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ABSTRACT

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THE ROLE OF CURRENT ACADEMIC PERFORMANCE OF MEDICAL STUDENTS IN PREPARATION FOR THE FINAL EXAM: EXPERIENCE IN TEACHING THE DISCIPLINE «HYGIENE AND ECOLOGY»

Introduction. Current academic performance is a critical indicator of medical students' preparedness for final examinations. High academic achievements during studies are proven predictors of success in licensing exams. This study examines the changes in academic performance of foreign medical students in the discipline "Hygiene and Ecology" across two academic years, 2023 and 2024, amidst the challenges of the war in Ukraine and their impact on final exam results. The primary focus is on analyzing academic performance, ECTS grade distributions, and their correlations with KROK-2 results to identify predictors of success.

Materials and Methods. The study analyzed the results of foreign medical students (Bogomolets National Medical University, 6th-year, "Medicine" specialty) on the KROK-2 exam for the "Hygiene & Health Care Organization" subtest, conducted on 6 June 2023 and 21 May 2024. Academic performance was assessed based on discipline scores, everyday current control scores, and ECTS grades. Statistical analysis was performed using MedStat v.5.2, Microsoft Excel®, and Jupyter Notebook with Python libraries: Pandas, NumPy, SciPy, Scikit-learn, Matplotlib, and Seaborn. Normality of distributions was assessed using the D'Agostino-Pearson and Shapiro-Wilk tests, while comparisons were made using Student's t-test and Mann-Whitney U test. Statistical significance was set at $p < 0.05$, with confidence intervals calculated for means and medians.

Results. In 2024, a significant increase in the number of students (252 compared to 112 in 2023) was observed, along with shifts in ECTS grade distributions. The percentage of students with grade "E" decreased significantly from 38.4% in 2023 to 12.7% in 2024, while grades "B" and "C" increased notably (from 7.1% to 22.6% and 22.3% to 37.3%, respectively). Mean scores decreased across all grades, with the overall

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average falling from 72.0 in 2023 to 61.1 in 2024 ($p < 0.001$). Correlation analysis showed that in 2024, everyday current control scores and discipline scores explained 22.3% ($R^2 = 0.223$) and 17.9% ($R^2 = 0.179$) of KROK-2 result variance, respectively, compared to 10.6% and 6.4% in 2023.

Discussion. The results indicate an improvement in current performance: a decrease in the proportion of students with low grades and a significant increase in the proportion of students with satisfactory ("C") and good ("B") grades. This could be attributed to enhanced learning conditions in 2024, such as stabilization of the educational environment. However, the decline in mean scores suggests the need for targeted interventions, particularly for students in the "C", "D", and "E" grade categories. Statistically significant correlations between KROK-2 results and both discipline and everyday current control scores highlight these as key predictors of success. The stability of "A" grade performance suggests that high-achieving students maintain their outcomes regardless of external challenges.

Conclusions. From 2023 to 2024, academic performance improved with fewer students scoring "E" and more achieving "B" and "C" grades. Despite an increase in student numbers, the overall mean scores decreased, emphasizing the need for focused preparation strategies. Correlations between KROK-2 results and academic indicators were stronger in 2024, suggesting these factors became more reliable predictors of success. Interventions should prioritize supporting students in the "C", "D", and "E" categories to further enhance academic outcomes.

Keywords: Distance Education, Educational Measurement, Medical Education, Motivation.

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РОЛЬ ПОТОЧНОЇ УСПІШНОСТІ СТУДЕНТІВ-МЕДИКІВ У ПІДГОТОВЦІ ДО ПІДСУМКОВОГО ЕКЗАМЕНУ: ДОСВІД ВИКЛАДАННЯ ДИСЦИПЛІНИ «ГІГІЄНА ТА ЕКОЛОГІЯ»

Вступ. Поточна академічна успішність є критичним показником рівня підготовки студентів-медиків до складання підсумкових іспитів. Високі академічні досягнення під час навчання є перевіреними предикторами успіху в ліцензійних іспитах. Це дослідження присвячене аналізу змін в академічній успішності іноземних студентів-медиків з дисципліни «Гігієна та екологія» протягом двох навчальних років (2023 та 2024), із врахуванням викликів створених війною в Україні та їхнього впливу на результати підсумкових іспитів. Основна увага приділяється аналізу академічної успішності, розподілу оцінок за шкалою ECTS та їх кореляції з результатами КРОК-2 задля визначення предикторів складання ліцензійного іспиту.

