

ANALYSIS OF FACTORS AFFECTING TEACHER ATTRITION IN BOSNIA AND HERZEGOVINA USING EXPLORATORY DATA ANALYSIS

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SUMMARY

Teacher attrition is a significant challenge to the educational system in Bosnia and Herzegovina, impacting student performance and the overall quality of education. This study aims to analyse the factors contributing to teacher attrition in Bosnia and Herzegovina using exploratory data analysis (EDA). By examining a dataset collected from a survey of teachers that are working in primary and secondary schools in Bosnia and Herzegovina, we identify key demographic, professional, and institutional variables influencing teachers' decisions to leave their positions. The methodology involves cleaning and preprocessing the data and applying various EDA techniques to recognise the patterns and relationships within the data. Key findings report that job satisfaction, support from parents, administrative factors, salary, workload, and insufficient administrative support, significantly affect teacher retention. Our results underscore the need for targeted interventions to address the specific issues identified, promoting a more supportive and sustainable teaching environment. This study provides valuable insights for policymakers, school administrators, and educational stakeholders, aiming to reduce teacher attrition and enhance the stability and effectiveness of the teaching workforce in Bosnia and Herzegovina.

KEY WORDS: teacher attrition, Bosnia and Herzegovina, exploratory data analysis, education, teacher retention

ANALIZA FAKTORA KOJI UTIČU NA ODLIV NASTAVNIKA U BOSNI I HERCEGOVINI KORIŠTENJEM EKSPLOATATORNE ANALIZE PODATAKA

SAŽETAK

Odliv nastavnika predstavlja značajan izazov za obrazovni sistem u Bosni i Hercegovini, utičući na uspjeh učenika i ukupni kvalitet obrazovanja. Ova studija ima za cilj analizirati faktore koji doprinose odlivu nastavnika u Bosni i Hercegovini korištenjem eksploatorne analize podataka (EDA). Ispitivanjem seta podataka prikupljenih putem ankete među nastavnicima koji su zaposleni u osnovnim i srednjim školama u Bosni i Hercegovini, identificirali smo ključne de-

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mografske, profesionalne i institucionalne varijable koje utiču na odluke nastavnika da napuste svoja radna mjesta. Metodologija uključuje obradu podataka te primjenu različitih tehnika EDA kako bi se utvrdile veze unutar podataka. Ključni rezultati pokazuju da zadovoljstvo poslom, podrška roditelja, administrativni faktori, plata, radno opterećenje i nedostatak administrativne podrške značajno utiču na zadržavanje nastavnika. Naši rezultati naglašavaju potrebu za ciljanom intervencijom kako bi se adresirali specifični problemi identificirani u studiji, promovirajući podržavajuće i održivo okruženje za nastavnike. Ova studija pruža vrijedne uvide za donosiocje odluka, školske uprave i obrazovne aktere s ciljem smanjenja odliva nastavnika i poboljšanja stabilnosti i efikasnosti nastavnog kadra u Bosni i Hercegovini.

KLJUČNE RIJEČI: *odliv nastavnika, Bosna i Hercegovina, eksploatatorna analiza podataka, obrazovanje, zadržavanje nastavnika*

