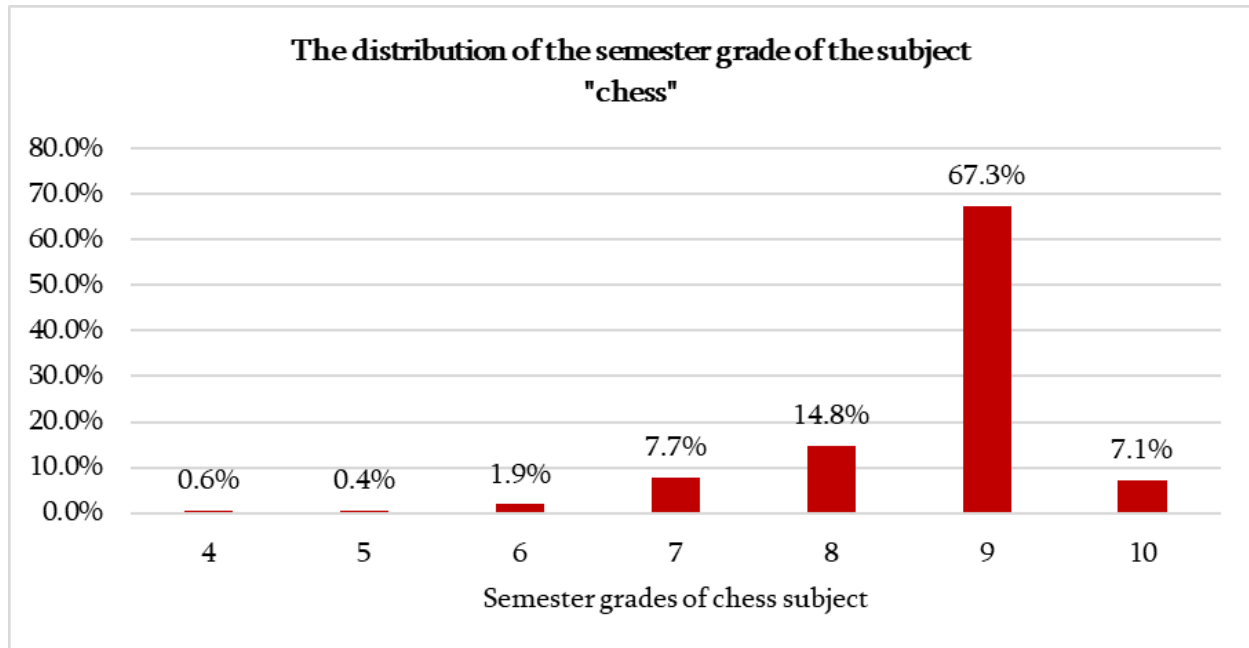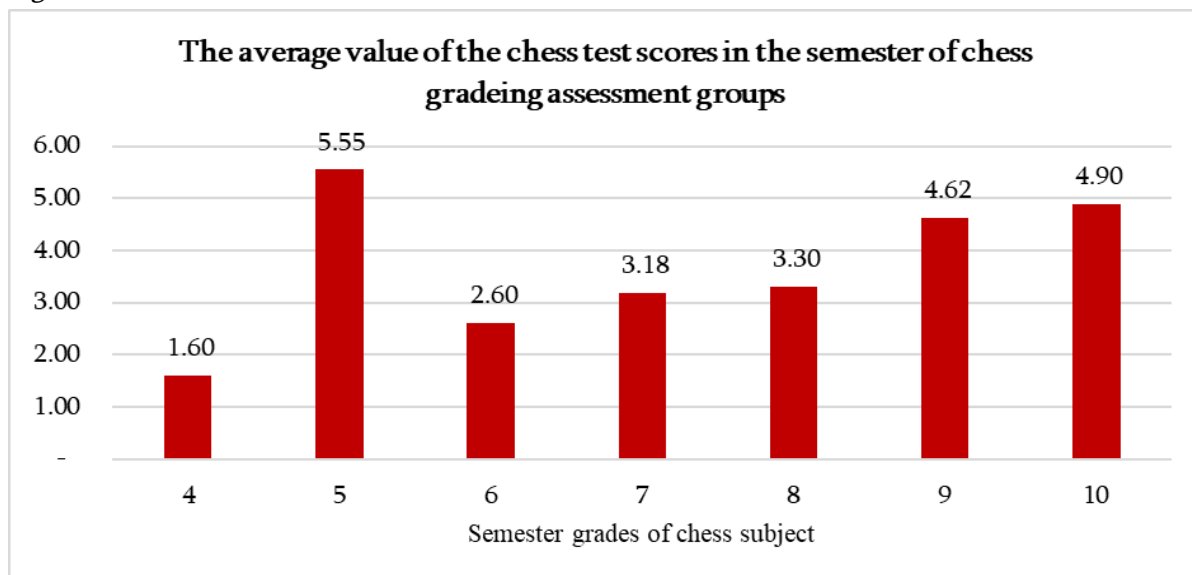**The average value of the chess test scores in the semester of chess gradeing assessment groups**