Матеріали та методи. У дослідженні проаналізовано результати студентів 6-го курсу (Національного медичного університету імені О.О. Богомольця за спеціальністю «Медицина») на іспиті КРОК-2 (субтест «Гігієна та організація охорони здоров'я»), що проводився 6 червня 2023 року та 21 травня 2024 року. Академічну успішність оцінювали за балами з дисципліни, поточними оцінками та трансформованими оцінками за шкалою

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ECTS. Статистичний аналіз проводили з використанням MedStat v.5.2, Microsoft Excel® та Jupyter Notebook із Python-бібліотеками: Pandas, NumPy, SciPy, Scikit-learn, Matplotlib та Seaborn. Нормальність розподілів оцінювали тестами Д'Агостіно-Пірсона та Шапіро-Вілка. Для порівняння використовували t-тест Стьюдента та критерій Манна-Уїтні. Статистична значущість встановлювалася на рівні $p < 0,05$, довірчі інтервали розраховували для середніх та медіан.

Результати. В 2024 році спостерігалися такі зміни: значне зростання кількості студентів, що складали ліцензійний іспит (252 порівняно з 112 у 2023 році) та зміни у розподілі оцінок за шкалою ECTS. Частка студентів із оцінкою «E» зменшилася з 38,4% у 2023 році до 12,7% у 2024 році, тоді як частки студентів з оцінками «B» та «C» значно зросли (з 7,1% до 22,6% та з 22,3% до 37,3%, відповідно). Середні бали знизилися в усіх категоріях оцінок, загальний середній бал впав із 72,0 (2023) до 61,1 (2024) ($p < 0,001$). Кореляційний аналіз показав, що в 2024 році поточні оцінки та бали з дисципліни пояснювали 22,3% ($R^2 = 0,223$) та 17,9% ($R^2 = 0,179$) дисперсії результатів КРОК-2, відповідно, порівняно з 10,6% та 6,4% у 2023 році.

Обговорення. Результати вказують на покращення поточної успішності: зменшення частки студентів із низькими оцінками та значне зростання частки студентів із задовільними («C») та добрими («B») оцінками. Це можна пояснити покращенням умов навчання у 2024 році, зокрема стабілізацією освітнього середовища. Водночас зниження середніх балів підкреслює необхідність цілеспрямованих заходів, особливо направлених на студентів із категорій «C», «D» та «E». Статистично значущі кореляції між результатами КРОК-2 та балами з дисципліни й поточними оцінками підтверджують їх як ключові предиктори успішного складання. Стабільність результатів у категорії «A» свідчить про те, що студенти з високими досягненнями залишаються успішними незалежно від зовнішніх чинників.

Висновки. В 2024 році зменшилася частка студентів із оцінкою «E» та зросла частка тих, хто отримав «B» та «C», що свідчить про покращення академічної успішності. Незважаючи на збільшення кількості студентів, середні бали знизилися, що підкреслює потребу в удосконаленні підходів до підготовки. В 2024 році кореляції між результатами КРОК-2 та академічними показниками стали сильнішими, що свідчить про їхню більшу предиктивну цінність. Необхідно посилити роботу із студентами категорій «C», «D» та «E» для покращення їхніх результатів.

Ключові слова: дистанційна освіта, оцінювання освітніх досягнень, медична освіта, мотивація.

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INTRODUCTION

Current academic performance of medical students plays an important role in their preparation for final exams. High academic performance during studies is an important predictor of success in the final exam. Many authors confirm this finding, noting that students with higher academic performance are usually better prepared for exams [1, 2]. Scientists from around the world analyze different strategies for preparing for exams, pointing out the importance of regular study and current academic performance, emphasizing that students with high academic performance have a higher

chance of success in final exams [1, 3]. Rebecca Morris with co-authors point out the importance of systematic study throughout the course to achieve high results in final exams [4].