INTRODUCTION

Teacher attrition represents a challenge for the educational sector globally, and Bosnia and Herzegovina is no exception. The high demand for teachers in the labour market allows them greater flexibility in choosing the school where they want to work. Additionally, temporary employment contracts contribute to high turnover rates among teaching staff (BHAS, 2021), which significantly impacts the quality of the educational process and the functioning of school communities (World Bank, 2020). At the same time, the unresolved key issues related to working conditions, complicated hiring procedures, the influence of politics on the education sector, and numerous other problems are leading to an increasing number of teachers deciding to leave the profession (OSCE, 2018). The educational system in Bosnia and Herzegovina is complex and non-complementary, consisting of 14 different educational policies within the country, which are often uncoordinated. At the national level, the mission of the Agency for Pre-primary, Primary, and Secondary Education is to improve the educational process and work on the competitiveness of the educational systems of Bosnia and Herzegovina on the international level (Popić & Džumhur, 2019). The Agency primarily has an advisory role. The responsibility and duty to implement laws rest with the Republic of Srpska entity, the Brčko District, and partly within its own limited jurisdiction in the Federation of Bosnia and Herzegovina entity. In the Federation of Bosnia and Herzegovina entity, competencies over education issues are assigned to the ten cantons. Each of the ten cantons has its own Ministry of Education as well as cantonal laws on education (Hörner et al., 2007). When it comes to funding the education sector, the Republic of Srpska entity allocates around 4,4% of its GDP for education, the Federation of Bosnia and Herzegovina entity around 4,8% of its GDP, and the Brčko District allocates around 18,3% of its total budget for education (Guthrie et al., 2022). Approximately 88% of the overall education budget is dedicated to spending on employees through salaries and benefits, 8% is allocated for material expenses, and only 4% is for capital investments (Magill, 2010; Liu et al., 2020). Due to such a decentralised system, different laws, and insufficient and unbalanced distribution of funds, teachers face numerous challenges that affect their job satisfaction. Despite all the challenges in the educational sector, systematic and detailed studies investigating the reasons for teacher attrition in Bosnia and Herzegovina and providing recommendations for improvement are almost nonexistent.

This research will fill this gap by employing exploratory data analysis (EDA) to investigate the factors influencing teacher attrition in Bosnia and Herzegovina. By analyzing

data collected from a comprehensive survey of teachers, this research seeks to identify key demographic, professional, and institutional variables that contribute to teachers' decisions to leave their positions or to leave the teaching profession at all. Through a detailed examination of these factors, this study will provide insights into the underlying causes of teacher attrition, offering evidence-based recommendations for policymakers, school administrators, and other stakeholders. By addressing the root causes of teacher turnover, it is hoped that targeted strategies can be developed to create a more supportive and sustainable teaching environment in Bosnia and Herzegovina. In the following sections, we will review the relevant literature on teacher attrition, describe the methodology used for data collection and analysis, present the findings of our exploratory data analysis, and discuss the implications of these findings for educational policy and practice.

LITERATURE REVIEW

Teacher attrition and turnover present significant educational challenges, profoundly affecting both schools and students (European Commission/EACEA/Eurydice, 2021). Previous research indicates that high teacher attrition rates often lead to teacher shortages (OECD, 2019), prompting schools to hire inexperienced or underqualified teachers, increase class sizes, or reduce course offerings, all of which negatively impact student learning outcomes (Sutcher et al., 2019). The negative effects of teacher inexperience and high attrition rates are well-documented, showing that students in schools with high turnover and a lack of experienced teachers face substantial educational disadvantages (Kini & Podolsky, 2016). Furthermore, these issues do not only affect students with new or less experienced teachers; they extend to the entire student experience, as high attrition rates disrupt instructional continuity and make difficult teacher collaboration and professional growth (Ronfeldt et al., 2013). This body of literature underscores the critical need to address teacher attrition to preserve the quality of education and mitigate the far-reaching consequences on students, schools, and the broader educational system.

Precise data on teacher attrition rates in Bosnia and Herzegovina, as well as in neighbouring countries, are largely unavailable, and research on this issue remains limited. In contrast, significant efforts have been dedicated to exploring and addressing teacher attrition in some European countries, as well as in the United States, Canada, and Australia. These countries have recognized the critical impact of teacher attrition on educational outcomes and have invested in research to better understand the phenomenon and develop strategies to mitigate its effects (Doherty, 2020). To provide a comprehensive overview of the factors influencing teacher attrition, we have compiled data from three key studies conducted in 1995, 2014, and 2020 (Table 1). It presents and compares the factors identified in these studies. By examining trends across different periods, this table highlights shifts in the causes of teacher attrition, allowing for a deeper understanding of the persistent and emerging challenges within the educational sector.

