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MASTERS IN ENVIRONMENTAL SCIENCE: EDUCATIONAL TRAINING IN UKRAINE AND SLOVAKIA

Abstract. *Purpose of the Study: To conduct a comparative analysis of master-level environmental education training between Ukraine and Slovakia, with a specific focus on the curricula of Petro Mohyla Black Sea National University and the University of Prešov.*

Design / Method / Approach: the study is based on a comparative analysis of the master's programs in ecology at both universities. It employs a method of juxtaposing key educational program parameters, such as study duration, credit system, number of disciplines, teaching methods, and approaches to final knowledge assessment, alongside a detailed review of course specifics. The analysis also includes a comparison of general trends in higher education in Ukraine and Slovakia, including demographic changes and the impact of external factors.

Research Results: both universities share a fundamental understanding of ecological principles and environmental science. However, significant differences were identified: the University of Prešov offers more specialized courses (e.g., limnoecology, soil ecology, insect ecology, beekeeping) and emphasizes the acquisition of specific technical skills (GIS, analytical chemistry, statistics) and English language proficiency. Petro Mohyla Black Sea National University, conversely, focuses more on applied ecology and environmental management, policy, and modeling. Differences are also observed in study duration (1 year 4 months at PMBSNU versus 2 years at the University of Prešov) and the number of educational credits.

Theoretical Significance of the Study: This research deepens the understanding of diverse approaches to environmentalist training at the master's level within a European context. It provides valuable theoretical foundations for future comparative studies of educational systems, demonstrating how various national and institutional priorities shape specialized educational programs.

Practical Significance of the Study: the research findings can be utilized by Ukrainian and Slovak universities to harmonize and enhance their master's programs in ecology, adapting them to labor market demands and international standards. The information is also beneficial for students considering international studies, as well as for educational policy makers aiming to optimize national higher education systems.

Originality / Value / Scientific Novelty of the Study: the originality of this research lies in conducting a unique comparative analysis of master's programs in ecology between specific universities in Ukraine and Slovakia, a topic rarely explored in scientific literature. Its value stems from shedding light on specific curricula,

allowing for a detailed understanding of their strengths and potential gaps. The scientific novelty lies in presenting current data and conclusions regarding the adaptation of educational programs within the context of Ukraine's European integration and the impact of demographic changes.
Prospects for Further Research / Limitations of the Study: a limitation of this study is its focus on only two universities and a specific degree level (Master's), which prevents generalization of findings to all higher environmental education in Ukraine and Slovakia. Prospects for further research include expanding the analysis to a larger number of universities, other specializations, and comparing teaching quality and graduate employment rates. A more detailed examination of the impact of the current military situation on the educational process would also be pertinent.
Keywords: *Master's programmes; Environmental education; Higher education; Bologna Process; Curricula; Comparative analysis.*
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Introduction

Over two decades have passed since Ukraine embarked on its higher education reform, adopting a clear direction towards European integration. Recent years have seen specific, concerted efforts to align with the Bologna Process, aiming to establish a unified European educational space. A key contemporary feature in higher education development is the integration of national systems for training specialists across various fields. This is achieved by addressing common challenges and implementing a harmonized educational policy at both regional and international levels. Such integration processes introduce European educational norms and standards, while also fostering the exchange of scientific and cultural achievements. Ultimately, these steps are designed to bolster Ukraine's European identity.

The pursuit of European integration within Ukraine's higher education system is not merely a political declaration; it represents a fundamental shift in pedagogical paradigms, quality assurance mechanisms, and academic mobility. This strategic direction aims to ensure that Ukrainian degrees are recognized and valued across Europe, opening new opportunities for both students and faculty. Implementing the principles of the Bologna Process, such as the three-cycle degree system (Bachelor, Master, PhD), the European Credit Transfer and Accumulation System (ECTS), and quality assurance frameworks, has necessitated significant structural and content-related transformations within Ukrainian universities. These reforms are critical for enhancing the competitiveness of Ukrainian graduates in the global labor market and fostering an academic environment that encourages innovation and research excellence (Luhovyi, 2015; The Law of Ukraine "On Higher Education", 2014; Vyshnevskyi, 2016).

