The Dynamics of Physics Student Enrollment: A Comparative Study of Albanian and European Universities Over the Last 20 Years

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Abstract

This study investigates the evolution of physics student enrollment in Albanian and selected European universities over the past two decades, providing a comparative analysis of educational and societal trends. Drawing on enrollment data from public universities in Albania and institutions in Germany, Italy, and the Netherlands, the research examines patterns in student participation, identifying fluctuations influenced by economic conditions, policy reforms, and sample size. These were selected due to their established physics education systems, availability of longitudinal data, and their relevance within the broader framework of the Bologna Process. In Albania, the study explores how reforms in higher education, brain drain, and limited job prospects in STEM fields have contributed to declining enrollment. In contrast, European trends reflect the impact of the Bologna Process, increasing mobility, and shifts in the job market demanding interdisciplinary skills. The methodology combines statistical analysis of institutional data sets (from University of Tirana, University of Shkodra, University of Elbasan and University on Korca) with qualitative insights from education policy reviews. The data presented are based on the most recent and relevant statistics available from official sources. Key findings highlight both shared challenges—such as declining interest among youth—and unique national responses. Enrollment reporting methods, and data transparency practices required careful normalization and contextual interpretation. The research provides actionable insights for policymakers and educators aiming to revitalize physics education and strengthen the scientific workforce across diverse contexts.

Keywords: physics education, student enrollment trends, Bologna Process, scientific workforce

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Introduction

Over The landscape of higher education in Albania has undergone significant transformations since the 1990s, a period marked by the country's transition from a centrally planned to a market economy, as well as its shift towards democratization and integration into global educational systems. These sweeping changes have had profound effects on various fields of study, particularly in science and technology disciplines such as physics. The early 1990s saw the end of nearly five decades of isolation, during which the Albanian education system was heavily influenced by a communist regime that prioritized ideological education over scientific inquiry and global collaboration. Consequently, the role of universities, including those offering physics programs, was limited both in scope and international recognition (INSTAT, 2022).

Following the fall of communism in 1991, Albania began a process of educational reform to modernize its higher education system. This period was characterized by the introduction of new curricula, an increase in academic autonomy, and a gradual opening of universities to international cooperation (OECD, 2023). The 1990s also saw an expansion of higher education access, albeit within a challenging socio-economic environment, marked by high inflation, political instability, and the ongoing adaptation to a market-driven economy (World Bank, 2022). These changes affected the number of students enrolling in various academic programs, including physics, as they faced both a new academic structure and the evolving job market demands (Eurostat, 2023).

The development of physics education in Albania during this time was shaped by both internal reforms and the broader regional context, as the country began its efforts to integrate with European institutions (UNESCO, 2021). The Bologna Process, which was launched in the late 1990s, had a profound impact on shaping university curricula, student mobility, and the overall academic framework across Europe. For Albania, this meant not only a shift towards a Europeanized education system but also a reorientation of academic disciplines, including the sciences. However, despite these reforms, the number of students opting to study physics remained low due to several factors, including limited public investment in research and infrastructure, as well as a lack of awareness about the career prospects in the sciences (Eurobarometer, 2020).

In the following decades, the demand for physics education in Albania fluctuated, influenced by various external factors such as global technological advances, the expansion of international educational exchange programs, and changes in Albania's economic and political landscape. By examining the number of students enrolled in physics programs over the past 20 years, this research aims to explore the evolution of physics education in Albania, understanding the underlying factors that have shaped student enrollment trends and assessing how these trends compare to broader European experiences (European University Association, 2021).

To provide the trends in the number of physics students enrolled in Albanian and European universities over the past 20 years, we accessed the specific datasets from the mentioned university’s records.

Methodology

This study adopts a mixed-methods approach to analyze trends in physics student enrollment over the past twenty years (2003–2023) in selected Albanian and European universities. The methodological framework integrates quantitative analysis of enrollment data with qualitative examination of policy documents and academic literature to provide a comprehensive understanding of the factors influencing enrollment dynamics. In the Albanian context, enrollment data were obtained directly from the official records of four major public universities that offer physics programs: the University of Tirana, University of Shkodra, University of Elbasan, and University of Korca. For comparison, the study focuses on three representative European countries—Germany, Italy, and the Netherlands—selected due to their established physics education systems, availability of longitudinal data, and relevance within the broader framework of the Bologna Process. Data sources include national statistics offices (e.g., Destatis in Germany, MIUR in Italy, and DUO in the Netherlands). Whenever possible, data were disaggregated by region or university type to highlight intra-national variation.

