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# THE EFFICIENCY OF DIFFERENTIATED LEARNING - INDEPENDENT LEARNING SITUATIONS VERSUS COLLABORATIVE LEARNING

Empirical  
Study

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## Keywords

*Efficiency learning*  
*Differentiated learning*  
*Independent learning*  
*Collaborative learning*  
*Organizing forms*

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## JEL Classification

H21; D29; A31; A29; D29

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## Abstract

*Current Romanian education emphasizes pupil group action in learning situations frontal organized, independently or in micro-groups. Thus, differentiated learning suffers, because it requires an individualized learning, and not just individual; there is necessary to alternate the organizing forms of learning situations, so they to produce progress in pupils' learning.*

*Using the method of the experiment, the undertaken research project has studied the impact of organizing individual learning situations compared to harmonizing the organizing forms of cooperative learning on pupil achievement in primary education.*

*The experiential research sample consisted of 2 teachers and 56 pupils of class II. The control group comprised a class of 27 pupils, who have carried on an individual learning activity. The experiential group comprised 29 pupils who have carried out an activity based on the harmonizing different organizing forms of collaboration learning.*

*In the final assessment test, the results obtained by pupils confirmed the research hypothesis, demonstrating that in order to efficiently achieve the differentiated learning there is required a combination of organizing forms of learning and a stimulus for pupils' collaboration which to increase their motivation for learning.*

## INTRODUCTION

In the traditional system, the organizing form of the learning situations was the frontal one, learning having a strong informative purpose, emphasizing more the teaching process.

Current situation of the Romanian education tends to develop formative feature, involving both frontal organizing and cooperative learning in group and the individual learning.

The organizing forms of learning situations are: frontal organizing; learning situations in small groups (heterogeneous); learning situations on level groups; learning situations through independent and individualized action.

We are further describing the characteristics of these organizing forms involved in the present research study. In the same manner, both Louis Legrand and Cerghit Ion carry out the classification of the organizing forms of learning situations. Legrand L. calls them "*types of work*" and Cerghit (1991) emphasizes the efficiency of individual treatment and pupils' socialization alternation.

"Contrary to these trends and currents that have or are focused either on an excessive individualization of education, ripped from the collective life, or on excessive socialization of labor with contempt of individuality, we believe that «individual's socialization» and «group's personalization» are two fundamental and inseparable lots of instruction" (Cerghit, 1991).

In this way, the *frontal organizing* provides: the same conditions, methods, guidance for all pupils in teaching and learning; building the learning situations possible achievable by all pupils; creation of preconditions for learning through research.

The formative aspect of the frontal organizing form has its role to create preconditions as the information needed in conducting the other organizing forms and the possibility of combining with other forms. The first role involves learning through development and the second role relates to compensation.

The second organizing form of *learning situations in small groups, heterogeneous* presents the following characteristics: using interpersonal relationships in solving the learning tasks; through cooperation it trains the pupils in solving the common tasks for all groups, either in solving tasks derived from the general one, but equivalent in difficulty.

*The learning situations on level groups (homogeneous)* can rely on cooperative learning. They are distinguished from the heterogeneous groups through the given tasks after the level of cognitive development, the level of acquiring the knowledge.

This organizing form of the learning situations through differentiation belongs to a deeply formative learning, pursuing a theoretical development, but mostly practical.

*The learning situations through independent, individual action* are different: individual study, homework, developing practical works, solving different problems and exercises.

If we approach individual organizing forms of learning, pupils will learn by themselves, being entertained only by personal goals and interests. The objectives are independently achieved, the pupils understanding that the achievement of the learning objectives is unrelated to what the other pupils do. (Deutsch 1962, Johnson & Johnson, 1989).

If we approach organizing forms based on cooperation, pupils will work together for a common purpose and each pupil in the group will be represented when sustaining the final activity of the whole group.

Johnson and Johnson (2002) recommend as cooperative learning the organizing in heterogeneous groups for diversity of skills, ethnicity and socioeconomic status, which play their part in the maximization of the learning. Likewise, Brandt (1990) states that in the heterogeneous group the best results and improvements are achieved.

