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"GLOBAL CREATIVE IDEAS FORUM 4.0"

SCIENTIFIC CONFERENCE-FORUM "UNITED PERSPECTIVES 24/7"

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Крім того, використання інтелектуальних чат-ботів та віртуальних асистентів у навчальному процесі забезпечує постійну підтримку студентів. Такі системи можуть відповідати на типові запитання, пояснювати складні теми та допомагати в організації самостійної роботи, що сприяє підвищенню мотивації до навчання.

Разом із перевагами впровадження штучного інтелекту в освіту існують і певні виклики. Серед них – необхідність підготовки викладачів до роботи з новими технологіями, етичні питання використання даних студентів та забезпечення академічної доброчесності. Водночас подолання цих проблем є важливим кроком до модернізації освітнього процесу.

Отже, інтеграція технологій штучного інтелекту та машинного навчання у підготовку фахівців з комп'ютерних технологій є перспективним напрямом розвитку інженерної освіти. Вона сприяє формуванню конкурентоспроможних спеціалістів, здатних працювати з сучасними інтелектуальними системами та ефективно реагувати на виклики цифрового суспільства.

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ANALYSIS OF EDUCATIONAL YOUTUBE CHANNEL PERFORMANCE DURING THE COVID-19 PANDEMIC AND RUSSIA'S FULL-SCALE INVASION OF UKRAINE: A CASE STUDY OF ORGANIC AND BIOORGANIC CHEMISTRY CONTENT FOR ZAPORIZHZHIA STATE MEDICAL AND PHARMACEUTICAL UNIVERSITY (2019–2025)

The COVID-19 pandemic and russia's full-scale invasion of Ukraine represent two major disruptive events that have fundamentally altered educational delivery in Ukrainian higher education institutions. This study examines the impact of these events on viewership patterns of an educational chemistry YouTube channel intended to Pharmaceutical, Organic and Bioorganic Chemistry Department of Zaporizhzhia State Medical and Pharmaceutical University (ZSMPhU). YouTube analytics data spanning November 2019 to November 2025 was analyzed, encompassing 311,185 total views across multiple metrics including geographic distribution, traffic sources, device types, subscription dynamics, and content performance. Data interpretation incorporated contextual analysis of affecting Ukrainian higher education. The channel experienced a 4,618% increase in views during the first year of the pandemic (2020), peaking at 89,972 views in 2021. Following the russian invasion in February 2022, views declined progressively: -25% (2022), -42% (2023), and -21% (2024). Geographic analysis revealed increased Ukrainian audience percentage ratio (from 24% to 43% of total views) despite absolute decline, while russian viewership collapsed from 8,630 (2022) to zero (2025). Several unexpected patterns emerged: russian audiences paradoxically peaked in the year of the invasion; external traffic from institutional sources increased during crisis conditions; device-specific engagement patterns suggest differentiated viewing contexts, and videos with embedded russian subtitles were restricted for viewing, while most videos with embedded Ukrainian and English subtitles remained open to all. Channel analytics provide quantitative evidence of war's educational impact on a frontline Ukrainian university, while also revealing institutional adaptive responses and unexpected audience behavior patterns. The data demonstrate both vulnerability to geopolitical disruption and resilience of digital educational resources in maintaining continuity during

crisis conditions. Keywords: YouTube analytics; chemistry education; COVID-19 pandemic; Ukraine war; educational technology; distance learning; student displacement; medical education; pharmaceutical education; Zaporizhzhia.

INTRODUCTION.

The integration of video-based learning resources into higher education curricula has accelerated substantially over the past decade, with YouTube emerging as a primary platform for supplementary educational content delivery [1]. Breslyn and Green's analysis [1] of a chemistry education YouTube channel with 98.6 million views demonstrated that educational video consumption follows predictable patterns aligned with academic calendars, with viewership closely tracking school terms and declining during holidays. The COVID-19 pandemic disrupted these established patterns, prompting questions about how subsequent crises—particularly armed conflict—might further alter educational video consumption behaviors. The overall market for online education was projected to reach $350 billion by 2025, reflecting fundamental shifts in educational delivery modalities [2].

For laboratory-based disciplines such as chemistry, biochemistry, and pharmaceutical sciences, video demonstrations serve a particularly critical function. Procedural knowledge and technique-specific skills that cannot be adequately conveyed through textual descriptions require visual demonstration [1]. During periods when physical laboratory access was restricted, video resources provided essential continuity for practical education components.