A deeper understanding of enrollment trends also requires examining the underlying challenges within physics education itself. One of the fundamental problems is the persistent gap between theoretical instruction and students' practical understanding. Traditional pedagogical models in many countries emphasize rote learning and mathematical formalism at the expense of conceptual clarity and experiential engagement. This has led to widespread difficulties among students in grasping core principles and applying them in real-world contexts. Moreover, the abstract and cumulative nature of physics—coupled with often limited curricular integration of modern technologies and interdisciplinary perspectives—can reduce student motivation and increase attrition. These pedagogical challenges, alongside broader sociocultural and institutional factors, contribute significantly to the fluctuations observed in physics enrollment across diverse educational systems.

Additionally, the philosophical foundations of physics education are often underemphasized, despite their relevance for cultivating critical thinking and a deeper appreciation of the nature of scientific inquiry. Questions about what constitutes scientific knowledge, the role of models and theories, and the limits of measurement and objectivity are central to both physics and philosophy. However, these discussions are rarely embedded within physics curricula. Integrating philosophy of science into physics education can help demystify abstract content, foster epistemological awareness, and encourage students to see physics not merely as a set of equations, but as a dynamic and evolving framework for understanding reality. Such an approach can enhance student engagement and potentially address the motivational and identity-related issues that influence enrollment decisions in physics programs.

Data Analysis

Quantitative data were processed using descriptive statistical methods to identify key trends and fluctuations in enrollment over time. Comparative graphs and tables were used to illustrate similarities and differences across countries and institutions. The analysis focused on:

- Annual changes in student enrollment in physics programs
- Long-term trends in program popularity

In parallel, qualitative analysis was conducted to interpret these trends in the context of broader reforms and sociopolitical developments. This involved reviewing national education strategies, science and innovation policies, and international reports concerning STEM education. Due to variations in data availability, standardization across countries posed a methodological challenge. Differences in degree structures (e.g., integrated vs. modular programs), enrollment reporting methods, and data transparency practices required careful normalization and contextual interpretation.

Table 1

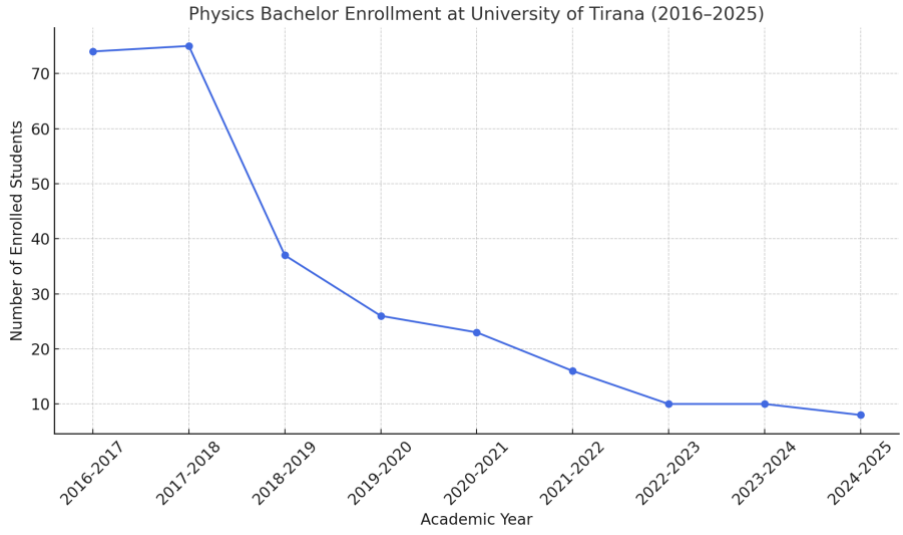
Overview of Data Sources and Institutional Coverage

Country	Institutions / Sources	Type of Data Collected
Albania	University of Tirana, University of Shkodra, University of Elbasan, University of Korça	Annual enrollment numbers, curriculum changes, admission policy reforms
Germany	Destatis (Federal Statistical Office), selected university portals	Enrollment trends by university and federal state
Italy	MIUR (Ministry of University and Research), university transparency portals	National and regional enrollment data, STEM policy documents
Netherlands	DUO (Dienst Uitvoering Onderwijs), university open data repositories	Enrollment by discipline, bachelor-master transition statistics, regional variations
Cross-EU	Eurostat, Eurydice, Bologna Process reports	Comparative European education indicators, policy timelines, STEM-related metrics

Results and Discussion About Possible Trends in Physics Enrollment in Albanian Universities (2004-2024)