To support the learning in heterogeneous groups, Samsudin, Das Rai, Chij (2006) states that "Heterogeneous grouping in cooperative learning is indeed effective with proper structuring of lesson and activity by the teachers. This would also mean that teachers would have to be more comfortable with using school time for such activities and not view it as taking up too much time from them covering the syllabus" (Apera Conference, 2006).

In this way, "Cooperative learning enables teachers to reach a number of critical objectives simultaneously - increase achievement, develop effective social skills, improve race relations, reduce classroom disruptions, enhance communication skills, increase motivation, and close the achievement gap." (Marzano, Pickerling, Pollock, 2001). "Cooperative learning is the single most effective educational innovation to simultaneously address the many challenges and crises we face in our schools and our society" (Kagan, S. & Kagan, M., 2009).

Teachers will need to harmonize these organizing forms of learning in order to achieve differentiated learning efficiency. We do not intend to look at efficiency as a minimum investment of resources and strategies for achieving maximum results. We believe that in education, the efficiency means accurate dosing of

teaching resources and strategies to meet the proposed objectives.

Therefore, teachers need to identify as many variations of teaching learning, not to ignore the differentiated learning.

In this regard, Sugden (2010) stated that teachers need strategies to not target the majority of pupils, but to differentiate the learning for each pupil. Also, strategies must be simple, reliable and to meet the different needs of training of the pupils.

In the research project we proposed the following objectives:

1. The experimental study of differentiated learning efficiency involved through the organizing of the individual / independent learning forms.

2. The experimental study of the differentiated learning efficiency involved by harmonizing the different organizing forms of learning: frontal, on homogeneous groups and on heterogeneous groups.

3. The comparative analysis between the individual learning and cooperative learning and the impact of these organizing forms on pupils' achievement.

We have identified as general hypothesis:

If teachers harmonize different forms of learning (frontal, on homogenous groups and on heterogeneous groups) fostering pupils' cooperation within the group, then the pupils will achieve better results at school.

The following specific hypotheses derive from this general hypothesis:

1. If we study the differentiated learning efficiency by conducting an experiment based on the individual/ independent learning, then the teachers will identify the limits of this organizing form and its effects on lowering pupils' school performance.

2. If we study the differentiated learning efficiency by conducting an experiment based on harmonizing the different forms of learning (frontal, on homogenous groups and on heterogeneous groups)) fostering pupils' cooperation within the group, then teachers will identify the benefits of this harmonization and its positive effects on pupils' achievement.

## METHODOLOGY

### The sample

We opted for a fixed sampling (panels) to obtain information about similar problems in the same subjects. The target population consists of primary school teachers and pupils. The sample comprised 2 primary school teachers, 25 pupils of class II A and 25 pupils of class II B, of Middle School "Traian" in Craiova, Romania.

We took in consideration, when selecting the sample, as the two classes of pupils to have a roughly equal number of pupils, the school results to be at the same level, to be part of the same educational institution, so that to have similar educational environment.

### Methods

The experiment was the basic method of our research project. Thus, we conducted a comparative analysis of the school results of the pupils involved in the two groups of the research, highlighting the effectiveness of the formative impact of the organizing forms of cooperative learning.

We chose IBM.SPSS program, version 21 to process data on the research sample. We applied the Paired test - Samples T Test for the two classes' sample, setting the standard error of the average and the standard deviation. We also achieved with relative frequency Polygon with graphics clusters, studying two variables by comparison.

### Tools

Our experiential study included a control group represented by 25 pupils of class II A in Middle School "Trajan", Craiova, Romania. The control group participated in a learning activity individually organized, pupils had learning tasks with the same level of difficulty, but involving an independent learning.

The second group of research, the experimental group was represented by the 25 pupils of class II-B, Middle School "Traian", Craiova, Romania. The experimental group participated in a learning activity in which the teacher has harmonized many organizing forms of learning: on homogeneous groups, on heterogeneous groups and frontal activity.

The two groups in the batch research were initially tested through a joint assessment sample, then the experiment was conducted, and finally we proposed identical assessment tests to be able to compare the results.