Study	Gonzalez (1995)	Weiqi (2014)	Doherty (2020)
Location	US	China	UK
Factors influencing teacher attrition	<ul style="list-style-type: none"> • external • societal, • economic, • institutional, • employment • professional qualifications, • work conditions, • work rewards, • commitment, • personal • demographic, • family, • cognitive/affective 	<ul style="list-style-type: none"> • leadership and administration, • job achievements, • student quality, • educational system and social environment, • social status, • income and welfare, • collegial relationships • social acknowledgment, • work stress, • work environment and conditions 	<ul style="list-style-type: none"> • workload, • financial compensation, • working conditions, • burnout, • leadership and continued professional development

Table 1: Comprehensive overview of the factors influencing teacher attrition compiled from studies conducted in 1995, 2014, and 2020

MATERIALS AND METHODS

This research employs a quantitative approach to investigate the factors influencing teacher attrition in Bosnia and Herzegovina. Data were collected through an online survey in Bosnian language conducted between July 25 and August 15, 2024, targeting primary and secondary school teachers across the country. The survey was designed to protect the anonymity of the respondents, ensuring privacy while gathering accurate data. In total, 395 responses were collected, representing various regions of Bosnia and Herzegovina. The survey questions were developed based on prior research and tailored to the specific context of this study (Weiqi, 2014; Doherty, 2020). Descriptive statistics were used to summarize the data, and exploratory data analysis (EDA) was performed using appropriate Python libraries to thoroughly examine the factors contributing to teacher attrition.

RESULTS AND DISCUSSION

The analysis was conducted on a dataset collected from teachers in Bosnia and Herzegovina. The dataset comprises 32 variables, systematically categorized into five distinct groups: Demographic Information (Age, Gender, Location, Education Level, School Type, School Level), Working Experience (Years of Experience, Current School Experience, Subject Taught, Students per Class, Weekly Workload, Material Conditions), Professional Development and Support (Professional Development, Administrative Support, Collegial Support, Parental Support, Student Cooperation, Job Satisfaction, Job Enjoyment, Job Frustration, Salary Satisfaction), Social Status (Teacher Status, Job Monotony, Administrative Discrimination, Collegial Discrimination, Parental Discrimination, Student Discrimination), and Future Plans (Attrition, Gender, Turnover, Retention, Conditions). The dataset also includes an open-ended question allowing participants to provide additional comments. The exploratory data analysis (EDA) process involved data cleaning, mapping responses to a Likert scale for enhanced interpretability, and a thorough analysis of

the variables that affect teacher attrition. A total of 395 teachers participated in the study. The distribution of participants across different regions is as follows: 38.5% from the Zeničko-dobojski Canton, 30.4% from the Sarajevo Canton, 9.9% from the Republic of Srpska entity, 7.3% from the Srednjobosanski Canton, 5.1% from the Unsko-sanski Canton, 3.3% from the Hercegovačko-neretvanski Canton, 2.5% from the Tuzlanski Canton, 2.3% from the Brčko District, and 0.8% from Canton 10 (Figure 1).