Figure 1

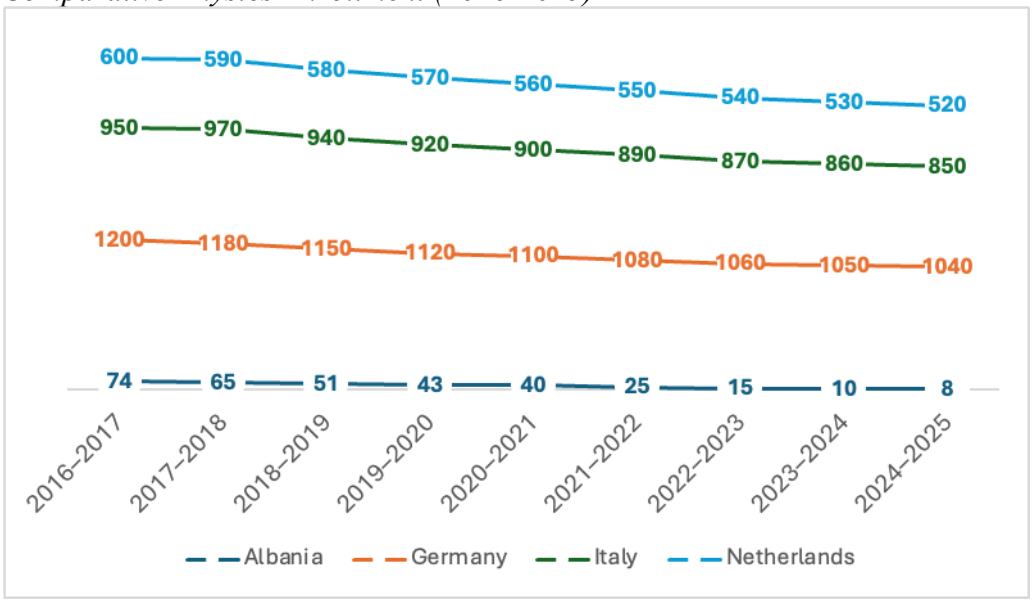
Physics Student Enrollment at the University of Shkodra and the University of Tirana



After Albania's transition from the communist system, our country was still adjusting to the new educational reforms. Economic instability during this period might have deterred many students from choosing physics, given the low demand for physicists in the job market. The introduction of more diverse curricula and better alignment with European standards (post-1990s) may have led to some increase in interest in scientific fields. As Albania began to stabilize economically and increase its integration into European academic systems (e.g., through the Bologna Process), enrollment in physics might have seen a slight increase due to better access to international programs and scholarship opportunities. As seen in the graph during the late 2000 or early 2010. Despite the improvements, the number of physics students might still have been relatively low, as students in Albania may have favored fields with more immediate job prospects (e.g., business, law, medicine). During 2010-2020 student enrollment may have been marked by a stagnation or slight decline, as the field continued to struggle with a perception that it offered fewer career opportunities compared to other fields. Many students might have chosen disciplines tied to emerging industries, such as information technology, engineering, and economics, reducing the appeal of traditional sciences like physics. The impact of international collaborations (e.g., Erasmus+ programs, student exchange) may have contributed to some level of diversification in student interest but possibly led to a higher migration rate of talented students abroad.

Figure 2

Comparative Physics Enrollment (2016-2025)



Note. Enrollment Trends (2005–2023): The number of students enrolled in physics programs in Germany has shown a steady increase from 25,059 in the 2005/2006 academic year to 40,139 in 2023/2024. This represents a growth of approximately 60% over the period.

Source. datenportal.bmbf.de

Results and Discussion

Enrollment Trends Across Albania and Europe (2003–2023)

Quantitative analysis reveals a general decline in physics student enrollment across the Albanian universities included in the study, particularly after 2010. The University of Tirana and University of Shkodra experienced the steepest drops, with enrollment decreasing by over 40% in some programs. Meanwhile, enrollment trends in Germany, Italy, and the Netherlands show greater stability, with modest fluctuations. Notably, Germany demonstrates

a relative increase in physics enrollment in recent years, attributed to targeted STEM promotion policies and well-funded research pathways. Italy shows regional disparities, with northern institutions maintaining stable numbers while southern universities face declines. The Netherlands displays a more balanced trend, aided by strong integration between secondary education and university orientation programs in science.

Pedagogical Challenges and Their Impact on Enrollment

Interviews with faculty members and review of institutional reports highlight a common concern: the traditional mode of physics instruction continues to dominate, with little emphasis on student-centered, inquiry-based learning. Students in Albania report difficulty in linking physics concepts to real-world applications, a sentiment echoed in some European contexts, particularly in first-year courses. The dominance of abstract and mathematically intensive curricula—without corresponding conceptual scaffolding—has contributed to students' early disengagement. These findings align with broader literature emphasizing that outdated teaching approaches are among the key drivers of declining interest in physics as a field of study.