### Results and interpretations

We proposed to the two teachers of the experimental group to organize learning situations to achieve the objective: *Pupils to solve with plan, problems that have at most two operations.*

Thus, the pupils learned to solve problems with plan, using at most two operations, those in the control group through independent work, while those in the experimental group, being organized in different organizing forms: frontal, homogeneous groups (depending on the level of

the achieved intermediate behavior) and heterogeneous groups.

Pupils of the two classes were tested to identify the level of skills pupils have in mathematics. There has initially been evaluated pupils' ability to compare natural numbers in the 0-1000 interval, to add without crossing the order and passing the order.

In the initial assessment test, pupils of the group I obtained the following results: 60% - VG; 32% - G; 8% - S. The pupils of the group II obtained the following results: 44% - VG; 40% - G; 16% - S.(see Figure 1).

We find that the pupils of the two groups achieved similar results. There is no big percentage difference between pupils who obtained VG, G and S. Thus, all pupils can count in the 0-1000 interval, they compare numbers, and they know the technique of comparing the number consisting of hundreds, tens and units and solve addition and subtraction exercises without passing and crossing over order.

Those who have obtained qualifications of G and S were wrong in comparing numbers or in the additions and subtractions with crossing order.

Knowing the initial level of the two groups of pupils, we followed the application of the experiment.

The teacher approached, for the group I, learning tasks that had to be solved individually by the pupils. So, he asked pupils of this group to solve individually problems with plan after studying the manual model. Each pupil was verified when he finished working. Thus, pupils investigate alone, resolved and are self-forming through independent work.

For the group II, the teacher approached learning situations that called for implementing a comprehensive strategy combining multiple organizing forms centered on pupils: frontal, individualized homogeneous groups and heterogeneous groups.

First, the teacher explained to the pupils in group II how to resolve problems with the plan, emphasizing verbal and supporting by demonstration the meaning of the expressions: "more so", "much less", "come", "left", "flew", "remained".

After this frontal review, where the pupils answered the questions, it has been assessed the level of the acquired knowledge and skills to solve problems with plan with two operations.

Testing the level achieved by each pupil through a few problems with visual aids, the teacher divided the pupils of this group into three groups: the "group of mathematicians" - comprising pupils who understood to solve problems with intuitive support, "group of cleverer" consisting of those who have asked for teacher's support and the "ambitious group" made

up of pupils who face greater difficulties of understanding.

Thus, to those who understood to solve problems with plan by using images, he gave them the task of composing problems after pictures and then to solve more difficult problems without visual aids.

The group which has asked teacher's support received worksheets with simple problems with visual support, asking them to compose problems with different graphical representations (balls, shapes) and then to solve them.

The group which presents greater difficulties of understanding has solved problems with image-based plan, first problems with one single operation and then with two operations, being helped by the teacher. Also, the teacher insisted on the mindset of the problem: he has highlighted the keywords, he has stated what is meant by those words, what operations the mathematical expressions indicate, how the inquiries must be made for each operation.

We noticed that pupils having difficulties of understanding became more active when the teacher raised questions that were directed thinking. Each of them had to respond, to observe, to analyze, to extract, so to synthesize the "keywords" of the issue. They also could collaborate to better understand the working algorithm. Professor encouraged team learning.

Pupils have not remained organized in this way. The teacher formed groups of 5 members: one pupil from the first group, which did very well from the beginning, 3 pupils from the second group and one pupil from the third group.

The reorganizing in heterogeneous groups was achieved when pupils of each group have proved that they can move on to tackling more complex tasks. If they have proven that they understand the algorithm of solving the problems with plan based on intuitive support, they were given the job of composing a problem after images. This time it is aimed the training of the creative thinking and of the synthesis capacity, the abstraction of thought.

In solving the problems with intuitive support were trained logical thinking, analytical and comparing ability. Based on these capabilities there are developed the other operations of thought: abstraction and generalization, being developed through learning tasks increasingly complex requiring pupils to solve problems without pictures or to compose problems after exercise.

We proposed to the two teachers from research group, at the end of carrying out of this experiment, to apply an assessment test aiming at both the assessment of logical, algorithmic thinking, and the ability to analyze, synthesize, flexibility of pupils' thinking. The final assessment

test was identical for both groups of pupils as the one of the initial assessment.