Ukraine's higher education system has faced compounded challenges during the period under study. The COVID-19 pandemic prompted transition to distance learning in March 2020, followed by russia’s full-scale invasion beginning February 24, 2022 [3]. The latter event has had particularly severe consequences for institutions in frontline regions, including Zaporizhzhia Oblast, where student enrollment declined by 48% between 2021/2022 and 2023/2024 academic years—one of the highest rates among Ukrainian regions [4].

Zaporizhzhia State Medical and Pharmaceutical University (ZSMPhU), located approximately 50 kilometers from the front line, has experienced direct impacts of the ongoing conflict. Prior to the invasion, the university hosted students from over 40 countries and maintained a substantial international student population, particularly from India, where approximately 18,000–22,500 medical students studied across Ukrainian institutions before their evacuation through Operation Ganga in February–March 2022 [5-7].

Research examining displacement of graduating high school students in Ukraine found that approximately 36,500 students (16% of the 2022 senior class) were displaced, with 64% moving abroad, primarily to Poland, Germany, and Czechia [8]. Zaporizhzhia oblast was identified among regions with highest external displacement rates. Additionally, UNICEF and the Ukrainian Ministry of Education have documented damage to over 3,800 educational structures since February 2022, with more than 365 completely destroyed [9].

The present study analyzes YouTube channel performance data for a chemistry channel [10] dedicated to ZSMPhU education of students of medical and pharmaceutical faculties, examining how documented external events—the COVID-19 pandemic and russia’s invasion—manifest in viewership patterns, geographic distribution, and engagement metrics. Beyond primary trend analysis, this study identifies several unexpected observations that warrant attention for understanding digital educational resource behavior during crisis conditions.

MATERIALS AND METHODS.

Data source and collection. Data were extracted from YouTube Studio Analytics for an educational chemistry channel [10]. The channel provides instructional video content for organic and bioorganic chemistry, with content available in Ukrainian, russian, and English embedded subtitles versions, aimedfor national and international students of various origin before the full-scale russian invasion in 2022. The analysis period spans November 21, 2019 (channel launch) to November 22, 2025.

Metrics analyzed. The following metrics were extracted and analyzed: (1) total views and watch time by year; (2) geographic distribution of viewers by country and city; (3) traffic source categorization (YouTube Search, External, Direct, Playlists, Suggested Videos, Channel Pages); (4) device type distribution (Computer, Mobile, Tablet, TV); (5) subscription status and acquisition sources; (6) individual video performance rankings; and (7) subtitle and translation usage patterns.

Analytical approach. Quantitative analysis employed descriptive statistics including year-over-year percentage changes, proportional distributions, and trend identification. Contextual interpretation incorporated published research

on pandemic impacts on educational technology adoption [1,2], documented statistics on Ukrainian higher education disruption [4,5], student evacuation operations [6,7], displacement patterns [8], and infrastructure damage [9]. Anomalous patterns deviating from expected trends were flagged for supplementary analysis.

Methodological limitations. Geographic data accuracy is affected by Virtual Private Network (VPN) usage, which increased substantially following the 2022 invasion among both Ukrainian users (for cybersecurity reasons) and russian users (to bypass platform restrictions) [11,12]. The Carnegie Endowment for International Peace reported that russians downloaded VPN services more than 33 million times in 2022—nearly three times more than the previous year [11]. Human Rights Watch documented that accessing YouTube in russia became largely impossible without VPN by mid-2024 [12]. Consequently, geographic distribution data should be interpreted as indicative rather than precise, with actual viewership patterns potentially differing from IP-based location reporting.

The 2025 data represents a partial year (Jan–Nov) and year-over-year comparisons for this period should be interpreted accordingly. Additionally, causal relationships between external events and viewership changes cannot be definitively established from observational analytics data alone.

The absence of published studies analyzing educational YouTube channels during armed conflict limits comparative interpretation. While Breslyn and Green [1] provide valuable pandemic-era baseline data, their analysis concluded before russia's invasion, preventing direct comparison of war-period effects. Similarly, studies of Ukrainian YouTube channels during the war [13] have focused on content analysis and audience surveys rather than analytics-based viewership metrics. The present study thus operates in a relatively uncharted methodological space, with findings requiring replication across other institutional channels to establish generalizability.