The dispersion analysis showed that there were no statistically significant differences between the 6-8 level and 9-10 level groups of the semi-annual chess subject grades. However, there are statistically significant differences between levels 6-8 and levels 9-10.

In addition, there is a statistically reliable linear trend in 6-10 series of semester chess subject assessments.

Semester grades of the subject "native language".

The distribution of the semester grade score of a native language subject (Figure 6) is very similar to that of a semester grade score of a chess subject (Figure 8). However, the dependence

of the chess test scores is much more adequate than the semester scores of the native language. The linearly growing trend is visible here.
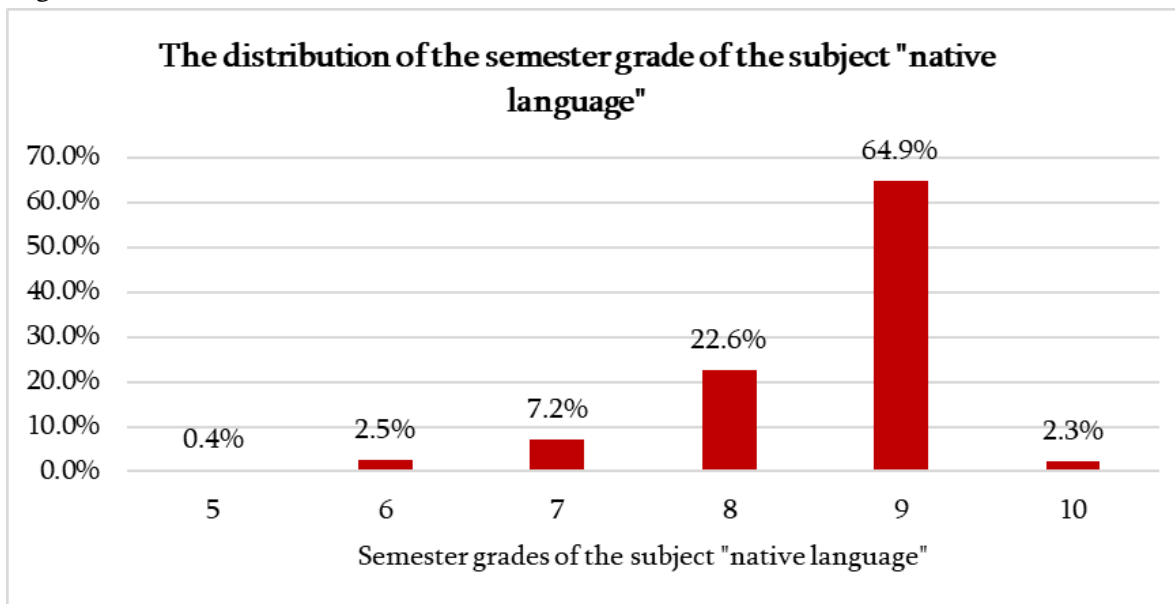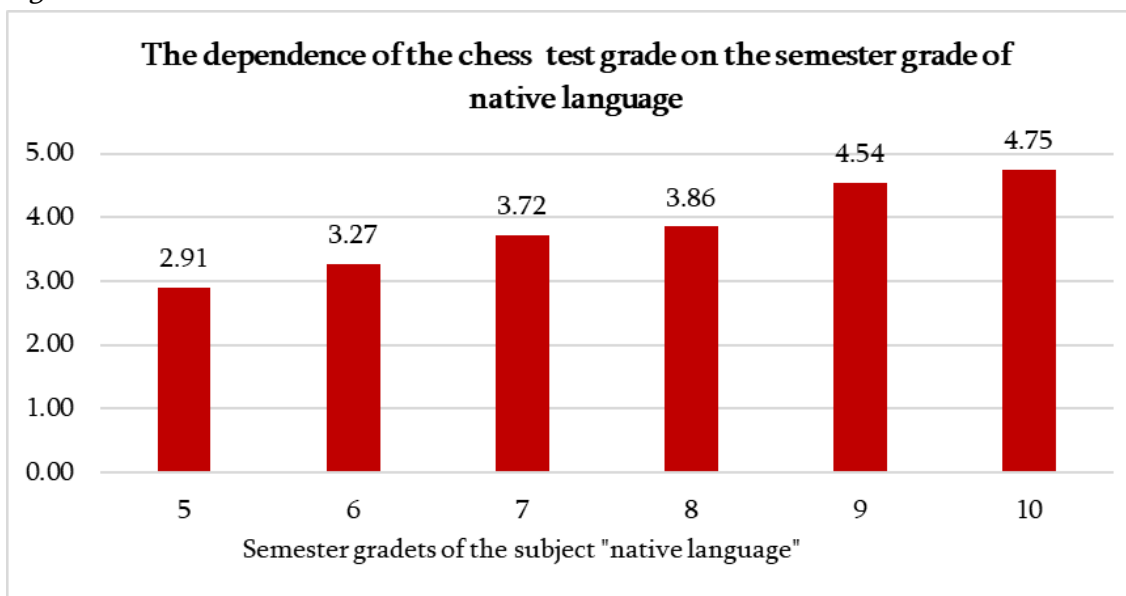
Figure 6.