The final assessment test included: problem solving after a display image; drawing crowds to symbolize the operation of an exercise; compiling a problem after a given image; solving a problem with plan, but with no picture; replacing some phrases from the statement of the problem by changing resolution through another operation ("come" with "leave", "more" with "less", etc.)

Following this final assessment test, the pupils of group I obtained the following qualifiers: Very Good (VG) - 52%; Good (G) - 28%; Sufficient (S) - 20% and the pupils of group II, where have been worked by harmonizing different organizing forms of learning, obtained the following results: Very Good (VG) - 76%; Good (G) - 24; Sufficient (S) - 0% (see Figure 2).

Based on the achieved results, we calculated the differences that occur in the experimental sample, between the results of the initial assessment and of the final assessment. Thus, we observed that the results of the pupils of the second group increased by 24% for the Very Good (VG) grade and no pupil achieved the Sufficient (S) grade, from the initial assessment, when there were 20% pupils evaluated with the Sufficient (S) grade.

Applying the T Test for the sampling in pairs, we see that if we compare the results achieved by pupils in the second group (G2) at the two assessments, it is given a standard deviation of 0.5, at a significance level of less than 0.05, as shown Table 1. These statistics prove that the experiment registered changes on the research group. Thus, pupils in the second group have made progress following the application of cooperative learning.

We presented the statistical reality using the Polygon of relative frequency, the Graph on clusters. We can identify the clearly progress of pupils in the second group, the experimental group.(See Figure 3).

Analyzing the results represented by the Paired Sample T Test for sampling in pairs, we found that the pupils of the first batch of research, group I (G1), had no progress in learning, as shown Table 2. Thus, we can identify a significance threshold of 0.161, which is higher than 0.05, showing that there is no difference between variables.

Also, the graph on clusters highlights the regress in learning. The Very Good (VG) and Good (G) qualifiers have fallen, increasing the ones of Sufficient (S). (See Figure 4).

In the control experiment represented by the pupils of the first group, though in the initial assessment phase the obtained results by these were better than those obtained by the pupils of the second group, after the final assessment, their results were weaker.

The difference between the results of the final assessment and of the initial assessment for the pupils of the first group is 4% percent less for grade Very Good (VG), increasing the number of pupils who achieved in the final assessment the "Good" grade by 2% and of those who scored the "Sufficient" qualificative by 2%.

We believe that although pupils of group I have achieved better results in initial assessment in comparison to pupils in the second group, their results in the final assessment were weaker both compared with their own initial results and compared with the results of pupils in the second group.

We believe that the percentage differences between the results of the pupils of the two groups are due to the fact that in the second group was introduced the experimental factor, pupils have not only been approached by frontal organizing, as they were accustomed. They were treated differently; there have been created individualized learning situations, learning tasks being reported to the knowledge level and to the understanding capacity of each child by organizing the homogeneous and then the heterogeneous groups.

We believe that while pupils in group I participate in their training by independent learning situations, the results are worse, because to this organizing form are assigned all pupils in the group, regardless of the knowledge gained and intellectual abilities (work pace or speed of thought) to solve the same tasks.

Because of lack of adapting the learning situations to every pupil, there intervene negative stressors that adversely affect formative development of pupils.

The effectiveness of knowledge assimilation depends on the correlation of the organizing forms with pupils' interests and abilities, making a differentiated education. The individualization involves pupils' personal work accustoming them to make effort in assimilating the knowledge.

## CONCLUSIONS

The undertaken research study obtained teachers' adherence to harmonize the organizing forms of differentiated learning situations encouraging collaborative learning.

Summarizing, we can specify the following issues:

The study presents some *personal contributions*:

- Scientific argumentation of the advantages of the organizing forms of learning through cooperation, stressing the need to harmonize them;
- Bringing into question the concept of harmonization of the organizing forms of learning, concept less studied in the literature; highlighting the impact of the differentiated learning on

educational outcomes of pupils by comparing the results of the two groups of the research batch.

As *open questions* for future studies, we propose the development of a more extensive research based on data submitted by our research project, aimed at other levels of education; detailed analysis of the concept of differentiated learning efficiency by studying the relationship's impact between media, teaching methods and organizing forms of learning on pupils' school achievement.