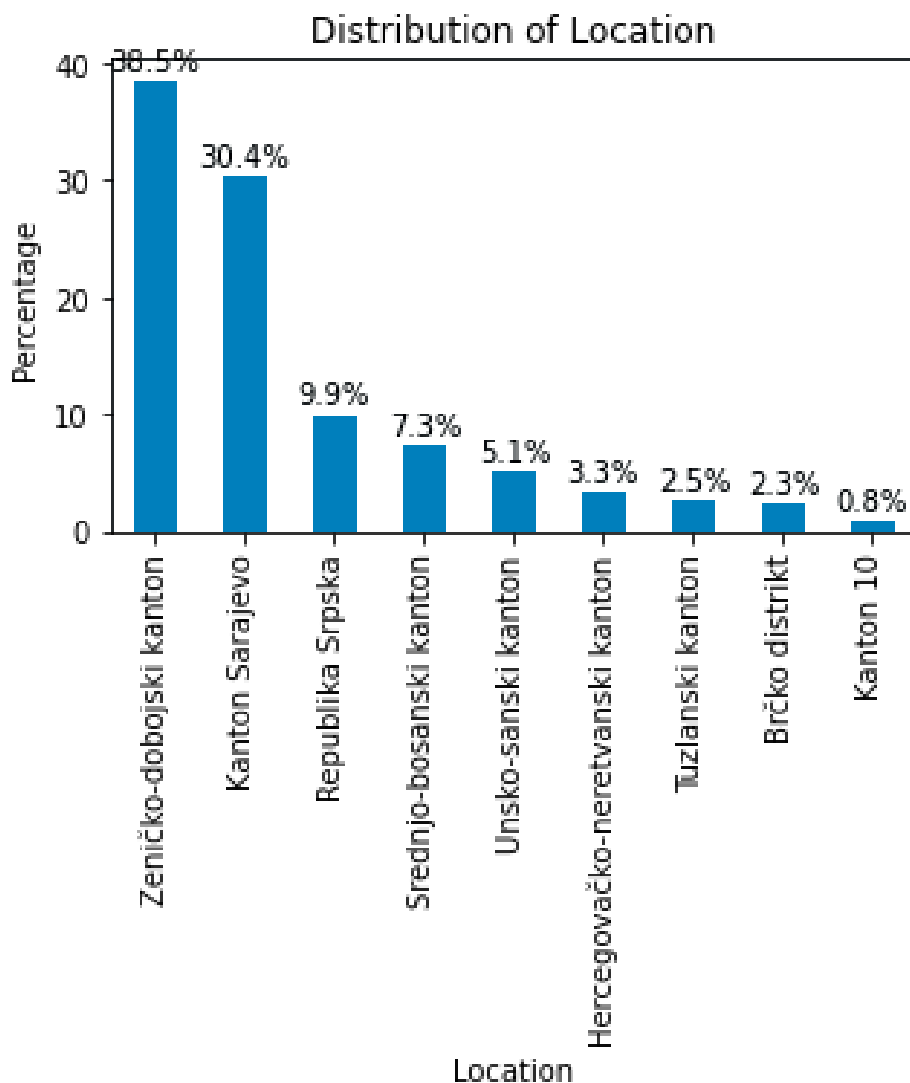


Figure 1: Distribution of Location

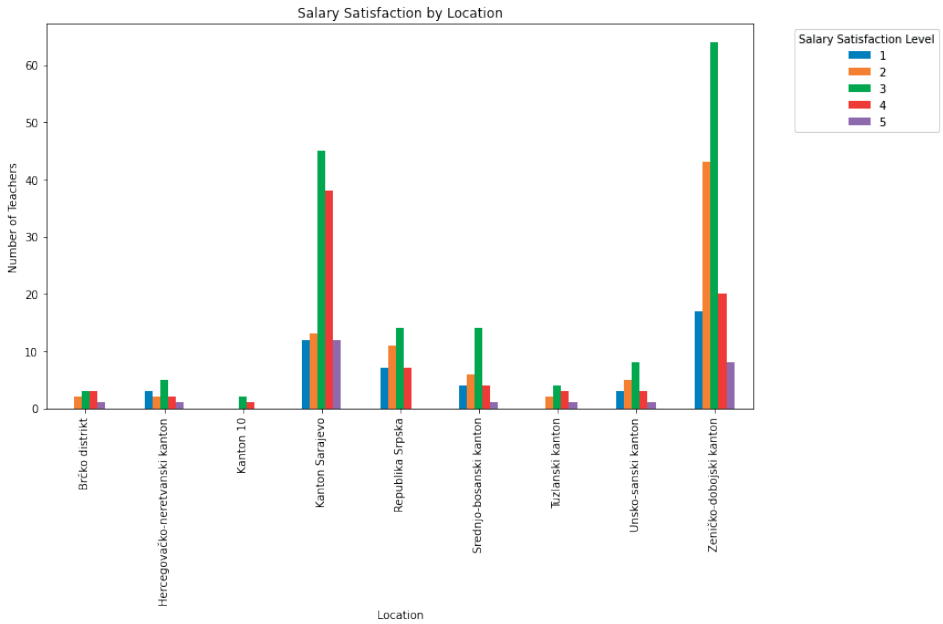


Figure 2: Salary Satisfaction by Location

Among the surveyed teachers, 63.3% are employed in primary schools, while 36.7% work in secondary schools. Based on the analysis of salary satisfaction across different regions in Bosnia and Herzegovina, it is evident that teachers in most locations are generally dissatisfied with their salaries (Figure 2). The data indicates that Canton Sarajevo and Zeničko-dobojski Canton have the highest number of teachers, both display a significant concentration of respondents reporting low levels of salary satisfaction, reflecting a general dissatisfaction. Although the sample size is smaller in other regions, a similar trend is observed, with a majority of teachers expressing lower satisfaction levels. This widespread dissatisfaction with salaries appears to be a prevalent issue across all regions examined.