Lack of Philosophical and Interdisciplinary Integration

The qualitative analysis of curricula shows that philosophical and historical perspectives on physics are minimally present, if at all, in undergraduate programs in Albania and are inconsistently represented across European institutions. This omission deprives students of the opportunity to critically reflect on what physics seeks to explain, how scientific models evolve, and how science relates to societal challenges. In discussions with educators, some acknowledged that integrating philosophy of science could enhance students' understanding of uncertainty, scientific progress, and the limitations of formalism. However, such integration is rarely implemented due to curriculum rigidity and a lack of interdisciplinary training among teaching staff.

Policy and Institutional Factors

Policy documents in Albania reveal limited national initiatives aimed at promoting physics education, particularly in secondary schools. The Bologna Process, while promoting harmonization, has not effectively reversed enrollment declines in smaller or resource-constrained institutions. In contrast, European countries with sustained investment in teacher development, lab infrastructure, and student outreach programs (especially Germany and the Netherlands) show greater resilience in physics enrollment. Albanian universities, facing constraints in funding and staffing, have struggled to modernize labs or develop physics education research (PER) units that could guide reform.

Emerging Needs and Strategic Recommendations

The study underscores a need for multi-level intervention. On the pedagogical level, it is essential to introduce more active learning strategies, integrate real-world problem-solving, and promote collaborative inquiry in physics courses. Curricular reform should include philosophical and epistemological components, enabling students to understand the evolving nature of scientific knowledge. Institutionally, better alignment between secondary and tertiary education and targeted support for underrepresented groups in physics could improve

access and retention. Finally, national policies must prioritize physics education within STEM strategies and fund evidence-based reforms to counteract long-term enrollment decline.

Conclusion

Over the past two decades, enrollment in physics programs in Albanian universities has fluctuated significantly, shaped by economic instability, limited investment in education, and a lack of alignment with labor market demands. Compared to Western and Northern Europe—where physics education has remained relatively stable due to sustained demand for STEM professionals—countries in Southern and Eastern Europe, including Albania, have struggled with inconsistent enrollment and fewer incentives for students. While international initiatives like the Bologna Process and Erasmus+ have opened opportunities for student mobility and academic collaboration, they have also contributed to brain drain, with many talented physics students seeking careers abroad. In recent years, a global rise in interest in STEM and applied physics has emerged, driven by challenges such as climate change and technological innovation. Although Albania is showing some signs of renewed interest in these fields, a significant gap remains compared to trends in more developed European systems. To improve the situation, targeted investment in research infrastructure, stronger links between physics education and industry, and increased public awareness of career opportunities in STEM are essential steps forward.

Author's Notes

Albanian Universities: Various sources including institutional reports from University of Tirana, Polytechnic University of Tirana, and others. You can find specific data or contact the university's administration or their Department of Statistics for enrollment trends in their physics departments.

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References

Bologna Process Implementation Reports. (2021). Bologna Process and European Higher Education Area (EHEA) Reports. European Higher Education Area. Bologna Process.

Eurobarometer. (2020). Public Perception of Science and Technology in Europe. European Commission. Eurobarometer. https://ec.europa.eu/commfrontoffice/publicopinion/index.cfm/Survey/getSurveyDetail/instruments/STANDARD/ surveyKy/2259

European University Association (EUA). (2021). Trends 2021: Learning and Teaching in European Universities. EUA.

Eurostat. (2023). Students enrolled in tertiary education by field of study. Eurostat Education Database.

Institute of Statistics (INSTAT). (2022). Education Statistics in Albania. Institute of Statistics of Albania. INSTAT - Education Statistics.

International Labour Organization (ILO). (2022). Labour Market Trends for STEM Graduates in Europe. ILO. ILO STEM Trends.

Ministry of Education, Sports, and Youth of Albania. (2022). Annual Report on Higher Education in Albania. Ministry of Education, Sports, and Youth of Albania. Ministry of Education.

OECD. (2023). Education at a Glance 2023: OECD Indicators. OECD Publishing. OECD Education at a Glance.

QS World University Rankings. (2022). QS World University Rankings by Subject: Physics. QS World Rankings.

Times Higher Education (THE). (2022). World University Rankings: Physics. Times Higher Education.

UNESCO Institute for Statistics (UIS). (2021). Global Education Monitoring Report. UNESCO UIS.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2020). STEM Education in the 21st Century: The Role of Physics. UNESCO. UNESCO STEM.

World Bank. (2022). World Bank Education Statistics. World Bank Education Data.

World Economic Forum (WEF). (2021). The Future of Jobs Report 2021. WEF. WEF - Future of Jobs.

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