RESULTS AND DISCUSSION.

Overall channel performance. Over the analysis period, the channel accumulated 311,185 total views, 7,836 hours of watch time, and 1,212 net subscribers. Average view duration was 1 minute 30 seconds, consistent with procedural demonstration content where viewers seek specific technique information rather than extended viewing sessions.

Temporal viewership patterns. Table 1 presents annual viewership data with year-over-year changes and contextual annotations. Three distinct phases are identifiable in the data:

Table 1. *Annual viewership statistics with contextual interpretation*

Year	Views	Change	Share	Context
2019	1,307	—	0.4%	channel launch, pre-pandemic baseline
2020	61,663	+4,618%	19.8%	COVID-19 lockdowns, distance learning
2021	89,972	+46%	28.9%	peak pandemic learning period
2022	67,710	-25%	21.8%	russian invasion begins Feb 24
2023	39,575	-42%	12.7%	ongoing displacement effects
2024	31,265	-21%	10.0%	working optimization period
2025	19,693	-37%	6.3%	continued war conditions (Jan-Nov)

Phase 1—pandemic-driven growth (2020–2021): The 46-fold increase from 2019 to 2020 aligns with documented global trends in educational video consumption during the pandemic [1]. Breslyn and Green's analysis of a major chemistry education channel revealed that March 2020 marked a distinct inflection point, with viewership approximately doubling compared to pre-pandemic levels and remaining elevated through 2021 [1]. The Zaporizhzhia channel exhibited a comparable trajectory: views increased from 1,307 (2019) to 61,663 (2020), representing a 4,618% increase that substantially exceeded the approximately 100% increase reported by Breslyn and Green. This amplified response likely reflects the ZSMPhU's institutional function—serving enrolled students who transitioned abruptly to distance learning—whereas Breslyn and Green's channel served a broader, self-directed learner population. The differential magnitude suggests that institutionally-embedded educational channels experience more pronounced pandemic-driven viewership surges than general educational content. The World Economic Forum similarly documented substantial growth in online learning platform usage during this period [2]. The channel's peak in 2021

(89,972 views) reflects mature pandemic-era educational patterns, with both students and faculty having adapted to hybrid learning modalities.

Phase 2—war impact and initial displacement (2022):The 25% decline in 2022 corresponds temporally with russia's full-scale invasion. Despite the invasion occurring late in first quarter of the year, its effects propagated throughout the academic year. ZSMPhU students faced evacuation decisions, curriculum disruptions, and psychological stress that reduced engagement with supplementary educational materials. The documented 48% decline in Zaporizhzhia oblast student enrollment [4] provides institutional context for this viewership reduction.

Phase 3—structural audience change (2023–2025):Continued annual declines (42% in 2023, 21% in 2024) indicate permanent structural changes in the audience base rather than temporary disruption. Research documenting displacement of 36,500 graduating high school students (16% of the 2022 senior class) [8], combined with the evacuation of approximately 22,500 Indian medical students [6,7] and the broader 40% reduction in foreign students in Ukraine [5], explains the sustained viewership decline as reflecting fundamental changes in ZSMPhU's student population composition.

Comparison with global educational channel trends. To contextualize the channel's performance, viewership patterns were compared with published data from other educational YouTube channels during overlapping time periods.

Breslyn and Green [1] reported that their chemistry education channel's viewership remained elevated at approximately double pre-pandemic levels through September 2021, even as students returned to in-person instruction. The Oleksii's channel exhibited a parallel pattern during this period, with 2021 views (89,972) representing the channel's peak—a 46% increase over 2020. Both channels demonstrated that pandemic-induced adoption of video-based learning persisted beyond the acute lockdown period, suggesting durable behavioral change among student populations.

However, a critical divergence emerged in 2022. While Breslyn and Green's data concluded in late 2021, preventing direct comparison, the Ukrainian channel's 25% decline in 2022 contrasts sharply with the sustained elevation they documented. This divergence temporally coincides with russia's invasion rather than pandemic recovery, suggesting that geopolitical disruption produces fundamentally different viewership dynamics than pandemic-to-endemic transition.

