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Surveying high school graduates' interest in physics studies

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ABSTRACT

Socioeconomic growth is largely influenced by education, which promotes equality and creativity. Recent trends show a sharp drop in high school graduates' enthusiasm in pursuing the natural sciences, particularly physics, despite past and present dedications to high-quality education. With an emphasis on physics, this study explores the choices and views of Kosovan high school students on their future education. An online survey was conducted among 3144 high school graduates across three cities in Kosovo. The poll looked at the students' experiences with physics in elementary and secondary school, their future educational goals, and how satisfied they were with the physics instructors and lab settings. The results reveal a strong preference for studying any engineering sciences over physics, with only a small percentage considering physics as a viable field of study. The findings highlight significant dissatisfaction with the difficulty and monotony of physics courses from primary and secondary schools, inadequate laboratory conditions, and lack of engaging teaching methods. Several recommendations have been made to address these issues. By focusing on these improvements, educational institutions, and policymakers in Kosovo can better support students, enhance the overall quality of higher education, and align with global trends where interest in exact sciences is similar.

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1. INTRODUCTION

Education plays a pivotal role in a country's social and economic development. It is an essential tool for raising living standards, promoting equality, and fostering society grounded in knowledge and innovation. According to UNESCO [1], quality education enhances job skills, increases productivity, and creates better economic opportunities for individuals and communities. Through quality education, students acquire critical thinking skills, problem-solving abilities, and technical competencies necessary to address the complex challenges of the modern world [2], [3].

Historically, many societies have demonstrated a strong willingness to make significant sacrifices to quality education [4]. This is evident in parents' efforts to secure better education for their children, often making substantial financial sacrifices [5]. In other cases, individuals migrate to other countries to pursue education, leaving behind their families and communities [6], [7]. This dedication to education has been essential for scientific and technological advancements over the past few centuries.

Today's generations face a different landscape, but continue to demonstrate a willingness to make sacrifices for quality education [8]. With the rising costs of higher education and economic challenges, many students work during their studies to cover their expenses. Additionally, there is growing interest in scholarship

programs and financial aid that alleviate the economic burden on students and their families. This indicates a continued commitment to achieving quality education despite these challenges [9].

In the digital age, access to scientific information has become easier than ever. Online libraries, open-access journals, and various digital resources offer a wide range of scientific materials to students and researchers [10]. New technologies have transformed the way information is collected, processed, and disseminated, making it easier for everyone to engage in scientific activities and follow the latest advancements in their respective fields [11], [12].

The number of students pursuing supportive fields, such as education, psychology, and social services, has increased in recent years. These fields are attractive to many students because of employment opportunities and the positive impact they can have on society. According to recent statistics, there has been a significant rise in enrollment in programs related to healthcare and social services, reflecting modern society's need for qualified professionals in these areas [13].

High school graduates' willingness to study natural sciences, particularly physics, has been a significant concern for scientists and educators. Unfortunately, this issue is even more pronounced among females [14], [15]. There is a noticeable trend of decreasing interest among young people in studying mathematics and the natural sciences. Schoolars are commanded to update science courses; they should include more labs and interactive activities to engage students and show the relevance of the material [16]. Students also need to be more exposed to practical applications and career opportunities in science [17], [18]. Young pupils are being encouraged and supported in pursuing these fields through a variety of educational initiatives and support programs. Understanding the needs of possible candidates is a prerequisite for taking proactive measures to encourage the next generation to pursue natural sciences, particularly physics. Why is studying physics not given priority? Consequently, the purpose of this study is to ascertain the preferences of recent high school graduates, their thoughts about physics, and their level of satisfaction with the caliber of their teachers, the lab, and the literature they encountered during their time in high school.

This study investigated the effects of educational quality and resources on students' interest in pursuing physics. While earlier studies have explored the impact of teacher effectiveness, laboratory facilities, and educational materials on general academic performance, they have not explicitly addressed their influence on students' perceptions of physics and their preferences for natural sciences after high school. This study explored a comprehensive analysis of high school graduates' preferences and perceptions of physics with a focus on the quality of teaching, laboratory resources, and literature encountered during their studies. However, further and in-depth studies may be needed to confirm its reliability, especially regarding the broader trends that could be revealed through nationwide surveys or simultaneous studies across multiple countries.

2. MATERIAL AND METHODS

Participants in this study were high school students from three cities who were getting ready for graduation or state exams. Google Forms was used for the online survey because of its user-friendliness and distribution capabilities. Complete anonymity was ensured meets ethical requirements for studies with human subjects. The education directorate of municipalities granted ethical approval at the time the survey was conducted. Prior to participation, each subject gave their informed consent, and during the study, their confidentiality and identities were rigorously protected. Since no personally identifiable information was gathered, ethical requirements were fully adhered to. Beginning after courses ended and ending shortly before the June 2024 university admission deadline, the poll was conducted for three months. Participants were told up front that no personally identifiable information would be gathered.