Furthermore, the integration process extends beyond formal structures, touching upon the very essence of academic culture. It involves promoting student-centered learning, encouraging critical thinking, and developing interdisciplinary approaches to education. Internationalization, a cornerstone of this integration, facilitates partnerships with European universities, joint research projects, and academic exchange programs. Such collaborations are vital for sharing best practices, enhancing curricula with global perspectives, and exposing students and faculty to diverse educational methodologies. The exchange of knowledge and experience with countries like Slovakia, which has a well-established European higher education

system, becomes particularly valuable. These interactions contribute to building a resilient and adaptable higher education sector in Ukraine, capable of responding to evolving societal needs and global challenges.

However, this ambitious integration path has not been without its challenges. The transformation requires substantial financial investment, a continuous update of legislative frameworks, and a cultural shift within academic communities. Overcoming resistance to change, ensuring adequate funding, and developing effective mechanisms for quality assurance remain ongoing tasks. Despite these hurdles, the commitment to European integration remains strong, driven by the understanding that a modern, high-quality higher education system is fundamental for Ukraine's democratic development and its future prosperity. The current geopolitical landscape, marked by the ongoing conflict, further underscores the urgency and importance of strengthening Ukraine's ties with the European educational space, providing both continuity and opportunities for academic growth amidst adversity. This context makes the comparative study of educational practices, particularly in specialized fields like environmental science, even more pertinent. The integration trends in Ukraine's higher education over recent years have been extensively analyzed in numerous scientific works (Dobko et al., 2014; Holovchuk et al., 2007; Rashkevych, 2014; Bulgakova and Rahmanov, 2011; Mitryasova, 2020, and etc.). Comparative analyses of environmentalist training in European universities are explored in publications by Bogolyubov (2014), Kofanova (2012), Mariychuk (2020), Ridej (2011), Rudyshyn (2008), Petruk (2015), Slivka et al. (2016), Sichkar (2013), and Zakon & Vasylyshyn (2018). The importance of environmental competence (Hrechanyk, 2018) and environmental culture (Ryzhkov, 2017) in this training is also widely discussed.

Slovakia, with a population of approximately 5.4 million, has around 20 universities, equating to roughly one university per 270,000 people (Slovak Accreditation Agency for Higher Education, n.d.). In contrast, Ukraine, with an initial population of about 41 million before the full-scale war, had approximately 200 universities, or one university per 205,000 people. This indicates that Ukraine, pre-war, had a slightly higher number of universities per capita than Slovakia.

As of January 2023, the Office of the United Nations High Commissioner for Refugees reported that about 8 million people had left Ukraine. It's crucial to acknowledge that this figure is dynamic and subject to constant change (REFUGEES FROM UKRAINE).

The demographic realities, particularly those exacerbated by geopolitical events, significantly impact the landscape of higher education in both countries, but most profoundly in Ukraine. Prior to the full-scale invasion, Ukraine maintained a robust network of higher education institutions, aiming for broad accessibility to university-level studies across its vast territory. The ratio of universities to population highlighted a commitment to providing widespread educational opportunities, reflecting a post-Soviet legacy of extensive higher education provision. While a higher number of institutions per capita might initially suggest greater access, it also raises questions about the concentration of resources, the quality of infrastructure, and the potential for fragmentation of expertise across a large number of universities. In peacetime, this expansive network supported regional development and catered to diverse student populations, including those in smaller towns and rural areas.

However, the ongoing conflict has drastically reshaped Ukraine's demographic profile, profoundly affecting its higher education system. The exodus of

approximately 8 million people – a significant portion of the total population – has led to an unprecedented decrease in the potential student pool, as well as a brain drain of academics and researchers. This mass displacement not only reduces the number of domestic students but also creates immense challenges for universities in maintaining their teaching staff, research capacities, and physical infrastructure, especially in regions directly affected by hostilities. Many institutions have been forced to relocate, adapt to online learning, or operate under constant threat. The dynamic nature of refugee figures underscores the fluidity of the situation and the continuous adaptation required from the Ukrainian educational sector.

In light of this outflow, Ukraine's current population is estimated at approximately 33 million. With around 200 universities, this translates to roughly one university per 165,000 people. In Slovakia, with a population of 5.4 million and 20 universities, the ratio is approximately one university per 270,000 people. This suggests that, even factoring in population displacement, Ukraine currently has fewer universities per capita than Slovakia. This shift highlights a critical turning point for Ukrainian higher education, as institutions face the dual challenge of adapting to a reduced domestic student body while simultaneously striving to retain quality and attract international students.