Kravchenko's survey of Ukrainian popular science YouTube channels provides additional context [13]. That study found that 64.8% of Ukrainian respondents viewed science content as a distraction from war news, and most channels continued operations during the conflict's initial months, though some reduced content volume. The ZSMPhU's experience differs: rather than serving as distraction content, the channel's educational function remained primary, but audience displacement reduced absolute viewership while proportionally concentrating remaining viewers among Ukrainian users (from 24% to 43% of total views).

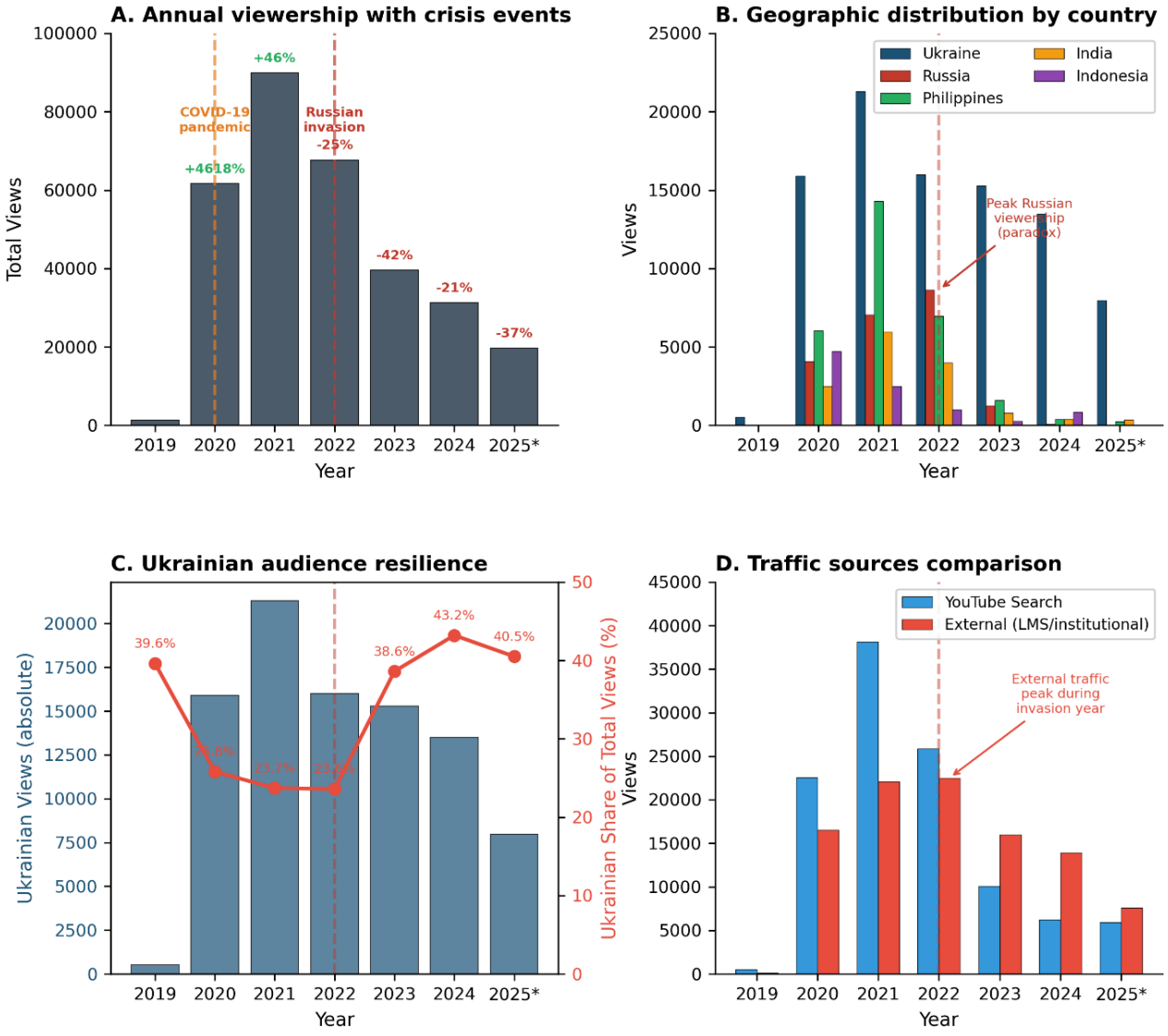
These comparisons suggest a taxonomy of crisis impacts on educational YouTube channels: pandemic conditions amplify viewership by expanding the learner population seeking video resources, while armed conflict contracts viewership by displacing the institutional audience base.