The questions of the survey varied in type, including yes/no questions, multiple-choice questions, open-ended questions, and Likert scale questions. The Likert scale used was a 10-point scale (strongly agree 1 to strongly disagree 10). The survey was constructed using an algorithm that directed subsequent questions based on the respondent's answers to previous questions. For example, if a respondent indicated they did not want to study at a university, they were not asked which field they wished to study in. Questions regarding what the respondents thought about the subject of physics, based on their experiences during primary and secondary education, specifically regarding their opinions about the subject and the physics teacher, were asked of all respondents.

To establish a stable balance between the respondents' actual opinions and the survey questions, particular emphasis was paid to first directing the respondents toward broad information. Five groups of questions were created: inquiries concerning the respondent's gender and the kind of high school they attended. Inquiries concerning their future goals, including if they intended to continue their education and, if so, which colleges they were considering. Inquiries pertaining to the respondents' perceptions of the subject's difficulty and the physics instructors they had in elementary and high school. Hypothetical questions asking graduating students if they had ever considered studying physics and, in the remainder, building a list of desired professions where physics would

rank among the top ten possibilities. Exclusionary questions for those who declared they did not want to study physics or wished to study it, regardless of the answers given in previous questions.

In this study, 3,144 students voluntarily participated from across the country. Of the respondents, 58% identified as male, 40% as female, and 2% chose not to declare. After completing the survey, the percentage of respondents grouped by school type from the population was as follows: 1,386 (44.09%) from general gymnasiums, 589 (18.73%) from technical high schools, 553 (17.58%) from mathematical-natural gymnasiums, 444 (14.12%) from economic and law high schools, and 172 (5.48%) from medical high schools. For some questions, it was important to clarify the percentage of respondents based on the type of high school they graduated from, compared to the number of graduates to whom the survey was distributed. The highest response rate was from technical high school graduates at 62.07%, followed by general gymnasium graduates at 58.85%. Economic and law high school graduates accounted for 37.69%, medical high school graduates 35.19%, and mathematical-natural gymnasium graduates had the lowest participation rate at 26.07%. Statistical analysis was performed using the statistical software "data analysis" in Microsoft Excel.

To ensure the validity of the data, several steps were taken. First, the survey was designed based on a comprehensive review of the literature and expert consultation, ensuring content validity. A pilot test was conducted to confirm the clarity and relevance of the questions. Additionally, the questionnaire included diverse question types (e.g., multiple-choice, Likert scale) to capture a comprehensive range of responses, and the logical structure of the survey ensured that follow-up questions were relevant to prior answers, enhancing construct validity. Statistical analysis was performed using appropriate tools to verify consistency and reliability of the results.

By organizing the survey into five thematic groupings and addressing important topics including attitudes toward physics, teacher opinions, and career goals while maintaining clarity and relevance, content validity was established. The instrument successfully tested the target components thanks to the logical design of follow-up questions that were adapted to respondents' prior responses, reinforcing construct validity. School administrators evaluated the tool to make sure it was acceptable after it was piloted with a small sample to verify face validity.

Several elements supported reliability. Cross-verification of responses was made possible by grouping related themes and repeating them across different question kinds to ensure internal consistency. The instrument's generalizability was improved, and random error was decreased by the huge sample size of 3,144 respondents from various high school kinds and geographical areas. By using Google Forms consistently, a standardized platform for data collection was made available, reducing procedural variability. The reproducibility of the results was further supported by response rate tracking, which showed consistent trends across school types. The data's reliability was further reinforced by ethical standards, such as informed consent, anonymity, and transparency. Lastly, statistical analysis utilizing the "data analysis" feature in Microsoft Excel guaranteed a solid interpretation of the findings, proving the instrument's validity and dependability. To adjust for confounding variables, a varied sample of kids from different types of schools was included. The three-month survey timeframe prevented temporal biases, while exclusionary questions reduced irrelevant responses. These factors were further taken into consideration by statistical analysis, which produced reliable results.

3. RESULTS

The survey results provide a comprehensive overview of participant responses, highlighting key trends, and insights that inform the broader context of this study. The data gathered reflects a diverse range of perspectives, illustrating both commonalities and variations in the experiences and opinions of the respondents. These findings serve as a foundation for deeper analysis, offering valuable insights into the subject matter and paving the way for targeted discussions in the subsequent sections. Through a detailed exploration of these results, we can better understand the core themes that emerge and their implications for the study's objectives.