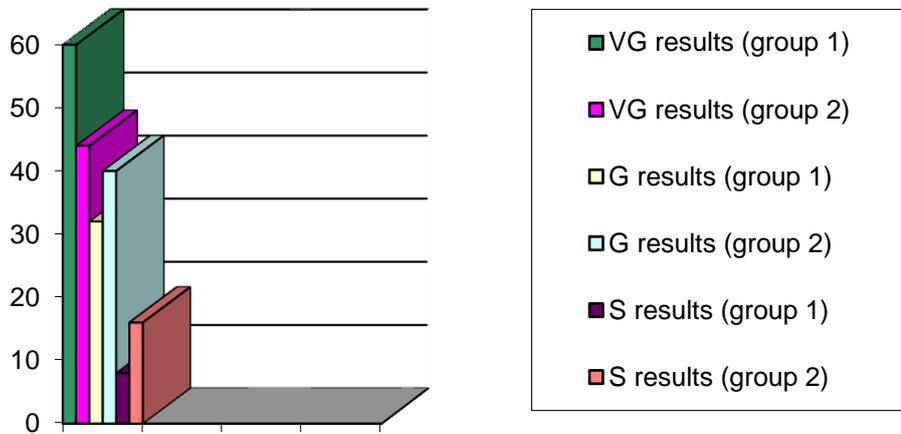
The study presents *research limits* determined by the following factors:

Given the fact that our research was at project level, the small number of teachers under investigation does not allow the formulation of relevant generalizations, but the quantitative analysis represents a basis for expanding the study.

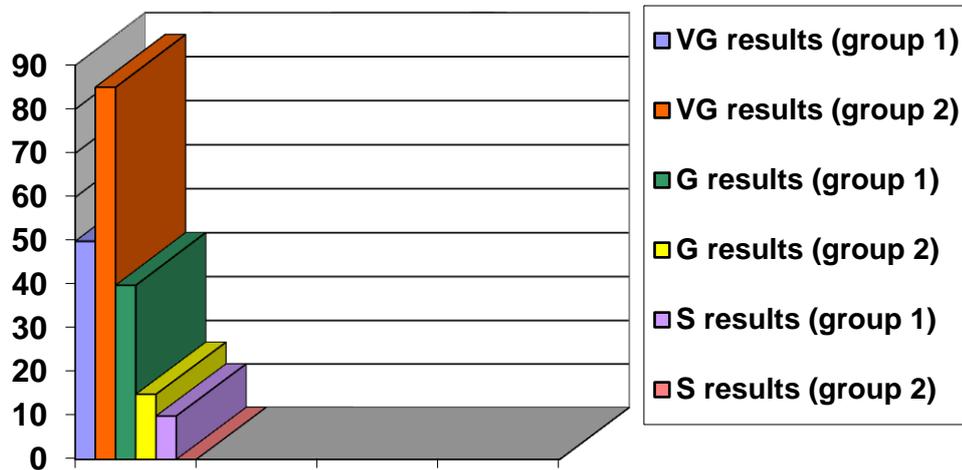
In a synthetic approach, we can think that in order to get an effective differentiated learning, the teachers must combine the organizing forms on groups of pupils, requiring collaborative work with individual and even individualized learning forms. For organizing in small groups, heterogeneous or homogeneous, to determine a formative learning, each pupil must work individually within a certain time, after the solutions being debated at group's level, embracing a common solution that will be communicated to the class by the group's leader. Thus, the learning through organizing situation in small groups can not be fully effective without combining it with the frontal organizing where the teacher concludes the outcome.

