

## **Correlations of organic chemistry study of the 2nd year “Pharmacy” faculty students of specialty “Technology of perfume-cosmetic preparations”**

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**Abstract.** In order to analyze the organic chemistry study for 2nd year students of specialty “Technology of perfume-cosmetic preparations” in Zaporizhzhya State Medical University, correlations between preparation time for the theoretical part of the classes, for computer testing and its percentage, the impact of the organic chemistry at school to university mark, and in general for all disciplines attestation, using Pearson and Spearman correlations, Kolmogorov-Smirnov test, were calculated and discussed. It was found, that the best positive impact at the university study was done by organic chemistry education at school. And there was negative correlation between time for tests or theory preparation and computer tests results due to student’s insufficient understanding of the problems.

**Keywords:** organic chemistry, specialty “Technology of perfume-cosmetic preparations”, Pearson product moment correlation, Spearman rank correlation, Kolmogorov-Smirnov test.

### Introduction

The main objectives of graduation for pharmacist-cosmetologist of specialty 7.12020104 «Technology of perfume-cosmetic preparations» in area 1202 «Pharmacy» are:

- productive work in beauty salons and cosmetic clinics with consultations on the rational use of medicines and cosmetics;
- creation of new effective formulations, regulatory and technical documentation for perfume and cosmetic products;
- quality and safety examination of perfumery and cosmetics;

- delivering drugs in the drug-stores.

After the course of organic chemistry at the second year of education students are going to:

- develop logical chemical thinking, examining the transformations of different classes of organic compounds, detecting electronic effects, conjugation, aromaticity, stereoisomerism and important functional groups, etc.

- acquire skills to form solutions of complex tasks by detection of the substances' acidic and basic properties, explaining the mechanisms of various chemical reactions;

- get acquainted with special literature, equipment used in the laboratory of organic synthesis;

- mastered the qualitative reactions;

- strengthen the professional orientation as a pharmacist by prediction the drug interactions and storage side products.

It was decided to investigate different factors, influencing the students productivity in the organic chemistry study: mathematical correlations between duration of preparation for theory, computer testing and its results, organic chemistry mark in school certificate, university rating in organic chemistry and in general for all disciplines.

#### Materials and methods

The most common measure of correlation in statistics is the Pearson Correlation. The full name is the Pearson Product Moment Correlation or PPMC. It shows the linear relationship between two sets of data [1]. Spearman's rank correlation coefficient is a measure of a monotone association that is used when the distribution of data makes Pearson's correlation coefficient undesirable or misleading [1]. It assesses how well an arbitrary monotonic function can describe a relationship between two variables, without making any assumptions about the frequency distribution of the variables. Unlike Pearson's product-moment correlation coefficient, it does not require the assumption that the relationship between the variables is linear, nor does it require the variables to be measured on interval scales; it can be used for variables measured at the ordinal level.

So, required calculations were completed with the help of Pearson product moment correlation [2], Kolmogorov-Smirnov test [3] to check the parametricity of the distribution and Spearman rank correlation [4], according to the data recorded from 10 students of the 2nd year "Pharmacy" faculty students of specialty "Technology of perfume-cosmetic preparations". Questions are mentioned in the footnotes of Table 1.

#### Results and discussion

The best positive Pearson correlation was found between average test results, attestation mark for all studied subjects and organic chemistry mark in school certificate (Table1). The negative one was presented involving preparation time and average attestation rating. These data confirmed the obvious - the more educated students are - the faster and better they solve the problems.

*Table 1.*

**Pearson Product Moment Correlation data**

$$r = \frac{N \sum (X - M_X) * (Y - M_Y)}{\sqrt{(\sum (X - M_X)^2 * \sum (Y - M_Y)^2)}}, N=10$$

Parameters	A*	B	C	D	E	F
A*	1					
B	-0.308770	1				
C	0.317067	-0.315060	1			
D	-0.359360	0.327327	-0.122230	1		
E	-0.190690	0.715829	0.106132	0.165395	1	
F	-0.711440	0.598709	-0.195780	0.448363	0.706458	1

\*A - average time spent for preparation for the computer test in minutes;

B - average test results in percentage;

C - average time spent for preparation for the theoretical material in minutes;

D - average organic chemistry mark;

E- organic chemistry mark in school certificate;

F - average attestation mark for all studied subjects at the moment.

It interesting to mention, that the lowest level connection was seen between the time spent for preparation for the theoretical material and the mark in the school certificate. The average organic chemistry rating practically hadn't influenced the homework time either. It may be caused by the amount of the new material, which students are dealing at every lesson.

According to Kolmogorov-Smirnov comparison of each two data, it was established, that researched distribution was a non-parametric one [3].

Hence, Spearman rank correlation was also calculated [4].

The strong negative relationship at the statistically significant level was detected between the time for tests preparation and their results (Table 2). The more attempts students had done – the lower percentage they obtained. This result is explained by the

attitude of the underachieving students. They didn't need to understand the problems – just want to faster pass the subject.

The positive correlation between organic chemistry mark in school certificate and in university shows the necessity to check this subject presence at school when entering this specialty.

**Table 2.**

**Spearman rank correlation data.**

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}, n=10$$

Correlations between Values	Preparation time for tests / tests results	Org. chemistry mark in school certificate / university org. chemistry mark	Preparation time for theory / tests results
Correlation coefficient	-0.98206241793023	0.70691123003858	-0.75115169476106
Tf, recalculation K for critical values of Student's t-test	14.731381310676	2.8268633641623	3.2184251763056
Critical values from the table of Student t-test	tcr = 2.306 for P ≤ 0.05 tcr = 3.3554 for P < 0.01		
The correlation is statistically significant at the level	all	0.05	

Unexpected was the result of preparation time for theory to tests evaluation. The theory explanation should improve the percentage of correct answers, but may be students have spent too much time for notes preparation, leaving less time for tests.

**Conclusions**

Thus, correlation study of some factors important for quality learning of organic chemistry for 2nd year "Pharmacy" faculty students of specialty "Technology of perfume-cosmetic preparations" was carried out. The best positive impact at university studies was done by organic chemistry education at school according to Spearman rank

correlation of non-parametric distribution. The students need assistance in explaining how to effectively divide their homework preparation time to overcome the negative correlation between the theory and tests training: to point the main theoretical questions, material, that should be memorized or just get acquainted with. The particular attention should be given to the tests evaluation, because at the start of 4th year of education students need to complete the licensed integrated examination KROK-1 – a form of external assessment of professional competence as specialists in the field of “Technology of perfume-cosmetic preparations”. And only then a significant transformation of perceptions would be demonstrated by the students.

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