The analysis indicates that a significant majority of teachers, 91.9%, are dissatisfied with their status within society, with only a minority of 8.1% believing that they receive the respect and recognition they deserve. From the open-ended responses, the teachers highlighted several factors contributing to their perceived low societal standing. These factors include the inadequate recognition of the teaching profession’s value, insufficient financial compensation, and a general lack of support and appreciation from parents, the public, and policymakers. Additionally, it was noted that the actions of a subset of teachers who do not adhere to professional ethics and standards may also contribute to the overall negative perception, further complicating efforts to elevate the profession’s status.

A significant portion of the surveyed teachers, 43.3%, expressed dissatisfaction with the working conditions in their current school, with the intention to change schools within the next five years. Additionally, 38.7% of the participants indicated a desire to leave the teaching profession entirely, reflecting broader concerns about job satisfaction and retention in the field.

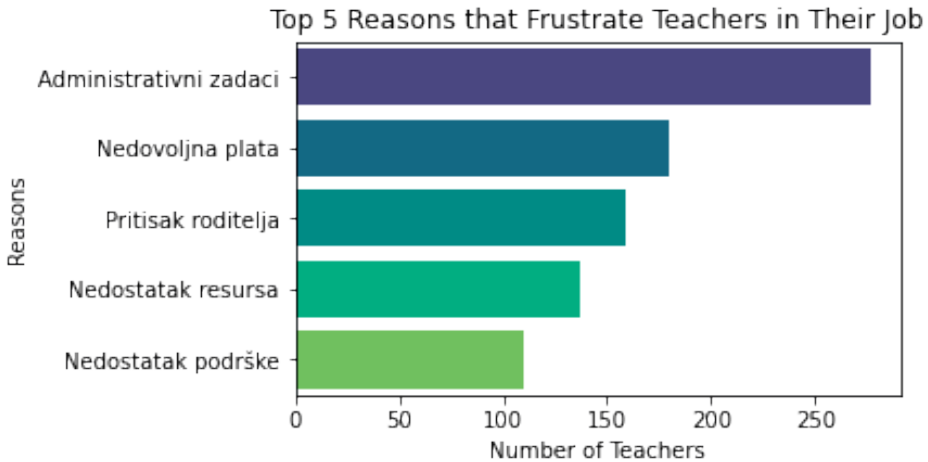


Figure 3: Top 5 Reasons Teachers Enjoy Their Job

In the survey, teachers were asked to identify the factors that contribute to their job satisfaction (Figure 3). The most frequently cited reason was the opportunity to work with students, which emerged as the top factor enhancing job enjoyment. Other factors such as flexibility in work, support from colleagues, opportunities for professional development, and salary and benefits were mentioned but were significantly less influential. Conversely, teachers also highlighted several factors that contribute to job frustration (Figure 4). The five most commonly reported sources of frustration were administrative tasks, insufficient salary, pressure from parents, lack of resources, and inadequate support. These issues were frequently mentioned, indicating substantial dissatisfaction among teachers regarding these aspects of their work environment.