Over the past decade, Ukraine has confidently established itself as a leading center for obtaining medical education by foreign students. The constant increase in the number of foreign applicants to higher medical education institutions (HMEI) testified to a high level of trust in the Ukrainian educational system and its competitiveness in the international market of educational services [5].

However, the military aggression by the Russian Federation, which began in 2022, has caused significant challenges for the Ukrainian educational environment, particularly in the field of medical education.

In the conditions of war, the Ukrainian HMEI was faced with the task not only of maintaining the education level for foreign students, but also of ensuring its competitiveness in the future. The satisfaction of the customer countries with the results of their citizens' education is one of the key factors in the attractiveness of Ukrainian HMEI [6]. Of particular importance is the level of graduates' mastery of professional competencies that are crucial for their further activities. The discipline "Hygiene and Ecology" plays an important role in this, which forms in future doctors the knowledge and skills necessary to confirm their high professionalism. It is important for future doctors to understand that preventing diseases is much more effective and economically feasible than treating them. According to the World Health Organization, a significant percentage of diseases are associated with non-compliance with the rules of personal and social prevention, as well as the influence of environmental factors [7].

The transition to remote studying has also created difficulties in providing practical training, which is critically important for medical students [8, 13]. In particular, this applies to preparation for the integrated licensing exam KROK-2, which assesses the professional competence of graduates and is a mandatory component of state certification [9, 14, 15].

It is also worth noting that students' motivation to learn is a decisive factor that affects the quality of knowledge acquisition and the formation of necessary skills. It determines the student's ability to overcome difficulties and effectively use their own resources to achieve educational goals [10]. It has been proven that motivation to learn can change under the influence of various factors, including learning conditions, the organization of the educational process and the characteristics of teaching [11, 12, 17]. Understanding these factors allows teachers to influence them to form positive motivation, especially among foreign students who face additional difficulties in adapting to a new educational environment.

Analysis of current student performance is an important tool for assessing the effectiveness of training and preparation for the KROK-2 exam in the Bogomolets National Medical University. This is especially relevant in the context of teaching disciplines that form basic professional competencies, such as "Hygiene and Ecology". In modern conditions, research on student performance allows us to identify factors that affect the quality of education and develop recommendations for optimizing the educational process.

This article is aimed at analyzing the current performance of medical students as a key element of their preparation for the final exam using the example of the discipline "Hygiene and Ecology", which is especially important in the context of a changed educational environment due to the war.

THE PURPOSE OF THE STUDY was to analyze the success of taking the KROK-2 exam by foreign students as a tool for improving the studying efficiency at universities.

MATERIALS AND METHODS

The results of the 6th-year foreign students' "Medicine" specialty testing (Hygiene & Health Care Organization subtest scores), conducted on 6 June 2023 and 21 May 2024 in the Bogomolets National Medical University, along with their academic marks in the discipline Hygiene and Ecology, were analyzed.

Statistical analysis of the obtained results was performed using licensed software MedStat v.5.2 (Copyright © 2003-2019) and Microsoft® Excel® for Microsoft 365 MSO (Version 2305 Build 12.0.6425.1000, 2007) (License Identifier: CWW_0071e48a-250c-4bdb-9013-b8daf357b5e9_b5685e92-c95d-4399-9b83-449d76a26fb6_79f3b2da2f9adcda29). Additionally, the interactive programming environment Jupyter Notebook was utilized for executing Python code and visualizing results. For data processing and analysis, the following Python libraries were employed: Pandas, NumPy, SciPy, Scikit-learn, Matplotlib, and Seaborn.

The normality of the distribution in the study groups was assessed using the D'Agostino-Pearson test (for group sizes $n > 30$) and the Shapiro-Wilk test (for group sizes $n < 30$). In most cases, a normal distribution was established ($p > 0.05$). Since the results obtained over two years were compared, paired comparisons were utilized. Groups with a normal distribution were analyzed using a parametric test (Student's t-test), while groups with a distribution differing from normal were analyzed using a non-parametric test (Wilcoxon's W-criterion (Mann-Whitney U test)).