The distribution of the semester grade of the subject "native language"

Semester grades of the subject "native language"

Figure 7.

The dependence of the chess test grade on the semester grade of native language

Semester gradets of the subject "native language"

Nevertheless, it is necessary to reveal statistically significant differences between the "trend" and the different grades of the "native language" subject in the chess test grades.

The dispersion analysis showed that there was no statistically significant difference (even between levels 10 and 5) for any pair of semi-annual mother tongue assessments, but the linear trend was statistically significant.

That is, the higher the half-year grade of the mother tongue, the higher the increase in the grade of the chess tests.

We think the reason is related to the teaching style and methods. Most teachers test students' current knowledge, as well as expected outcomes, through an oral means of checking. And those learners who have developed speech and language ability, can easily answer questions, but it is also possible that other learners, hearing the correct answers, simply repeat them by heart. For example, questions like "what is a check?", "what is a mate?" The learner can say the rule but cannot find the right check or mate on the chessboard while solving the problem.

Semester grades of the subject "mathematics".

The distribution of semester grades in Mathematics is given in Figure 8. And the dependence of the chess test scores on the semester grades in Figure 9. From the data it can be seen that inadequate data in Figure 10 is available in the case of the 0-semester grade in mathematics. And the volumes of groups 1-5 are very small. Therefore, the dispersion analysis was performed for 6-10 groups.
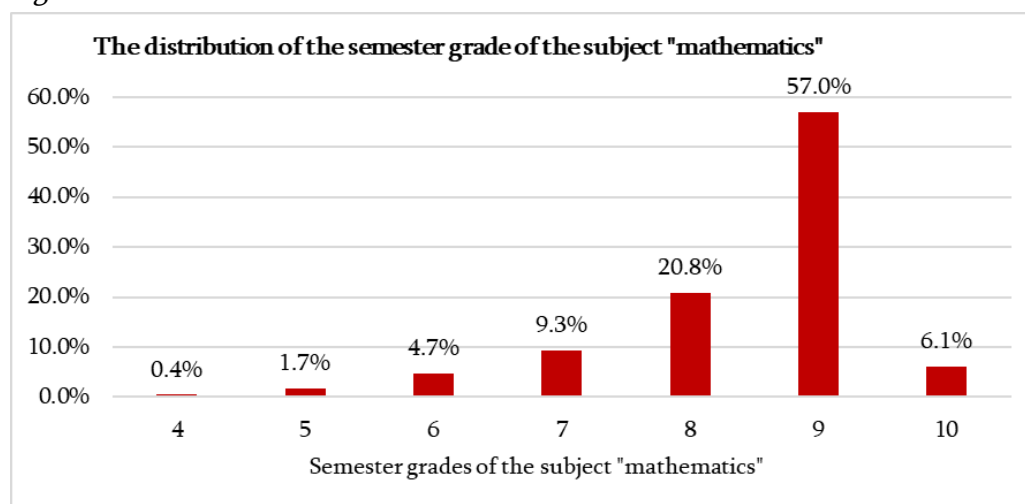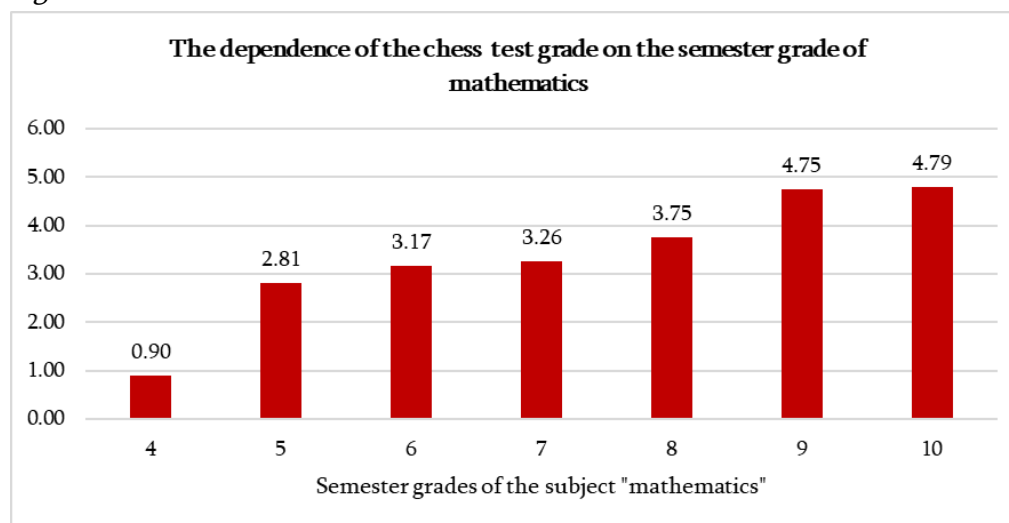
Figure 8.

Figure 9.

The dispersion analysis showed that the score of the chess test in the group with 9 semester scores in mathematics is statistically different from the scores of the 6, 7 and 8 groups.

In addition, there is a linear trend: in parallel with the increase in the semester grades in mathematics, the grades in the chess test are increasing.

Socio-psychological analysis of the research results.

Thus, the socio-psychological analysis of the obtained results is advisable to carry out in the form of answers to the questions posed, which are aimed at the realization of the purpose of the research.

1. To the question "What are the connections and interactions between chess, native language and mathematics grades and chess achievement indicators", it can be stated that based on the available data, the semi-annual grades of "chess", native language and mathematics subjects express similar tendencies.