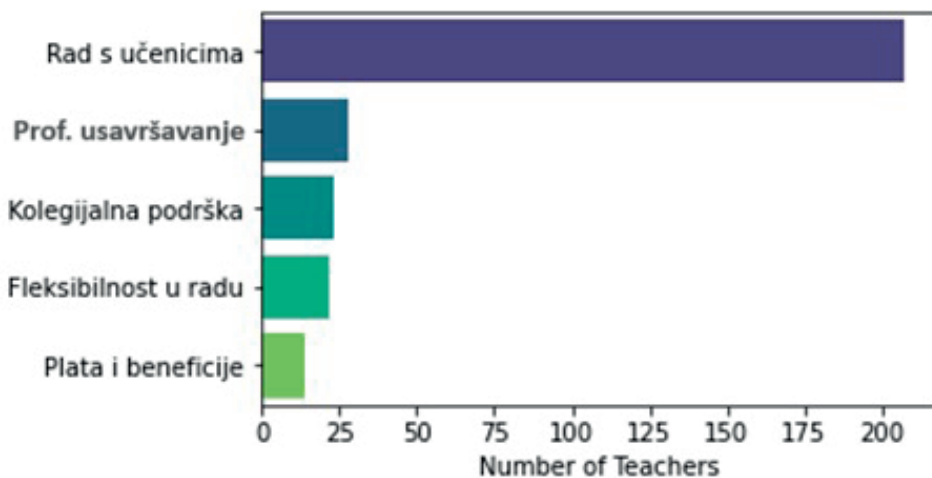


Figure 4: Top 5 Reasons that Frustrate Teachers in Their Job

Figure 5 illustrates teacher attrition by location, comparing the number of teachers who are likely to leave the profession (“Da” - Yes) versus those who are not (“Ne” - No) across different regions. It indicates that teacher attrition is a widespread concern across multiple regions, with some areas like Sarajevo and Zeničko-dobojski Canton showing a particularly high risk of losing educators. From the survey’s open-ended comments, it is evident that teachers with a low number of teaching hours per week face significant challenges in securing full-time employment. To achieve a full-time workload, many of these teachers are compelled to work across multiple schools, a situation that often leads to difficulties in coordinating schedules. School administrations are not always supportive in accommodating these teachers’ needs, expecting them to adjust their availability, which can be challenging or even impossible given the circumstances. Moreover, these teachers frequently experience difficulties in securing long-term contracts, often having to reapply for their positions annually or even more frequently. This recurrent participation in job competitions and the accompanying administrative processes create additional stress and uncertainty for these educators.