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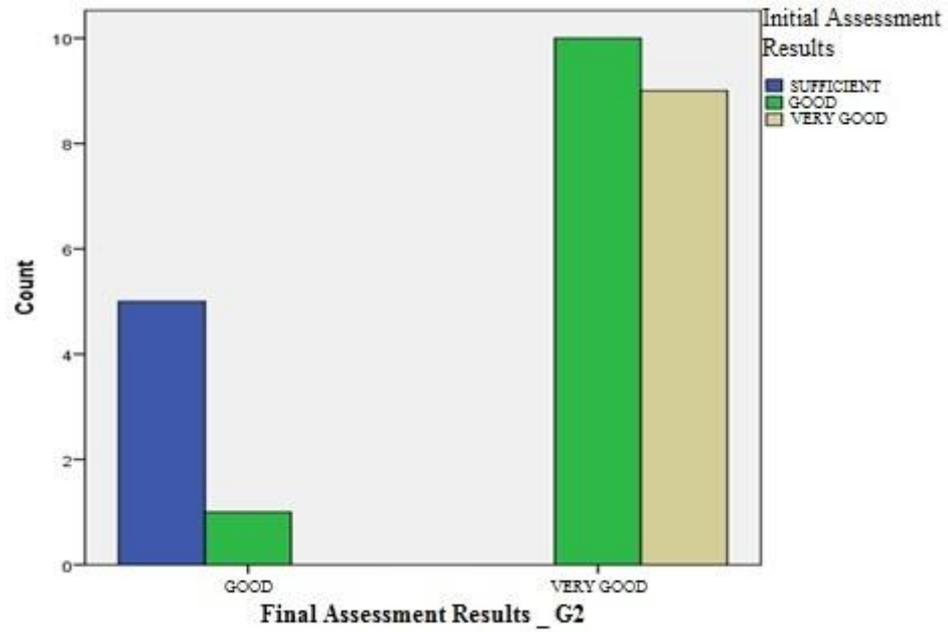
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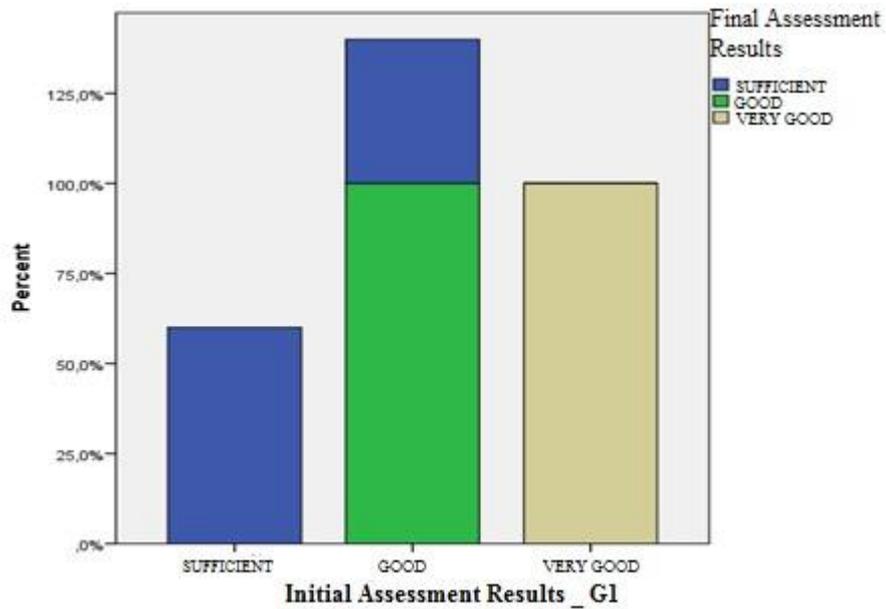
**Figure 1. The pupils' results on the initial assessment**  
*Source: author's processing.*



**Figure 2. The pupils' results on final assessment**  
*Source: author's processing.*



**Figure 3. Graphon clusters-Summative Assessment-Initial Assessment-G2**  
 Source: author's processing.



**Figure 4. Graph on clusters - Summative Assessment-Initial Assessment - G1**  
 Source: author's processing.

**Table 1. Paired Samples Test – Comparing Assessment Results G2**

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Initial Assessment Results_G2 -Final Assessment Results_G2	-,600	,5000	,1000	,80639	-,393610	6,0	4	,000

Source: author's processing.

**Table 2. Paired Samples Test – Comparing assessment Results**

Pair 1	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Initial Assessment Results_G1 Final Assessment Results_G1	,08	,276887	,055377	-,034294	,194294	1,445	24	,161

Source: author's processing.