Furthermore, it is vital to remember that university count isn't the sole indicator of higher education quality. Factors such as teaching quality, scientific research, international collaborations, and graduate employment are equally significant. Slovakia, despite having fewer universities, benefits from its established integration within the European Higher Education Area, which often translates into more extensive international partnerships, access to European funding, and streamlined recognition of qualifications. Its smaller, more concentrated university system might allow for greater resource allocation per institution and a more focused approach to specialized fields.

The current situation has also prompted a significant number of Ukrainian students to seek education abroad, with Slovakia becoming an increasingly attractive destination due to its geographical proximity, cultural similarities, and the availability of accessible educational programs. This influx of Ukrainian students into Slovak universities further underscores the interconnectedness of the two countries' educational landscapes and highlights the role of international student mobility in mitigating the impact of conflict on educational continuity. Understanding these complex demographic and systemic interactions is crucial for a comprehensive comparative analysis of environmental education training, as it shapes the context in which future specialists are prepared to address pressing global and regional challenges. Considering the outflow of about 8 million Ukrainians due to the Russian-Ukrainian war, Ukraine's current population is estimated at approximately 33 million. With around 200 universities, this translates to roughly one university per 165,000 people. In Slovakia, with a population of 5.4 million and 20 universities, the ratio is approximately one university per 270,000 people. This suggests that, even factoring in population displacement, Ukraine currently has fewer universities per capita than Slovakia. However, it's vital to remember that university count isn't the sole indicator of higher education quality. Factors such as teaching quality, scientific research, international collaborations, and graduate employment are equally significant. Furthermore, a substantial number of Ukrainian students are now pursuing studies in Slovakia.

Leading universities in Ukraine include Taras Shevchenko National University of Kyiv, V. N. Karazin Kharkiv National University, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (Kyiv Polytechnic Institute), and Ivan Franko National University of Lviv. These institutions represent the pinnacle of academic excellence in Ukraine, encompassing a wide spectrum of disciplines from fundamental sciences and humanities to cutting-edge engineering and technological fields. Taras Shevchenko National University of Kyiv, often considered the flagship university, boasts a rich history dating back to 1834 and is renowned for its comprehensive educational offerings and strong research output across numerous faculties. It plays a pivotal role in shaping Ukraine's intellectual and scientific landscape, contributing significantly to both national and international discourse. V. N. Karazin Kharkiv National University, established in 1804, is one of the oldest and largest universities in Eastern Europe. Despite facing immense challenges due to the ongoing conflict, it remains a vital scientific and educational hub, particularly strong in natural sciences, physics, and mathematics. Kyiv Polytechnic Institute, a leading technical university, is instrumental in preparing highly skilled engineers and IT specialists, driving innovation in crucial sectors of the economy. Its focus on applied sciences and robust industry partnerships makes it a key player in Ukraine's technological advancement. Ivan Franko National University of Lviv, with its deep historical roots dating back to the 17th century, is a prominent center for humanities, social sciences, and natural sciences in Western Ukraine, contributing significantly to the region's cultural and academic life. The resilience of these universities, particularly those in frontline regions, in continuing their educational and research missions amidst adversity, underscores the profound commitment to higher education within Ukraine. They are not merely educational establishments but strategic national assets, crucial for the country's recovery and future development.

In Slovakia, prominent institutions include Comenius University in Bratislava, Slovak Technical University in Bratislava, Pavol Josef Šafárik University in Košice, Technical University in Košice, and the University of Žilina. Comenius University, founded in 1919, stands as Slovakia's oldest and largest university, offering a broad range of academic programs and excelling in various scientific disciplines, including medicine, law, natural sciences, and humanities. It is a cornerstone of Slovak academic life, widely recognized for its research capabilities and contribution to national development. The Slovak Technical University in Bratislava is the country's largest and most important university of technology, specializing in engineering, architecture, and computer science. It plays a crucial role in providing highly qualified technical professionals and fostering innovation, particularly in collaboration with industry. Moving eastward, Pavol Josef Šafárik University in Košice is a comprehensive institution with strong faculties in medicine, natural sciences, law, and arts, serving as a vital academic center for eastern Slovakia. The Technical University in Košice complements this by focusing on engineering and technology, contributing significantly to the industrial and technological landscape of the region. Finally, the University of Žilina, situated in northern Slovakia, is renowned for its specialization in transport, communications, and management, reflecting the strategic importance of logistics and infrastructure development in the country. These Slovak universities, through their diverse specializations and established integration within the European Higher Education Area, consistently contribute to the nation's human capital and innovation capacity, serving as key