In particular, the grades of native language, mathematics and chess subjects were …, …, … percent, respectively. Referring to the connections between the grades of the native language and mathematics subjects and the indicators of chess achievements, let us state that along with the increase of semester grade of the native language, the increase of the grade of the chess test begins to be expressed. This may be due to the fact that students' general abilities are taken into account during the assessment, or it may be conditioned on the interaction of knowledge, as well as on both of these factors at the same time. Almost the same tendency is evident in the interaction of mathematics and chess test grades. It is also interesting the dependence of the chess test scores on semester grades of the chess subject, where the linear trend is generally maintained, but with the difference that quite high scores were obtained in the case of 5 points. We tend to explain this by the fact that the distribution of tasks and topics according to the degree of complexity is not completely preserved in both the test and the program, which has already attracted the attention of the research institute during the development of new standards. Therefore, to the question "To what extent do the chess achievements reflect the main indicators of the school curriculum, what is the level of complexity of each task of the chess test?", it should be answered that in general the test has a high degree of suitability, but during the development of its tasks there is a problem to improve the condition of proportional complication of tasks.

Considering the students' chess knowledge grades according to the number of diagrams correctly solved and the mismatch of the distribution of chess semester grades, we assume that the differences of students' educational levels are generally taken into account in school progress consideration, but there is some upward trend in grades, which may be due to the complexity of the subject on the one hand, and the need to ensure compliance with the grades of other subjects in elementary school on the other hand.

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ԱՄՓՈՓԱԳԻՐ

ՏԱՐՐԱԿԱՆ ԴՊՐՈՑՈՒՄ ՇԱԽՄԱՏԱՅԻՆ ԳԻՏԵԼԻՔՆԵՐԻ ԿԱՊԸ ՄԱԹԵՄԱՏԻԿԱ ԵՎ ՄԱՅՐԵՆԻ ԼԵԶՈՒ ԱՌԱՐԿԱՆԵՐԻ ԱՌԱՋԱԴԻՄՈՒԹՅԱՆ ՑՈՒՑԱՆԻՇՆԵՐԻ ՀԵՏ
ՍԱՐԳՍՅԱՆ Վ., Ժ., ՄԱՆՈՒԿՅԱՆ Մ. Ա., ՍԱՐԳՍՅԱՆ Թ., Ա., ԳԵՎՈՐԳՅԱՆ Լ., Լ.

Հոդվածում ներկայացված են «Շախմատ» գիտահետազոտական ինստիտուտի կողմից իրականացված «Շախմատային գիտելիքների գնահատում» համահանրապետական հետազոտության սոցիալ-հոգեբանական հիմքերը, շահագրգիռ կողմերի դիրքորոշումներ: Հետազոտության արդյունքում աշակերտներից ստացած տվյալների վերլուծության հիման վրա բացահայտվել է շախմատային գիտելիքների կապը տարրական դպրոցի մաթեմատիկա և մայրենի առարկաների առաջադիմության հետ:

Հիմնաբառեր: Շախմատային գիտելիք, սոցիալ-հոգեբանական վերլուծություն, կիսամյակային գնահատական, շախմատային ձեռքբերում, գնահատում, շախմատային խնդիրների համաչափ բարդացում:

РЕЗЮМЕ
СВЯЗЬ ШАХМАТНЫХ ЗНАНИЙ С ПРЕДМЕТАМИ МАТЕМАТИКИ И РОДНОГО ЯЗЫКА В НАЧАЛЬНОЙ ШКОЛЕ
САРГСЯН В, Ж ., МАНУКЯН С. А., САРГСЯН Т. А ., ГЕВОРГЯН Л. Л.

В статье представлены социально-психологические основы общенационального исследования «Оценка знаний о шахматах», проведенного НИИ «Шахматы», позиции заинтересованных сторон. На основе анализа данных, полученных от учеников, выявлена связь шахматных знаний с успеваемостью начальной школы по математике и родным предметам.

Ключевые слова: Шахматные знание, социально-психологический анализ, полугодовая оценка, шахматные достижения, оценование, пропорциональное усложнение шахматных задач.

Approved for publishing by expert of education Serob Khachartyan

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