During the study, the following statistical analyses were performed: calculation of the mean (median), standard deviation, standard error of the mean (median), 95% confidence interval, proportion, and assessment of group independence (χ^2 test). Statistical force was set at 80% with a significant level of 0.05.

RESULTS AND DISCUSSION

The students were divided into five groups based on their grades in the discipline "Hygiene and Ecology" according to the ECTS scale (Table 1). It was established that academic performance in 2024 was significantly different from that of the 2023 cohort (χ^2 test = 41.82; $p < 0.001$). It should be noted that there have been no changes in the assessment methodology, educational platform, or the format of distance learning.

A significant decrease is observed in the “E” grade category, dropping from 38.4% in 2023 to 12.7% in 2024. This indicates a reduction in the number of students just barely meeting the minimum requirements. The percentage of students receiving a “D” grade decreased from 26.8% in 2023 to 21.0% in 2024, which might suggest a shift towards higher performance levels. The “C” grade category saw a substantial increase from 22.3% in 2023 to 37.3% in 2024, indicating that more students are performing at a satisfactory level. There was a significant increase in the percentage of students scoring a “B” grade, jumping from 7.1% in 2023 to 22.6% in 2024. This suggests a notable improvement in the number of students achieving above-average results. The percentage of students achieving an “A” grade slightly increased from 5.4% in 2023 to 6.3% in 2024, indicating a minor improvement in top performance.

Table 1. Distribution of Students by ECTS Grades in the Discipline “Hygiene and Ecology” for 2023 and 2024 (%)

Score in points	*Score on a national scale*	*ECTS scale*	*2024 (%)*	*2023 (%)*
170-200	Perfectly	A	6.3	5.4
155-169	Fine	B	22.6	7.1
140-155		C	37.3	22.3
125-139	Satisfactorily	D	21	26.8
111-124		E	12.7	38.4
60-110	Unsatisfactorily	FX	-	-
1-59		F	-	-

The change in grade distribution suggests an improvement in students' academic performance in 2024. This is evidenced by several facts, including a significant decrease in the proportion of students with lower grades (“E”) and a notable increase in the proportion of students with higher grades (“B” and “C”).

These changes may be attributed to improved learning conditions (adaptation to wartime circumstances, shorter power outages, and periodic stabilization of the energy system), which allowed students to better prepare for practical classes. It should also be noted that the number of students taking the KROK-2 exam increased significantly – 252 out of 390 in 2024 compared to 112 out of 440 in 2023 (χ^2 test = 64.57; $p < 0.001$). The significant increase in the number of students in 2024 (more than twice as many) can be explained by the military-political situation in Ukraine in 2023. The risks of unpredictable consequences for students' lives, health, and education were considerably higher in 2023 compared to those in 2024.

The results of the KROK-2 subtest “Hygiene & Health Care Organization” were analyzed, including their mean values (medians), confidence intervals, and comparisons within groups for a single academic year and across groups of the same ECTS cohort between years (Table 2).

Table shows that the total number of students increased from 112 in 2023 to 252 in 2024. The overall mean score decreased from 72.0 in 2023 to 61.1 in 2024. However, the 95% confidence interval narrowed slightly, indicating a slight improvement in overall consistency of performance across all grades. This comprehensive analysis highlights both the changes in student numbers and performance between 2023 and 2024, showing a general trend of increased participation but lower average scores with varying levels of consistency across different grades.