drivers of societal and economic progress. Their stability and high quality make them attractive partners for international collaboration, including with Ukrainian institutions, particularly in times of heightened cross-border mobility. Key differences in higher education between Ukraine and Slovakia encompass several aspects. For instance, funding is predominantly public in Ukraine, whereas Slovakia employs a mix of public and private sources. In terms of structure, Ukraine's system is more centralized, contrasting with Slovakia's more decentralized approach. International cooperation is generally more extensive in Slovakia. The language of instruction is Ukrainian in Ukraine and Slovak in Slovakia, though both countries offer English-language programs. Both nations are active participants in the Bologna Process. Finally, accessibility to education also varies: Slovakia provides free education at public universities if studies are conducted in Slovak, while Ukraine has both state-funded ("budget") and contract-based places (QS World University Rankings 2025: Top global universities). Before the full-scale war, approximately 1.5 million students were enrolled in Ukraine, a number that has significantly decreased due to the conflict. Slovakia hosts around 130,000–150,000 students and is increasingly favored by Ukrainian students seeking a safe and affordable study destination. This has narrowed the student number gap between the two countries, though these figures are approximate and subject to change.

In Ukraine, environmentalists are trained at numerous universities, as environmental majors are quite common. These programs are notably offered at Taras Shevchenko National University of Kyiv, Ivan Franko National University of Lviv, V. N. Karazin Kharkiv National University, and other large universities nationwide. Slovakia also trains environmentalists at several institutions, including Comenius University in Bratislava and Pavol Josef Šafárik University in Košice. However, overall, Ukraine boasts a greater number of universities offering environmental majors than Slovakia, reflecting its larger size and higher number of higher education institutions.

Purpose of the study: to conduct a comparative analysis of master-level environmental education training between Ukraine and Slovakia, with a specific focus on Petro Mohyla Black Sea National University and the University of Prešov.

Object of the study: the educational training for master's-level environmentalists in Ukraine and Slovakia.

Subject of the study: the concepts and characteristics of the educational programs in ecology offered by Petro Mohyla Black Sea National University and the University of Prešov.

Petro Mohyla Black Sea National University (PMBSNU) in Mykolaiv, Ukraine, and the University of Prešov, Slovakia, serve as compelling examples for this comparative study of master's-level environmental education. Both are multidisciplinary higher education institutions, yet they present notable differences in their institutional structure, student populations, and core educational philosophies. These distinctions are not accidental; they are deeply rooted in their unique historical trajectories and their evolving priorities within their respective national contexts.

PMBSNU, a relatively young institution, was established in 1996 in Mykolaiv, a vital port city. Its creation reflected Ukraine's post-independence push to broaden access to higher education and cultivate intellectual growth in key regional hubs. From its inception, PMBSNU has been recognized for its robust focus on humanities and social sciences, quickly becoming a prominent academic center in Southern Ukraine. Currently, it enrolls approximately 4,000 students. This size often allows for a more

personalized learning environment compared to the larger, more established universities. A defining characteristic of PMBSNU's approach is its strong emphasis on interdisciplinarity. This means fostering connections across various fields of study, encouraging students to develop a comprehensive understanding of complex issues, and preparing them for careers that increasingly demand diverse skill sets. This philosophy is particularly pertinent in areas like environmental science, where effective solutions often require insights from biology, economics, sociology, and policy. The university's more recent founding has also afforded it the agility to integrate modern educational methodologies and adapt quickly to contemporary challenges, including navigating the complexities of online learning and supporting displaced students and faculty amidst ongoing conflict. Despite immense pressures, PMBSNU remains steadfast in its crucial mission, demonstrating remarkable resilience and an unwavering commitment to academic continuity.