The gathered results form the question: after completing high school, what are your plans: i) you will study at a university in the country, ii) you will not study, but work in the country, iii) you will study abroad, and iv) you will not study, but will migrate abroad (Figure 1). Of the respondents, 78.6% declared that they were interested in studying in Kosovo, whereas only 9.9% intended to emigrate. Only 3.8% planned to study abroad at a university.

From the next question, it is understood that 61.96% of potential students prefer to study at public universities, whereas 20.46% prefer private universities. Meanwhile, 17.58% of those who decided to pursue studies remained undecided. From the next question, it is understood that 62.25% of potential students prefer to study at public universities, whereas 20.4% prefer private universities. Meanwhile, 17.6% of those who decided to pursue studies remained undecided. The overwhelming majority of respondents wish to study engineering sciences (information technology, electrical engineering, computer engineering, construction, and architecture), with this group comprising 46.4% of the respondents.

Regarding the respondents' perception of multiple question regarding if the physics as a subject from primary and secondary schools, 56.9% of respondents stated that physics has been one of the most difficult subjects to learn and is heavily loaded with equations and literature that is difficult to understand. Meanwhile, 13.26% of all respondents confirmed that physics in their schooling was monotonous; only 9.2% of the

graduates evaluated physics as one of the easiest subjects to learn see in Figure 2. Regarding the multiple-choice question about satisfaction with physics teachers and laboratory conditions, 74.6 % of graduates said that the teachers were engaging and well prepared, while 86.2 % of respondents said that the laboratory conditions were insufficient see in Figure 3.

In response to the hypothetical questions about whether they have ever considered studying physics and having it as a profession in their life, only 0.41% (13 participants) answered "yes" while all the rest said "no." From the group of graduates who responded "no" 43.8% provided the reason that they simply do not like physics and find it difficult to learn, while 30.8% believe that it does not have a good future and is not well-paid after graduation.

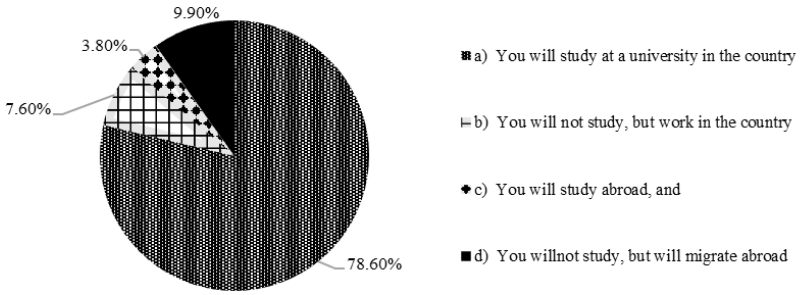

Figure 1. Results of question after completing high school, what are the plans of the future

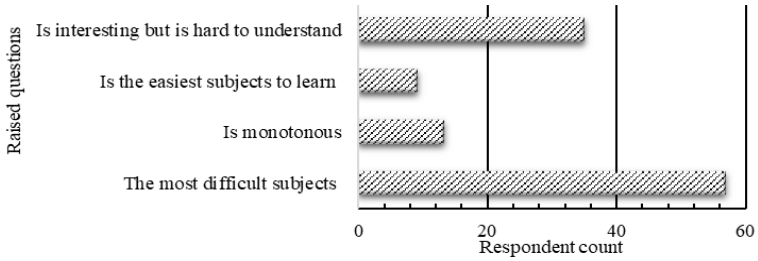

Figure 2. The opinion about physics as a subject from high school students

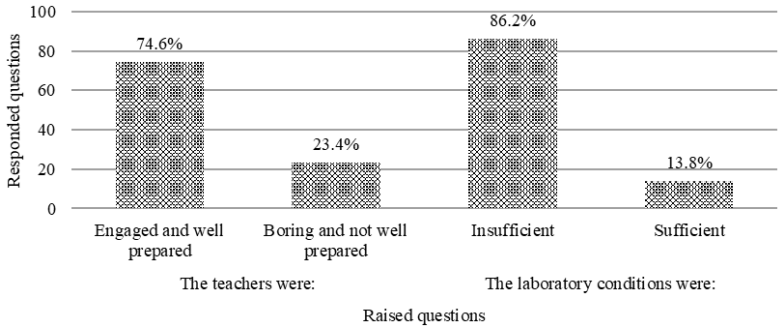

Figure 3. The opinion about the physics teacher and laboratory condition

4. DISCUSSION

Since Kosovo received visa liberalization for travel to the Schengen area in early 2024 [19], it was initially anticipated that a significant number of young people would choose to leave the country. However, the findings presented in Figure 1 do not support this expectation. In the other side, the relatively low number of graduates expressing a desire to study abroad can be primarily attributed to two key factors: the absence of effective informational campaigns and the economic limitations of their families. Given that it is in Kosovo's best interest to increase the number of students pursuing higher education abroad [20], it is recommended that additional scholarships be made available. These scholarships should include a provision requiring recipients to return to the country [21] and serve the country upon completing their studies.