The number of students achieving a grade “A” increased from 6 in 2023 to 16 in 2024. However, the mean score slightly decreased from 74.1 in 2023 to 71.5 in 2024. There was a significant increase in the number

of students receiving a grade “B”, rising from 8 in 2023 to 57 in 2024. Despite this increase, the mean score for this group decreased significantly from 79.2 in 2023 to 66.5 in 2024. The number of students achieving a grade “C” rose from 25 in 2023 to 94 in 2024. The mean score for this grade decreased from 73.1 in 2023 to 62.2 in 2024. The 95% confidence intervals for all above mentioned grades are narrowed, indicating improved consistency in scores. For grade “D”, the number of students decreased from 30 in 2023 to 53 in 2024. The mean score dropped from 75.4 in 2023 to 56.5 in 2024. The number of students achieving a grade “E” decreased from 43 in 2023 to 32 in 2024. The mean score also fell from 67.4 in 2023 to 51.6 in 2024. The 95% confidence interval widened, suggesting greater variability in scores for this grade.

Table 2. Comparison of KROK-2 Results for the Discipline “Hygiene and Ecology” in 2023 and 2024 by ECTS Grades

Discipline ECTS grade	*"A"*	*"B"*	*"C"*	*"D"*	*"E"**	*ALL**
2024						
Number of students:	16	57	94	53	32	252
Mean±standard error of the mean	71.5±3.1	66.5±1.3	62.2±1.3	56.5±1.7	51.6±3.1	61.1±0.9
95% confidence interval	64.9-78.2	63.9-69.1	59.7-64.8	53-60	45.2-57.9	59.2-62.3
2023						
Number of students:	6	8	25	30	43	112
Mean±standard error of the mean	74.1±2.3	79.2±3.4	73.1±2.1	75.4±2.5	67.4±1.9	72.0±1.2
95% confidence interval	68.1-80.1	71.1-87.3	68.8-77.4	70.3-80.5	63.5-71.4	69.7-74.4

*Note: * – distribution differing from normal for «E» (2023) median ± standard error of the median = 66.7±2.7 (95% CI 66.7-72.2); «ALL» (2023) = 72.2±1.5 (95% CI 66.7-77.8); «E» (2024) = 50.0±4.0 (95% CI 44,4-61,1); «ALL» (2024) = 61.1±1.1 (95% CI 55.6-66.7)*

In 2023, no statistically significant differences were observed between most groups (p = 0.130–0.760), except for the “B” & “E” and “D” & “E” groups (p = 0.016 and 0.023, respectively). In contrast, in 2024, statistically significant differences were observed between most groups (p < 0.001-0.035), except for “A” & “B” and “D” & “E” groups (p = 0.120 and 0.230, respectively). Overall, in 2024, a decline in the overall KROK-2 results compared to 2023 was observed (p < 0.001) (Table 3). The largest decline was noted in the “B”, “C”, and “D” groups. The “E” group also experienced a decrease in mean scores, which may be explained by the influence of external factors (such as learning under wartime conditions and the long-term effects of the pandemic) that negatively affected student outcomes.

Table 3. Statistical Analysis of KROK-2 Results for 2023 and 2024 by ECTS Grades

Discipline ECTS grade		All	"A"	"B"	"C"	"D"	"E"
STEP-2 results		STEP-2 (2024)					
"E"	STEP-2 (2023)						<0.001[1]*
"D"						<0.001[2]*	
"C"					<0.001[2]*		
"B"				<0.001[2]*			
"A"			0.523[2]				
All		<0.001[1]*					
Statistical significance (p -value)							

*Notes: [1] – comparison conducted using Student's t-test; [2] – comparison conducted using Wilcoxon’s W-criterion; * – indicates a statistically significant difference*

For the next academic year, efforts should focus on improving the preparation of students in the "C", "D", and "E" ECTS groups for KROK-2. The results of students with an "A" grade remained stable between 2023 and 2024 (p = 0.523). This stability may indicate that high-performing students remain equally prepared regardless of external factors, likely due to their strong personal motivation and preparation, which mitigate the effects of changes in learning conditions.

To prevent unsatisfactory results among students in the KROK-2 licensing exam, an analysis was conducted to identify correlations between KROK-2 results and discipline scores as well as everyday current control scores. In both 2023 and 2024, a positive correlation was established between these variables and KROK-2 performance (Table 4, Figures 1–4).