In significant contrast, the University of Prešov boasts a much more venerable history, tracing its origins back to 1665. This long and rich heritage provides the university with deep-seated academic traditions and a well-established institutional framework. As a comprehensive university, it offers an exceptionally broad spectrum of programs, ranging from theology and humanities to natural sciences and medical sciences. This extensive academic portfolio caters to a wide array of student interests and societal demands, reflecting centuries of intellectual evolution. With approximately 8,000 students, the University of Prešov is larger than PMBSNU, yet it maintains a strong regional presence and focus. A key priority for the University of Prešov is regional development, underscoring its profound commitment to serving the social, economic, and cultural needs of its immediate geographical area. This often translates into research initiatives and academic programs specifically tailored to local industries, environmental concerns, and community requirements. Furthermore, the university places a significant emphasis on international cooperation. This commitment is a testament to Slovakia's long-standing integration into broader European academic networks, facilitating student and faculty exchanges, joint research projects, and alignment with continent-wide educational standards. This robust international engagement equips students with global perspectives and opportunities, enhancing their professional readiness in an increasingly interconnected world.

Theoretical part, materials and methods

To effectively compare the master's-level environmental education programs in Ukraine and Slovakia, a rigorous theoretical framework and clear methodological approach are essential. This section delves into the conceptual underpinnings of environmental education and outlines the methods employed for the comparative analysis. Understanding the nuances of each programmes requires a systematic examination of their curriculum structures, learning outcomes, and overall educational philosophies. By comparing specific elements, we aim to highlight both shared principles and distinct characteristics that shape the training of future environmental specialists in these two countries. This detailed comparison forms the basis for our subsequent findings and discussion (Mitryasova and Mariychuk, 2025).

Comparative analysis of the concepts of educational programmes in ecology (Master level) at the Petro Mohyla Black Sea National University and the University of Prešov is in a Table 1.

Table 1. Comparative analysis of educational programme concepts (Standard of Master; MAIS)

Common information	Petro Mohyla Black Sea National University, Mykolaiv, Ukraine	University of Prešov, Slovakia
App name, short description	The standard load for a student is 90 credits. The Ecology and Environmental Protection program offers a comprehensive study of ecological principles and their application to environmental issues. It covers theoretical foundations, research methodologies, and practical aspects of conservation, management, and assessment, preparing graduates for diverse roles in the environmental field.	The standard load for a student is 120 credits. The graduate is an expert in ecology, ecosystems, biodiversity protection, nature, landscape, and the care of protected areas. He is proficient in scientific research methods (both basic and applied). He can creatively apply scientific knowledge, solve human-nature conflict situations, and verify various ecological hypotheses. He has practical experience gained through internships and student work experience in state institutions, the private sector, and non-governmental organizations. The graduate is able to work and manage working groups (field and laboratory), can appropriately identify and take samples, store them, process the obtained data, and evaluate and interpret them correctly. The graduate is employed in management functions of nature and landscape protection, in scientific research institutions, in international cooperation of protected areas, and at universities.

According to the data in Table 2, the educational programmes in ecology at the Petro Mohyla Black Sea National University and the University of Prešov have both similar and different characteristics; both programs offer a master's degree, but the duration of study at PMBSNU is shorter than at the University of Prešov, which may indicate a different approach to the organization of the educational process or a different number of ECTS credits required to obtain a degree.

Table 2. Comparative analysis of educational ecology programmes.

Parameter	Petro Mohyla Black Sea National University, Mykolaiv, Ukraine	University of Prešov, Slovakia
Name of the educational program	E2 Ecology, "Ecology and Environmental Protection"	Ecological and Environmental Sciences (1610T00)
Term of study	1 year 4 months	2 years
Total number of disciplines, including practices	11 (90 credits)	24 (120 credits)
Number of disciplines per semester	6−8	5–6
Teaching methods	Combined	Combined
Final control of knowledge	Master thesis defense (12)	Diploma thesis defense (15) State exam (5)

Both programmes share a fundamental commitment to core ecological principles. Courses like "Forest Ecology," "Landscape Ecology," "Soil Ecology," and "Biodiversity" in the University of Prešov curriculum align with courses such as "Ecology" and topics found within "System analysis of environmental quality" in the PMBSNU programme. This indicates a shared emphasis on the foundational knowledge of ecological systems and processes.

Both curricula integrate environmental science concepts. The University of Prešov includes "Introduction to Environmental Science," "Chemistry of the Environment," and "Global Problems of the Environment", while PMBSNU offers courses like "Environmental Management and Audit" and "Technologies of Environmental Protection." This demonstrates that both programs recognize the importance of applying ecological knowledge to address environmental challenges.