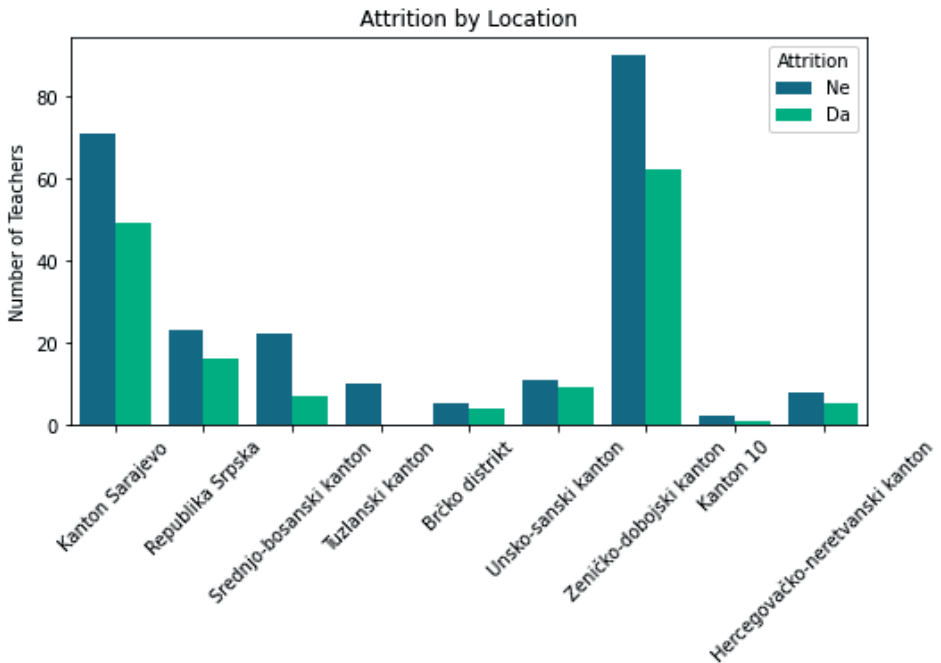


Figure 5: Attrition by Location

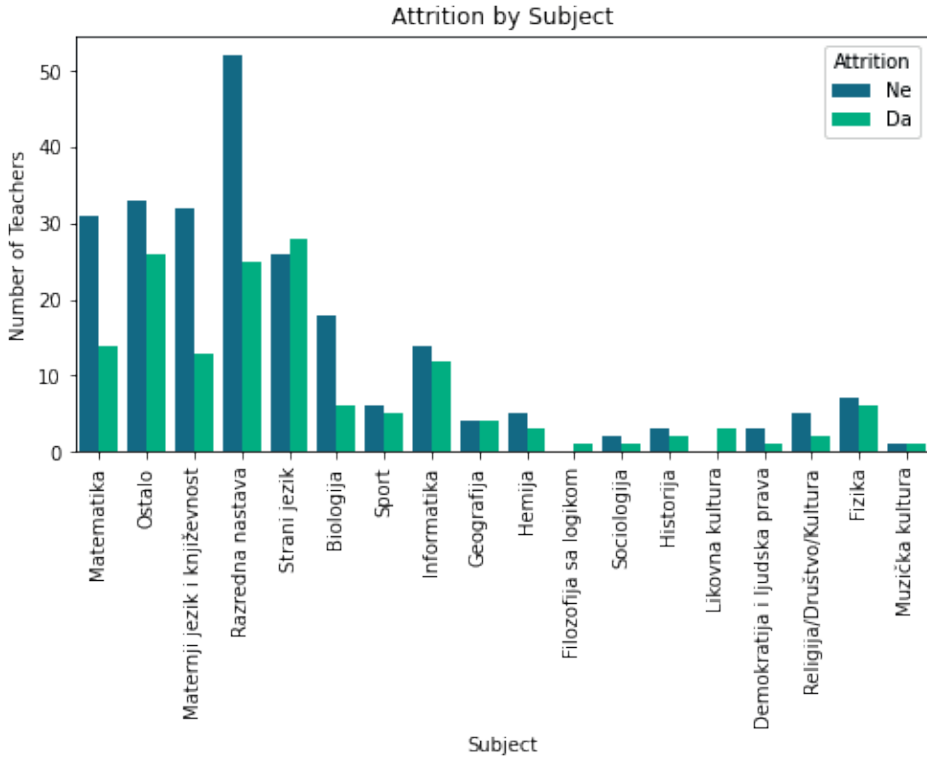


Figure 6: Attrition by Subject

On the other hand, teachers in subjects like languages, sports, and IT have more opportunities in the broader job market. These fields offer more profitable positions or easier pathways to secure long-term contracts, contributing to higher attrition rates as educators in these disciplines may choose to leave the teaching profession in favour of more stable or better-paid opportunities outside of the school system. These factors collectively contribute to the observed high attrition rates, particularly in subjects where teachers face both professional instability within the education system and attractive alternatives in the wider job market (Figure 6).