Further analysis of the data reveals that most high school graduates (62.25%) prefer to pursue their higher education at public universities. However, it is noteworthy that around 18% of respondents remain undecided. When this percentage is added to those opting for private universities, it becomes evident that the number of graduates intending to attend private universities is nearly equal to those choosing public institutions. This shift in educational preferences underscores the importance of understanding the factors influencing students' decision-making processes.

In the context of subject preferences, physics is generally regarded as a challenging discipline by high school students, as Colletti [22] explains in his research, physics is not perceived as a valuable opportunity but rather as a barren obstacle along their educational path. Despite the positive feedback regarding their teachers' preparedness and dedication, as illustrated in Figures 2 and 3, the perceived difficulty of physics is linked to at least two critical factors. First, students find the literature and explanations challenging, largely due to the inclusion of complex equations and mathematical reasoning. Second, the lack of well-equipped laboratories further exacerbates the problem. These findings point to the urgent need for curriculum reform. As other authors recommend to be oriented on project based learning [23], [24], for ensuring that physics education is adapted to meet the needs and abilities of its audience. In addition, increased investment in real or virtual laboratory infrastructure would significantly enhance the appeal of physics to future generations of students [25], [26].

Notably, only 13 high school graduates representing a mere 0.41% of the respondents indicated an interest in studying physics at the university level. Of the 13 high school graduates who expressed a desire to study physics, only 2 were identified as female. Additionally, other studies have confirmed that girls tend to perceive physics as less suitable for them [27]–[29]. These students were exclusively graduates of mathematical-natural gymnasiums and expressed their desire to pursue physics due to a keen interest in understanding natural laws and phenomena. In contrast, the majority of respondents cited the difficulty of the subject and limited career opportunities as primary reasons for not considering physics, similar conclude were identified by Djudin [30]. This sentiment is particularly strong when compared to the more popular engineering fields such as programming, construction, and architecture, which are favored by 46.3% of the respondents. Meanwhile, 22% of the respondents expressed an interest in studying natural sciences. Despite the low interest in physics, those motivated to study it emphasized their passion for understanding natural laws and viewed teaching physics as a potential career path. To achieve this level of engagement, physics educators must possess the ability to connect with diverse perspectives, thereby providing students not only with a foundation for future technical skills but also with a well-rounded general education [31].

5. CONCLUSION

Our findings provide a clear picture of students' preferences and thoughts about their future education, especially regarding physics. It is evident from the data that most graduates do not want to study physics, and only a small number have any ambition to do so. This is worrying because many current physics teachers in primary and secondary schools are nearing retirement age. If this trend continues, we may soon face a significant shortage of qualified physics teachers. This decline in interest is also observed in neighboring regions and beyond, where there is a noticeable drop in the number of students pursuing exact sciences, particularly physics. Several steps were taken to tackle the issues highlighted by the survey.

Our study suggests that investing in better laboratory facilities is crucial. Upgrading lab environments can make studying physics more engaging and less intimidating for students, which is the quickest way to boost interest in the subject. Providing additional training for physics teachers to use dynamic and interactive teaching methods can make the subject more appealing and address the perception that physics is boring and difficult. Increasing motivation by offering scholarships for current physics students can encourage more students to pursue and adhere to the subject. By focusing on these areas, schools and policymakers in Kosovo can better support students, improve their experience of studying physics, and enhance the overall quality of higher education in the country.

Considering the study's conclusions, we advise the establishment of a broad network of academics and researchers from different nations who may carry out comparable surveys in their own areas. Once their data has been processed, it will be possible to ascertain whether the trend of reluctance to pursue physics is also prevalent in other nations. This cooperative endeavor might also serve as a forum for talking about possible fixes, presenting specific ideas for addressing the issues surrounding students' reluctance to study physics. We could obtain more comprehensive understanding and create more potent tactics to reverse this trend with the help of such an endeavor.

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Gezim Hodolli		✓		✓	✓	✓		✓	✓	✓	✓			

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

It is not applicable

ETHICAL APPROVAL

This research complies with all relevant national regulations and institutional policies. Specifically, the municipal education directorates granted ethical approval prior to conducting the survey.

DATA AVAILABILITY

The data that supports the findings of this study are available on request from the corresponding author, [GH]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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