Both programmes emphasize research skills and thesis preparation. The University of Prešov has "Diploma Thesis Seminar 1" and "Diploma Thesis Seminar 2", and PMBSNU includes "Methodology and organization of scientific research in ecology" and "Pre-diploma practice," culminating in "Diploma thesis defense" in Prešov. This highlights the importance of developing students' research capabilities for their master's theses.

Both programmes incorporate practical training, though the format varies. The University of Prešov has "Large ecological practicum" and "Professional practice 2", while PMBSNU includes "Assistant practice" and "Pre-diploma practice." This reflects the need for hands-on experience in ecological and environmental studies.

Both programmes include courses that address current environmental concerns. The University of Prešov offers "Global Environmental "Issues" and "Environmental Crisis - Reality vs. Media", and PMBSNU includes "Global Environmental Change and Environmental Management in the EU" and "Strategies of Sustainable Development." This indicates a focus on preparing students to tackle contemporary environmental problems.

Results and Discussion

The comparative analysis of master's-level environmental education programmes at the University of Prešov in Slovakia and Petro Mohyla Black Sea National University (PMBSNU) in Ukraine reveals both shared foundational principles and distinct pedagogical approaches. While both institutions are committed to equipping future ecologists with essential knowledge and skills, their curricula diverge in specific areas, reflecting differing priorities, historical contexts, and perhaps responses to national and international demands.

Our detailed comparison highlights several pivotal distinctions in the professional training of ecologists at the two universities. The curriculum at the University of Prešov notably offers a higher degree of specialized courses within particular ecological domains. This is evident in dedicated modules such as "Limnoecology," "Soil Ecology," "Lichen Ecology," "Ecology and Biodiversity of Insects," "Ecophysiology and Stress Physiology of Plants," "Ecology and Biodiversity of Parasites," and "Ecology and Biodiversity of Soil Animals." This deep dive into specific ecological niches suggests a pedagogical philosophy aimed at producing highly specialized researchers or field experts who possess in-depth knowledge of particular ecosystems or organism groups. Such a granular approach allows students to develop profound expertise, which can be invaluable for advanced scientific

research, conservation biology, or specialized environmental consulting roles. While PMBSNU certainly covers a broad spectrum of environmental topics, its curriculum, based on the provided data, does not appear to offer the same level of dedicated, niche-specific courses. This may indicate a broader, more interdisciplinary approach to ecological studies, aiming for a versatile generalist rather than a deep specialist. This difference could be attributed to varying academic traditions or distinct national requirements for environmental professionals. For instance, in a smaller country like Slovakia, specialized expertise might be highly valued for specific research institutions or targeted environmental projects, whereas a larger nation like Ukraine might prioritize a broader understanding to address diverse environmental challenges across its vast territory.

Another significant distinction lies in the explicit inclusion of courses focused on specific technical and analytical skills within the University of Prešov's curriculum. Courses like "Geographical Information System (GIS)," "Analytical Chemistry," and "Statistic 2" are prime examples. These modules are crucial for equipping students with practical, hands-on competencies that are indispensable for modern ecological research, data analysis, and effective environmental management. GIS, for instance, is fundamental for spatial analysis of environmental data, mapping ecosystems, and monitoring environmental changes. Analytical chemistry provides the necessary background for understanding pollutants and environmental processes, while robust statistical skills are paramount for designing experiments, interpreting research findings, and drawing valid conclusions. While PMBSNU does include "Geoinformation Systems in Ecology," the level of explicit specialization in analytical chemistry and advanced statistics, as standalone, dedicated courses, is less apparent from the provided curriculum data. This could imply that such skills are integrated into broader courses, or that the emphasis might be placed more on theoretical understanding than on practical application of these specific tools. The clear emphasis at the University of Prešov suggests a deliberate effort to prepare graduates for research-intensive roles or positions requiring strong quantitative and data-handling abilities.

In contrast, the PMBSNU curriculum appears to place a stronger emphasis on applied ecology and environmental management. This is evident through courses such as "Ecological Management and Audit," "Technologies of Environmental Protection," and a broader focus on environmental policy and modeling. This orientation suggests that PMBSNU aims to produce graduates who are not only knowledgeable about ecological principles but also adept at implementing practical solutions, managing environmental projects, and contributing to policy development. Graduates from such a program would be well-suited for roles in environmental consulting, governmental environmental agencies, industrial environmental departments, or non-governmental organizations focused on practical conservation and pollution control. While the University of Prešov’s curriculum undoubtedly includes elements relevant to applied ecology, its overall specialization seems to lean more towards fundamental and specific ecological areas rather than comprehensive management frameworks. This difference reflects varying educational goals: PMBSNU seems to prioritize the professional who can directly apply ecological knowledge to solve real-world environmental problems, while the University of Prešov may be geared more towards academic research or highly specialized scientific roles.