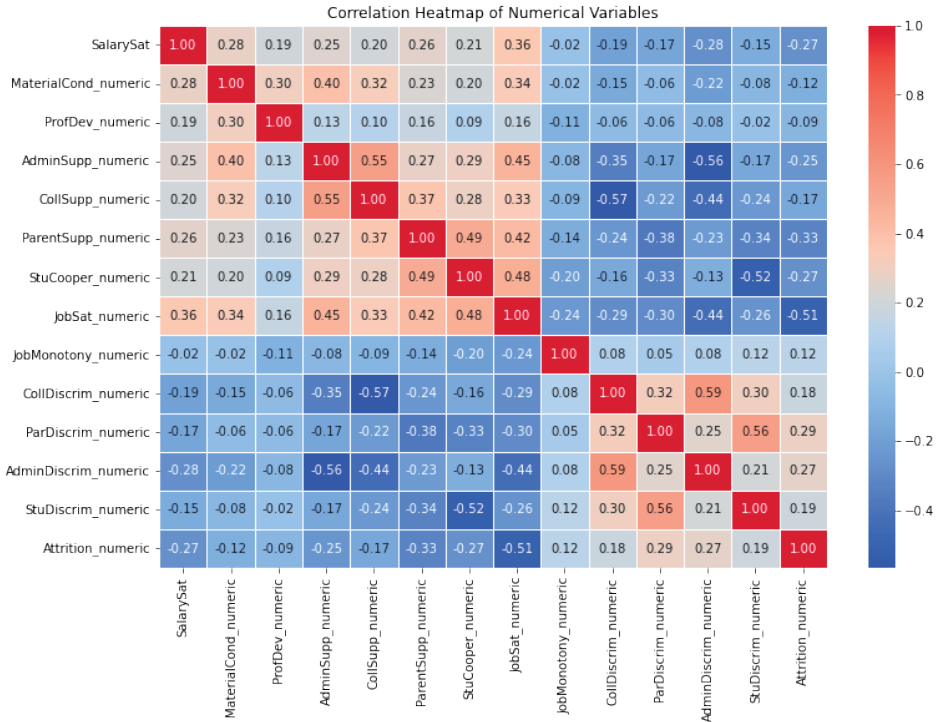


Figure 7: Correlation Analysis

The correlation analysis conducted to explore the relationships between teacher attrition and various factors within the dataset reveals several significant associations (Figure 7). The most prominent correlation is observed with job satisfaction, which exhibits a correlation coefficient of 0.511. This finding underscores job satisfaction as a critical determinant of teacher retention, with higher levels of satisfaction correlating with lower rates of attrition. This finding is consistent with existing research, which underscores job satisfaction as a crucial factor in teacher retention. Following job satisfaction, parental support and parental discrimination emerge as significant factors, with correlation coefficients of 0.330 and 0.288, respectively. These results indicate that both the degree of support received from parents and experiences of discrimination by parents are influential in determining teacher attrition. Teachers who perceive inadequate support or experience discriminatory behaviour from parents are more inclined to consider leaving their positions. Notably, open-ended comments from participants highlight issues such as parental pressure on grading and other educational processes, which, coupled with political influence on school administration, exacerbate the challenges faced by educators. Other important factors identified include student cooperation and salary satisfaction, with correlation coefficients of 0.270 and 0.268, respectively. These factors suggest that a supportive learning environment and satisfaction with financial compensation are also relevant to teacher retention. Despite widespread dissatisfaction with their salaries, teachers do not predominantly quit

their positions due to salary issues. This is reflected in the lower correlation between salary satisfaction and attrition compared to other factors. Administrative factors, specifically administrative discrimination and administrative support, exhibit correlation coefficients of 0.265 and 0.252, respectively, further emphasizing the importance of a supportive and equitable administrative environment in mitigating attrition. Additional factors, such as discrimination by students and colleagues, and colleague support, show weaker yet still meaningful correlations, ranging from 0.175 to 0.167. Teachers who experience supportive administration are more likely to remain in their positions, whereas those who face administrative discrimination are at a higher risk of leaving. These results highlight that while job satisfaction remains the foremost factor influencing teacher attrition, a combination of support from various stakeholders, equitable treatment, and fair compensation collectively contribute to the retention of educators.

CONCLUSION

In conclusion, this research provides crucial insights into the factors influencing teacher attrition in Bosnia and Herzegovina, highlighting the significant role of job satisfaction, parental support, and administrative factors in determining teachers' decisions to stay in or leave the profession. The findings underscore the importance of creating a supportive work environment, where teachers feel valued and supported by both parents and administrators, as this is strongly linked to lower attrition rates. Although salary dissatisfaction is prevalent among teachers, it is not the primary driver of attrition, with job satisfaction and other factors playing more significant roles. The study also emphasizes the need for targeted policies and interventions that address these multifaceted issues to enhance teacher retention and build a more stable educational workforce. Future research should continue to explore these determinants in greater depth and assess the effectiveness of implemented strategies. However, it is important to acknowledge the limitations of this research. The timing of data collection during the summer vacation period may have impacted the response rate, as did the lack of support from some educational ministries who did not allow survey distribution in schools. Despite these challenges, the active participation of teachers and their willingness to share the survey among colleagues demonstrate the relevance and importance of this research. Many participants expressed appreciation for the opportunity to voice their opinions, indicating the value they place on efforts to improve working conditions in education. While a higher response rate would have provided a more comprehensive understanding, the findings offer valuable insights and contribute to ongoing discussions on improving teacher retention.

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