Table 4. Correlation Between KROK-2 Results and Discipline Scores as Well as Everyday Current Control Scores in 2023 and 2024

		Parameter	*Correlation (R)*	*p-value*	*Coefficient of determination*
2024	KROK-2	Discipline score	0.423	<0.001	0.179
		Everyday current control score	0.472	<0.001	0.223
2023		Discipline score	0.252	0.007	0.064
		Everyday current control score	0.325	<0.001	0.106

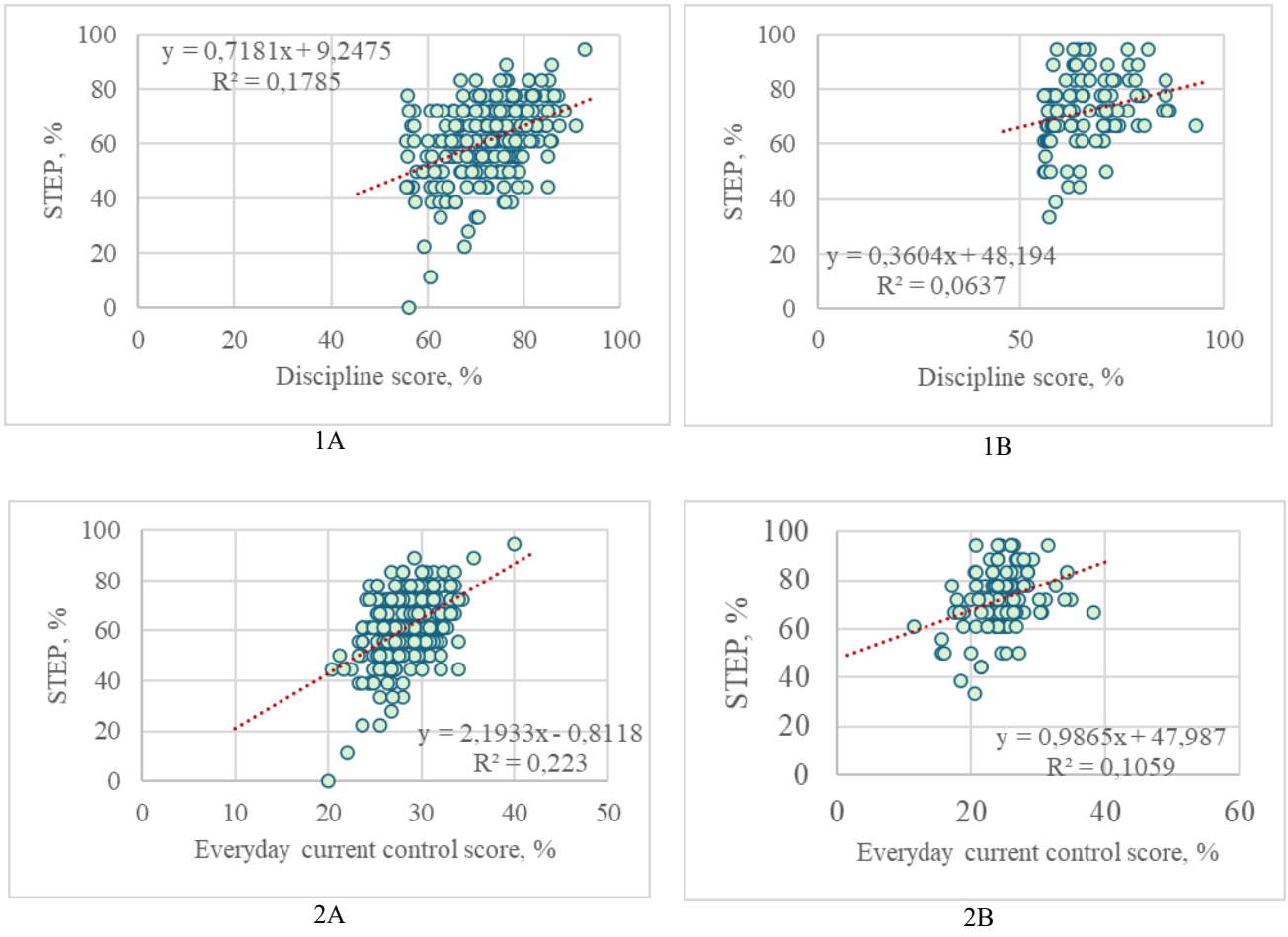

Figure 1. Correlation between discipline scores and STEP-2 results in 2024 (1A) and in 2023 (1B) and correlation between everyday current control scores and STEP-2 results in 2024 (2A) and in 2023 (2B)