A noteworthy element in the University of Prešov curriculum is the explicit inclusion of "English Language 3." This dedicated language course underscores the institution's recognition of the increasing importance of English proficiency in the global scientific and environmental community. English is the lingua franca of international research, conferences, and publications, and strong English skills are crucial for accessing cutting-edge scientific literature, collaborating with international partners, and contributing to global environmental discourse. While language skills are undoubtedly valuable and expected in any higher education program, their explicit listing as a separate, required course in the University of Prešov curriculum suggests a deliberate pedagogical choice to ensure graduates are well-equipped for an international career path. The absence of an explicitly listed separate language course in the PMBSNU curriculum does not necessarily imply a lack of emphasis on English, but it might mean that language development is integrated into other courses or is considered a prerequisite rather than a core component of the master's program itself.

A particularly unique inclusion in the University of Prešov curriculum is the presence of "Beekeeping 1" and "Beekeeping 2." While the broader topic of biodiversity is covered in both programs, this specific focus on apiculture is distinctive to the University of Prešov. This unique offering could reflect regional interests, specific research strengths within the faculty, or a response to particular environmental or agricultural needs within Slovakia. Beekeeping is intrinsically linked to ecosystem health, pollination services, and biodiversity conservation, making it a relevant, albeit specialized, area within environmental studies. Its inclusion highlights how universities can tailor their curricula to leverage unique local expertise or address specific regional challenges and opportunities. This contrasts with PMBSNU’s more generalized approach to biodiversity, which does not delve into such specific practical applications.

In conclusion, both the University of Prešov and PMBSNU curricula share a common foundation in ecological principles and environmental science, essential for any master's program in this field. However, they also exhibit notable differences that shape the profile of their graduates. These disparities are evident in course specificity, the explicit inclusion of specialized skills, the balance between theoretical and applied ecology, and the level of detail provided about individual courses. The University of Prešov appears to cultivate highly specialized environmental researchers with strong analytical and language skills, potentially catering to specific scientific and academic roles. PMBSNU, on the other hand, seems to emphasize a broader, more applied approach to environmental management, preparing graduates for diverse roles in practical environmental protection and policy implementation. These differences are not indicative of one program being inherently "better" than the other, but rather reflect distinct educational philosophies and responses to different academic and societal contexts. Understanding these variations is crucial for prospective students, academic institutions, and policymakers seeking to align educational outcomes with evolving environmental challenges and professional demands in both Ukraine and Slovakia.

Conclusions

This study offers a comparative analysis of master's-level environmental education between Ukraine and Slovakia, specifically examining programs at Petro Mohyla Black Sea National University (PMBSNU) and the University of Prešov.

Our findings underscore that both institutions share a foundational commitment to ecological principles and environmental science, aligning with the broader European trend of integrating national higher education systems. Ukraine's two-decade journey towards European integration, including its participation in the Bologna Process, has significantly shaped its educational landscape, as evidenced by the curriculum at PMBSNU. Similarly, Slovakia's well-established higher education system, despite a smaller population, demonstrates robust engagement in environmental training.

The comparative analysis revealed several key distinctions in curriculum design and focus. The University of Prešov's program stands out for its emphasis on highly specialized ecological domains, offering dedicated courses in areas like limnoecology, soil ecology, and insect ecology. It also integrates essential technical skills such as GIS, analytical chemistry, and statistics, along with mandatory English language training. This approach suggests a focus on developing highly specialized environmental scientists equipped with diverse methodological tools. Conversely, PMBSNU's curriculum appears to place a stronger emphasis on applied ecology and environmental management, including coursework in environmental policy and modeling. This reflects a practical orientation aimed at addressing real-world environmental challenges, possibly driven by Ukraine's ongoing reforms and the need for professionals capable of implementing environmental policies. The differences in study duration (1 year 4 months at PMBSNU versus 2 years at the University of Prešov) and the associated credit requirements further highlight distinct pedagogical approaches to master's-level education.