Geographic distribution patterns. Table 2 presents geographic distribution of viewership by major source countries. The data reveal divergent trends between domestic and international audiences.

Table 2. *Geographic distribution of viewership by country*

Year	Ukraine	% Total	russia	Philippines	India	Indonesia
2019	517	39.6%	11	0	0	0
2020	15,899	25.8%	4,089	6,027	2,491	4,720
2021	21,302	23.7%	7,049	14,279	5,963	2,483
2022	16,002	23.6%	8,630	6,971	3,985	980
2023	15,283	38.6%	1,254	1,602	799	270
2024	13,496	43.2%	68	395	388	855
2025	7,985	40.5%	0	242	347	0

Figure 1 presents a multi-panel visualization of key viewership trends across the analysis period, illustrating the distinct phases of pandemic-driven growth and war-induced decline, alongside the unexpected patterns identified in geographic distribution and traffic source dynamics.



**2025 data represents partial year (January–November). Dashed red lines indicate February 2022 invasion.*

Figure 1. YouTube channel analytics for educational chemistry content for Zaporizhzhia State Medical and Pharmaceutical University (2019–2025). **(A)** Annual viewership with year-over-year percentage changes. Dashed vertical lines indicate the onset of the COVID-19 pandemic (2020) and russia's full-scale invasion of Ukraine (February 2022). Positive changes are shown in green; negative changes in red. **(B)** Geographic distribution of viewership by the five major source countries. The annotation highlights the paradoxical peak in russian viewership during the invasion

year (2022). **(C)** Ukrainian audience resilience: bars represent absolute Ukrainian views (left axis), while the line with markers shows Ukrainian viewers as a percentage of total channel viewership (right axis). Despite absolute decline from 2021, Ukrainian audience share increased from 24% to 43% post-invasion. **(D)** Comparison of traffic sources: YouTube search versus external sources (learning management systems, institutional websites). External traffic peaked in 2022, suggesting increased institutional integration during crisis conditions. *2025 data represents partial year (January–November).

Ukrainian audience resilience: Despite absolute view decline, Ukrainian viewers' proportional share increased from 23–25% during the pandemic peak (2020–2021) to 38–43% in 2023–2025. This shift indicates that while international viewership collapsed, domestic Ukrainian engagement remained relatively stable. Ukrainian students—whether in Zaporizhzhia, relocated to safer cities, or studying abroad—continued accessing familiar ZSMPhU content, suggesting the channel maintains relevance to its core institutional audience.

International audience decline:Philippine viewership declined from 14,279 (2021) to 242 (2025), a 98% reduction. Indian viewership declined from 5,963 (2021) to 347 (2025), a 94% reduction. These patterns reflect multiple documented factors: post-pandemic return to in-person instruction [1], the evacuation of approximately 22,500 Indian medical students from Ukraine through Operation Ganga [6,7], and increased competition from newer educational content created during the pandemic-driven expansion of educational technology [2].

Traffic source analysis. Table 3 presents traffic source distribution. External sources (31.7% of total views) represent traffic from embedded links on learning management systems, course websites, and social media platforms.

Table 3. *Traffic source distribution*

Traffic source	Total views	Share	Peak year	2025 views
YouTube search	109,339	35.1%	2021	5,942
External	98,702	31.7%	2022	7,563
Direct/Unknown	32,766	10.5%	2021	1,995
Playlists	29,745	9.6%	2021	1,874
Suggested videos	20,126	6.5%	2021	1,297
Channel pages	6,145	2.0%	2020	357

YouTube Search traffic declined from 38,154 (2021) to 5,942 (2025), an 84% reduction, likely reflecting reduced active searching by displaced students, competition from newer content ranking higher in search results, and possible algorithm changes affecting discovery of older educational content.

Device type distribution. Table 4 demonstrates device type distribution for content access.

Table 4. *Device type distribution*

Device type	Total views	Share	Average duration	Trend
Computer	152,329	48.9%	1:35	declining
Mobile phone	147,898	47.5%	1:24	stable
Tablet	8,075	2.6%	1:38	stable
TV	1,405	0.5%	2:16	minimal

The near-equal split between computer and mobile viewing takes on additional significance during wartime. Mobile device usage may have increased for displaced students lacking stable access to desktop computers. The ability to access educational content on smartphones would be particularly valuable for students in temporary accommodations, shelters, or transit situations.