There is a moderate positive correlation (R = 0.423) between KROK-2 results and discipline scores in 2024. The p-value indicates that this correlation is statistically significant ($p < 0.001$). The coefficient of determination (R^2) of 0.179 suggests that approximately 17.9% of the variance in KROK-2 results can be explained by discipline scores.

There is a moderate to strong positive correlation (R = 0.472) between KROK-2 results and everyday current control scores in 2024. The p-value shows this correlation is statistically significant ($p < 0.001$). The R^2 of 0.223 indicates that about 22.3% of the variance in KROK-2 results can be explained by everyday current control scores.

In 2023, the correlation between KROK-2 results and discipline scores is weak (R = 0.252) but also statistically significant (p = 0.007). The R^2 of 0.064 suggests that only 6.4% of the variance in KROK-2 results can be explained by discipline scores. The correlation between KROK-2 results and everyday current control scores is weak (R = 0.325) but statistically significant ($p < 0.001$). The R^2 of 0.106 indicates that about 10.6% of the variance in KROK-2 results can be explained by everyday current control scores.

These findings suggest that, in 2024, everyday current control scores better explained the variations in KROK-2 results.

CONCLUSIONS

1. The overall trend from 2023 to 2024 indicates a positive shift in student performance, with increases in higher ECTS grades (“A”, “B”, and “C”) and a decrease in lower grades (“D” and “E”). This improvement might be attributed to numerous factors such as changes in teaching methods, increased student engagement, or better preparation for the exams.

2. There has been a noticeable increase in the number of students in 2024 compared to 2023 (112) across all ECTS grades. However, the mean scores in 2024 (in general 61.1 ± 0.9) are generally lower than those in 2023 (in general 72.0 ± 1.2) for each grade, indicating a slight decline in average performance. The confidence intervals suggest that while the overall consistency in performance has improved slightly, there is more variability within certain grades (notably “D” and “E”) in 2024. This could be due to a variety of factors, such as changes in exam difficulty, student preparedness, or other external factors affecting performance. Further analysis would be needed to identify the specific causes.

3. The statistical analysis highlights that while the performance at the highest grade (“A”) remained consistent (p= 0.5232), there were significant changes in performance for grades “B”, “C”, “D” (p<0.001), and “E” (p<0.001) The overall student performance also saw significant differences between 2023 and 2024 (p<0.001). This could be indicative of various factors influencing student outcomes, such as changes in curriculum, teaching methods, or student engagement.

4. In both years, there are statistically significant correlations between KROK-2 results and both discipline scores (p<0.001) and everyday current control scores. However, the strength of these correlations (R) is higher in 2024 (0.423-0.427) compared to 2023 (0.252-0.325). This suggests that in 2024, both discipline scores and everyday current control scores were better predictors of KROK-2 results compared to 2023.

AUTHOR CONTRIBUTIONS

Borysenko Andrii: Writing – original draft.
Antonenko Anna; Writing – review & editing.
Kondratiuk Mykola: Data curation, Software.
Bardov Vasyl: Supervision.
Omelchuk Serhii: Formal Analysis.
Parfonova Oksana: Conceptualization.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Atwa H, Potu B, Fadel R, Deifalla A, Fatima A, Othman M, Sarwani N, Nasr El-Din W. Implementing Formative Assessment in Human Anatomy Practical Sessions: Medical Students’ Perception and Effect on Final Exam Performance. *Advances in Medical*