Despite these differences, both universities demonstrate a shared commitment to developing research skills, with both programs culminating in a master's thesis defense and incorporating practical training components. This commonality underscores the universal recognition of the importance of hands-on experience and independent research in environmental studies.

The socio-demographic context, particularly the impact of the Russian-Ukrainian war on Ukraine's population and student numbers, adds another layer of complexity to this comparison. While pre-war Ukraine had a slightly higher number of universities per capita than Slovakia, the significant outflow of population has altered this ratio. This demographic shift has also made Slovakia an increasingly attractive destination for Ukrainian students, influencing student mobility and potentially highlighting areas where educational systems can adapt to external pressures.

In conclusion, while both Ukraine and Slovakia are committed to fostering environmental expertise through master's programs, their approaches differ in specialization and pedagogical structure. These findings provide valuable insights for continuous curriculum development, fostering international academic collaboration, and ensuring that future environmental professionals are well-prepared to address complex global challenges. Further research could expand this analysis to a broader range of universities and explore the long-term career outcomes of graduates from these differing educational models.

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МАГІСТРИ ЕКОЛОГІЇ: ОСВІТНЯ ПІДГОТОВКА В УКРАЇНІ ТА СЛОВАЧЧИНІ

Анотація. Мета дослідження: здійснити порівняльний аналіз освітньої підготовки магістрів-екологів в Україні та Словаччині, зосереджуючись на навчальних програмах Чорноморського національного університету імені Петра Могили та Пряшівського університету.

Дослідження ґрунтується на порівняльному аналізі навчальних планів магістерських програм з екології обох університетів. Використано метод зіставлення ключових параметрів освітніх програм, таких як тривалість навчання, кредитна система, кількість дисциплін, методи викладання та підходи до фінального контролю знань, а також детальний огляд специфіки курсів. Аналіз також включає порівняння загальних тенденцій у вищій освіті України та Словаччини, включаючи демографічні зміни та вплив зовнішніх факторів.

Виявлено, що обидва університети мають спільне базове розуміння екологічних принципів та природоохоронної науки. Однак існують значні відмінності: Пряшівський університет пропонує більш спеціалізовані курси (наприклад, лімноекологія, екологія ґрунту, екологія комах, бджільництво), а також акцентує на набутті специфічних технічних навичок (ГІС, аналітична хімія, статистика) та володінні англійською мовою. Чорноморський національний університет імені Петра Могили, натомість, більше зосереджений на прикладній екології та екологічному менеджменті, політиці та моделюванні. Різниці також спостерігаються у тривалості навчання (1 рік 4 місяці в ЧНУ проти 2 років у Пряшівському університеті) та кількості навчальних кредитів.

Дослідження поглиблює розуміння різноманітності підходів до підготовки екологів на магістерському рівні в європейському контексті. Воно надає цінні теоретичні основи для подальших компаративних досліджень освітніх систем, демонструючи, як різні національні та інституційні пріоритети формують спеціалізовані освітні програми.

Результати дослідження можуть бути використані українськими та словацькими університетами для гармонізації та вдосконалення своїх магістерських програм з екології, адаптації до вимог ринку праці та міжнародних стандартів. Інформація корисна для студентів, які розглядають навчання за кордоном, а також для розробників освітньої політики з метою оптимізації національних систем вищої освіти.

Оригінальність дослідження полягає у проведенні порівняльного аналізу магістерських програм з екології між конкретними університетами України та Словаччини, що рідко зустрічається в науковій літературі. Цінність полягає у висвітленні специфіки навчальних планів, що дозволяє детально зрозуміти їхні сильні потенційні сторони та прогалини. Наукова новизна полягає у представленні актуальних даних та висновків щодо адаптації освітніх програм у контексті європейської інтеграції України та впливу демографічних змін.

Обмеження дослідження полягає у фокусі на лише двох університетах та конкретному рівні (магістр), що не дозволяє узагальнювати висновки на всю вищу екологічну освіту України та Словаччини. Перспективи подальших досліджень включають розширення аналізу на більшу кількість університетів, інших спеціальностей, а також порівняння якості викладання та працевлаштування випускників. Доцільним буде також вивчення впливу поточної військової ситуації на освітній процес більш детально.

Ключові слова: магістерські програми; екологічна освіта; вища освіта; Болонський процес; навчальні плани; порівняльний аналіз.

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