Content performance analysis. Table 5 shows top-performing videos by view count. Eight of the ten highest-performing videos are English-language content, reflecting the channel's role in serving international pharmacy and medical education.

Table 5. *Top-performing videos by view count*

Video title	Views	Watch hours	Language
Solubility test	24,820	656	EN
Acid hydrolysis of starch	22,458	901	EN
Precipitation of proteins by heavy metals salts	12,593	226	EN
Test for unsaturation	11,881	274	EN
Reduction of copper(II) hydroxide (Trommer's test)	7,311	196	EN
Copper acetate test	6,182	174	EN
Emulsification test	5,901	107	EN
Iodoform test (acetone identification)	5,781	83	EN
The method of furfural synthesis and its detection	5,678	179	ru
The identification of the uric acid (The murexide test)	5,091	128	UA
Total, all videos	311,185	7,836	-

Unexpected observations and supplementary analysis. Beyond primary trend analysis, several unexpected patterns emerged from the data that warrant specific attention. These observations deviate from anticipated patterns and may have implications for understanding digital educational resource behavior during crisis conditions.

The 2022 russian viewership paradox. Viewership of russia paradoxically peaked at 8,630 views in 2022—the very year russia launched its full-scale invasion of Ukraine. This represents its highest viewership in the channel's history, exceeding 2021 (7,049) by 22%. The expected pattern would be immediate decline following the invasion due to: (a) political/cultural decoupling between russian and Ukrainian educational spaces, (b) anticipated platform restrictions, and (c) psychological barriers to accessing content from an adversary nation's institution.

Several hypotheses may explain this anomaly. First, the data may reflect russian-speaking Ukrainian students in occupied territories being counted as russian viewers due to infrastructure changes. Second, their students may have engaged in anticipatory downloading or intensive viewing of Ukrainian educational materials before expected platform restrictions, representing a form of 'knowledge hoarding' behavior. Third, some Ukrainian refugees temporarily located in russia or transiting through its territory may have accessed familiar educational content using russian IP addresses, appearing as their viewers in analytics. Fourth, early 2022 VPN adoption patterns may have caused geographic misattribution in both directions. The subsequent collapse to 1,254 (2023), 68 (2024), and zero (2025) views aligns with documented YouTube access restrictions in russia [11,12], but the 2022 peak remains an analytically significant anomaly warranting further investigation.

Crisis-period institutional integration. External traffic—representing views from embedded links on learning management systems (LMS), course websites, and institutional platforms—peaked in 2022 rather than 2021, despite overall channel viewership declining 25% that year. This counter-trend pattern suggests that ZSMPhU faculty *increased* institutional integration of video content specifically during the wartime crisis.

This finding has significant implications for understanding institutional adaptive responses to crisis conditions. Rather than representing simple resource degradation, the data suggest active pedagogical adaptation: faculty responded to emergency conditions by more deeply embedding video resources into formal curricula, potentially to support students accessing education remotely from evacuation locations, shelters, or abroad. The external traffic source's resilience (7,563 views in 2025, representing 38.4% of total traffic, compared to 30.2% in 2021) indicates that institutional integration has become a permanent feature of the channel's traffic profile. This pattern demonstrates institutional resilience rather than collapse, with digital resources serving as continuity infrastructure during displacement.

The 96.3% non-subscriber phenomenon. An exceptionally high proportion of views (96.3%; 299,581 of 311,185) originated from non-subscribers, with subscribers contributing only 3.7% (11,604 views). This ratio substantially exceeds typical educational channel patterns and indicates a fundamentally different content consumption model.

This pattern aligns with findings from other educational channel analyses. Breslyn and Green reported that YouTube Analytics data from their chemistry channel showed viewership closely following the academic calendar, with views dropping during holidays and breaks [1]. This calendar-synchronous behavior characterizes channels functioning as curricular resources rather than entertainment destinations. The ZSMPhU channel's even more pronounced non-subscriber ratio (96.3% versus typical educational channels) likely reflects its role as embedded institutional infrastructure: students access specific procedural videos through learning management system links rather than through YouTube's recommendation algorithms or subscription feeds. This institutional embedding may explain why external traffic—representing LMS-embedded links—peaked during 2022 rather than declining with overall viewership: faculty actively increased curricular integration precisely when crisis conditions most disrupted conventional instruction.