Education and Practice. 2024;15:551-563. https://doi.org/10.21203/rs.3.rs-3759452/v1
2. Mageswaran N, Ismail NAS. Preparing Medical Students for the Final Examinations During the COVID-19 Crisis: A Bumpy Ride to the Finishing Line. *JMIR Medical Education*. 2022;8(1):e31392. https://doi.org/10.2196/31392
3. Bin Abdulrahman KA, Khalaf AM, Bin Abbas FB, Alanazi OT. Study habits of highly effective medical students. *Advances in Medical Education and Practice*. 2021;12:627-633. https://doi.org/10.2147/amep.s309535.
4. Morris R, Perry T, Wardle L. Formative assessment and feedback for learning in higher education: A systematic review. Review of Education. 2021;9(3). https://doi.org/10.1002/rev3.3292
5. Mayer A, Yaremko O, Shchudrova T, Korotun O, Dospil K, Hege I. Medical education in times of war: a mixed-methods needs analysis at Ukrainian medical schools. *BMC Medical Education*. 2023;23(1):804. https://doi.org/10.1186/s12909-023-04768-2
6. Goncharuk-Khomyn M, Kaliy V, Pohorilyak R, Cavalcanti A, Keniuk A, Yavuz Y, Olena B. Impact of war on foreign students' satisfaction with quality of dental and medical education in Ukraine. *Brazilian Oral Research*. 2023;37:e026. https://doi.org/10.1590/1807-3107bor-2023.vol37.0026
7. Health risks. World Health Organization (WHO). [Internet]. 2024 [cited 2024 Dec 18]. Available from: https://www.who.int/teams/environment-climate-change-and-health/air-quality-energy-and-health/sectoral-interventions/ambient-air-pollution/health-risks.
8. Kalyniuk NM, Franchuk VV, Selskyy PR, Humenna NV, Hladii OI. Blended form of education as an innovative approach in the training of medical students: The experience of Ukraine. *Educación Médica*. 2024;25(6):100965. https://doi.org/10.1016/j.edumed.2024.100965
9. Ministry of Education and Science (Ukraine). Ukrainian State Center for International Education. *Study in Ukraine*. [Internet]. 2022 [cited 2024 Jul 18]. Available from: https://studyinukraine.gov.ua/en/.
10. Goncharuk M, Leite Cavalcanti A, Stoika O, Hliudzyk-Shemota M, Boykiv A, Deviatko Y. Satisfaction with dental and medical education quality among foreign students considering non-native English-speaking origin of the teachers. *Cumhuriyet Dental Journal*. 2020. https://doi.org/10.7126/cumudj.773890
11. Papastephanou M. Coming full circle: A pamphlet on Ukraine, education and catastrophe. *Educational Philosophy and Theory*. 2023;55(1):77-88. https://doi.org/10.1080/00131857.2022.2071260
12. Srichawla BS, Khazeei Tabari MA, Găman M-A, Muñoz-Valencia A, Bonilla-Escobar FJ. War on Ukraine: Impact on Ukrainian medical students. *International Journal of Medical Students*. 2022;10(1):15-17. https://doi.org/10.5195/ijms.2022.1468
13. Sarkar S. Medical students escape war torn Ukraine but face limbo. *BMJ*. 2022;o908. https://doi.org/10.1136/bmj.o908
14. The Testing Board. Pro ispyty. [About the Exams]. *DNP «Tsentr testuvannia»*. 2024 [cited 2024 Jul 18]. Available from: https://www.testcentr.org.ua/uk/ispyty/potochna-informatsiia/pro-medychni-litsenziini-ispyty
15. Kyrian TI. [On the issue of the implementation of the licensing integrated exam in medicine in higher education institutions of Ukraine]. *Visnyk Cherkaskoho natsionalnoho universytetu imeni Bohdana Khmelnytskoho Seriia: Pedahohichni nauky*. 2020;(2). Available from: https://ped-ejournal.cdu.edu.ua/article/view/3827
16. Blagaia AV, Antonenko AM, Vavrinevych OP, Borysenko AA, Kondratiuk MV, Bardov VG, Tkachenko IV. Features of preparation of foreign students for taking objective structured practical (clinical) examinations in a combined learning format. *Medicina Clínica Práctica*. 2024;7(2):100426. https://doi.org/10.1016/j.mcpsp.2024.100426

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