This pattern characterizes the channel as a *'reference resource'* rather than a *'content destination.'* Viewers discover specific videos through search queries targeting particular laboratory procedures (e.g., 'solubility test,' 'acid hydrolysis of starch') rather than subscribing to receive new content notifications. The practical implications are substantial: (1) search engine optimization and accurate video titling are more important than subscriber cultivation strategies; (2) content value persists indefinitely as a searchable archive rather than depending on publication timing; (3) the channel functions as distributed institutional infrastructure rather than a personal creator platform. This model may be particularly suited to procedural educational content where students seek specific technique demonstrations at moments of need rather than continuous content consumption.

TV viewers' extended engagement. Despite representing only 0.5% of total views (1,405), TV device viewers exhibited the longest average view duration at 2:16—approximately 50% longer than mobile viewers (1:24) and 26% longer than computer viewers (1:35). This disproportionate engagement warrants examination.

The extended TV viewing duration likely reflects differentiated viewing contexts rather than device-specific effects. Probable scenarios include: (1) classroom projection environments where instructors display content for student groups, resulting in longer institutional viewing sessions; (2) study group settings where multiple students view content together on shared screens; (3) domestic contexts where students cast content to larger screens for more comfortable extended viewing. The TV viewer segment, while small, may represent higher-value educational engagement characterized by structured, intentional viewing rather than brief reference checks. This finding suggests that content optimized for larger-screen group viewing environments may serve distinct pedagogical functions. The pattern also implies that the 1,405 TV 'views' may represent substantially higher actual viewer counts if group viewing is common.

Evergreen content value persistence. Top-performing videos continue generating substantial views years after initial upload, with 'Solubility test' (24,820 total views) and 'Acid hydrolysis of starch' (22,458 views) maintaining consistent performance across the analysis period. This pattern contrasts with typical social media content decay curves where engagement peaks shortly after publication and rapidly diminishes.

The evergreen performance pattern reflects fundamental characteristics of procedural educational content: laboratory techniques do not become obsolete, and each new cohort of students requires the same foundational demonstrations. It has strategic implications: investment in high-quality procedural content yields compounding returns over time as videos continue serving successive student generations. The acid hydrolysis video's 901 watch hours (highest among all content) despite ranking second in views indicates particularly deep engagement, suggesting students watch this more complex procedure more completely. Content strategy should therefore prioritize foundational procedures with stable curricula presence over time-sensitive topics.

English content performance superiority. Eight of ten top-performing videos are English-language content, despite the channel originating from a Ukrainian institution with Ukrainian official, and russian being among the primary languages of instruction before the invasion for national and international students of various origin. The top English video ('Solubility test,' 24,820 views) outperforms the top video in russian (The method of furfural synthesis and its detection,' 5,678 views) in 4.4 times, and the top video in Ukrainian (The identification of the uric acid (The murexide test),' 5,091 views) in 4.9 times.

This substantial performance gap reflects the global reach differential between English and national languages in educational content markets. English content attracts viewers from Philippines (peak 14,279), India (peak 5,963), Indonesia (peak 4,720), and numerous other countries, while Ukrainian content serves primarily domestic audiences. Given the post-invasion collapse of russian viewership and the structural decline in domestic student populations,

English content has become the channel's primary value driver. This finding strongly supports prioritizing English-language content development for future growth, while maintaining Ukrainian content for institutional continuity and domestic educational mission fulfillment.

CONCLUSIONS.

This analysis of YouTube channel analytics for educational chemistry content from ZSMPhU demonstrates quantifiable impacts of two major disruptive events—the COVID-19 pandemic and russia's full-scale invasion of Ukraine—on digital educational resource utilization, while also revealing several unexpected patterns that enhance understanding of educational technology behavior during crisis conditions.

The COVID-19 pandemic (2020–2021) created conditions for substantial channel growth, with a 46-fold increase in views during 2020. This increase exceeded the approximately twofold elevation documented by Breslyn and Green for a comparable chemistry education channel [1], suggesting that institutionally-embedded channels serving enrolled student populations experience amplified pandemic effects compared to general educational content for clearer understanding how different categories of educational YouTube channels respond to crisis conditions.

Invasion of russia (2022–present) produced effects qualitatively distinct from pandemic impacts documented in existing literature. While Breslyn and Green's data suggested pandemic-induced viewership gains would persist post-pandemic [1], the reported here channel's sustained decline (25% in 2022, 42% in 2023, 21% in 2024) demonstrates that armed conflict and population displacement can override pandemic-era behavioral changes. The present study thus extends existing research on educational technology during crisis conditions by documenting a second, compounding crisis with fundamentally different mechanisms of impact. Besides russia's invasion (2022–present) fundamentally disrupted the channel's audience base through documented displacement effects [4,5,8], manifesting as sustained viewership decline reflecting permanent structural alterations to the university's student composition.

The unexpected observations identified in this study—particularly the 2022 russian viewership paradox, crisis-period institutional integration, the reference-resource consumption model, and TV viewers' extended engagement—suggest that digital educational resources exhibit complex behavioral patterns during crisis conditions that merit further investigation. The finding that external traffic peaked during the invasion year, rather than declining with overall viewership, indicates institutional adaptive capacity that may inform crisis preparedness strategies for educational technology infrastructure.

Positive indicators persist despite challenges: Ukrainian audience share increased from 24% to 43% of total views, indicating continued domestic relevance; external traffic resilience suggests institutional adoption of content; English-language videos demonstrate potential for international educational contribution; and evergreen content value suggests compounding returns on educational video investment. The 96.3% non-subscriber ratio indicates the channel functions as searchable educational infrastructure rather than a subscription-based platform, with implications for content strategy and performance metrics interpretation.

The data provide quantitative evidence of war's educational impact that may be valuable for institutional reporting, grant applications, and advocacy efforts documenting disruption to Ukrainian higher education. Future content development should prioritize English-language materials to maximize international reach while maintaining institutional integration with learning management systems to support displaced students. The unexpected patterns identified merit further research attention, particularly regarding digital educational resource behavior during geopolitical crises and the mechanisms underlying institutional adaptive responses to emergency conditions.

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РОЛЬ ІННОВАЦІЙНОЇ ДІЯЛЬНОСТІ У ЗАБЕЗПЕЧЕННІ КОНКУРЕНТОСПРОМОЖНОСТІ В СУЧАСНОМУ УПРАВЛІННІ БІЗНЕСОМ

Актуальність дослідження ролі інноваційної діяльності в менеджменті зумовлена стрімкою трансформацією глобального економічного простору, де здатність організації до безперервного оновлення стає головним чинником її виживання та стратегічної конкурентоспроможності. В умовах тотальної цифровізації, інтеграції штучного інтелекту та переходу до принципів сталого розвитку, традиційні підходи до управління стають недостатніми, що вимагає від менеджерів формування гнучких інноваційних стратегій, здатних адаптувати бізнес до непередбачуваних викликів. Глибоке розуміння сутності та класифікації інновацій дозволяє системно підходити до оптимізації внутрішніх процесів, ефективного розподілу обмежених ресурсів та мінімізації ризиків, що є критично важливим для забезпечення довгострокового лідерства підприємства в умовах динамічних змін ринкової економіки.

Теоретико-методичні засади дослідження ролі інноваційної діяльності у забезпеченні конкурентоспроможності бізнесу грунтуються на фундаментальних працях вітчизняних та зарубіжних науковців. Зокрема, сутність та закономірності інноваційного розвитку, а також специфіка інноваційних процесів, висвітлені у науковому доробку таких вчених-економістів як: Р. С. Білик, І. О. Геращенко, В. В. Джеджула, І. Ю. Єпіфанова, О. Г. Цвик, І. В. Довба, С. М. Карюк, Р. С. Квасницька, Ю. С. Шипуліна, С. М. Ілляшенко та інших.

У сучасних економічних реаліях інноваційна активність виступає базовим фундаментом для підтримки конкурентних переваг підприємства. Прямий вплив інновацій на виробничий потенціал зумовлений їхньою здатністю забезпечувати радикальну модернізацію техніко-технологічної бази. Слід підкреслити, що інноваційна діяльність є нерозривною з відповідним інноваційним процесом, який відображає динаміку перетворення ідеї у конкретний ринковий результат [1].