

Income Rates and Career Choice Factors Among University Students

Group 33

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1. Introduction

The transition from academia to the professional world is a pivotal stage for university students, often marked by uncertainty about aligning their academic choices with desired career outcomes. Many students lack clarity on how factors such as education level, industry demand, and personal interests influence wage rates and career path decisions, leading to mismatched expectations and potential discontent in their professional lives.

This report investigates the key determinants shaping the career trajectories of university graduates, focusing on income rates and career choice influences. Using descriptive and diagnostic analyses, it explores the impact of education levels, years of experience, and professional variables on salary trends and popular job roles. Additionally, the report examines students' perceptions of career counseling services and their preparedness for the labor market.

By offering actionable insights, this research aims to empower students to make informed academic and career decisions, while providing educational institutions with data to enhance career counseling services and align curricula with market needs. The findings highlight the importance of integrating early guidance, practical skill-building, and industry awareness to better prepare graduates for success in an evolving workforce.

2. Problem Statement and Motivation

Many university students are uncertain about the relationship between their academic choices and the career outcomes they will ultimately achieve, leading to significant confusion about their future professions. In particular, there is limited understanding of how various academic fields specifically influence post-graduation wage rates. Additionally, students often lack sufficient information on how industry demand, employment trends, and personal preferences shape their career choices (Cheng, J., 2021, December 24). This knowledge gap can result in a mismatch between expectations and reality, leading to potential dissatisfaction in their professional lives.

Focusing on income rates and the factors influencing career path choices, this research aims to identify the key determinants shaping university graduates' career trajectories. The study seeks to provide students with insights that will help them make more informed decisions regarding their education and career paths. Ultimately, this research aims to enhance student success and long-term professional satisfaction by equipping educational institutions with valuable data to improve career counseling services and inform students about the skills needed to align with the evolving demands of the labor market (Flaherty, C., 2024, January 19).

3. Data Profile:

This research project uses openly available data from Kaggle, specifically focusing on three key datasets relevant to our study.

The dataset "*Understanding Career Path Selection Challenges and Their Impact on Academic Journey*" (The Islamia University of Bahawalpur) offers knowledge about the potential factors that influence their career choices and their academic performance. The data consists of categorical variables capturing the opinions and perspectives of 101 students.

The dataset "*Salary by Job Title and Country*" (Aboutalebi, A) offers a global view of the relationship between income levels and education across various industries. Using this data analysis, school career counseling can provide students with directions on their education level and expected income. Sourced from reputable employment websites and surveys, it includes data on job titles, salaries, geographic locations, and job sectors, allowing for a comparative analysis of income rates by region and education level. The independent variables include age, gender, education level, job title, years of experience, country, and seniority.

4. Data Analysis Methods:

The analysis leveraged multiple approaches to provide comprehensive insights into the career trajectories of university graduates. The methodologies employed are categorized into descriptive analysis, diagnostic analysis, and visualization techniques to address the objectives systematically.

4.1 Descriptive Analysis

Descriptive analysis was employed to summarize and explore the characteristics of the dataset, providing insights into key variables such as salary distribution, years of experience, education level, and job title. Summary statistics, including means, medians, and standard deviations, were calculated to identify central tendencies and variations within the data. Box plots were used to visualize salary distributions, revealing patterns and outliers across job titles and education levels. Association rules were also used to determine correlations and trends among the variables in the data. These descriptive measures highlighted significant trends, such as the positive correlation between educational attainment and salary, and offered an initial understanding of how variables like age and years of experience contribute to salary differences. Additionally, pie charts and bar charts were generated to analyze survey data related to career counseling, presenting the prevalence of various influencing factors, such as passion, financial stability, and family opinions, on students' career choices.

4.2 Diagnostic Analysis

Diagnostic analysis was conducted to uncover relationships and dependencies between variables. A correlation matrix was utilized to assess the strength and direction of relationships among key variables, such as salary, age, education level, and years of experience. This analysis revealed strong positive correlations between years of experience and salary, as well as moderate correlations between education level and salary, emphasizing the impact of professional experience on earning potential. Pair plots were further used to investigate the interaction between salary, years of experience, and education level, illustrating how higher educational qualifications lead to concentrated experience distributions and higher salaries. These findings informed deeper diagnostics, such as identifying collinearity between age and years of experience, which refined the interpretation of salary determinants.

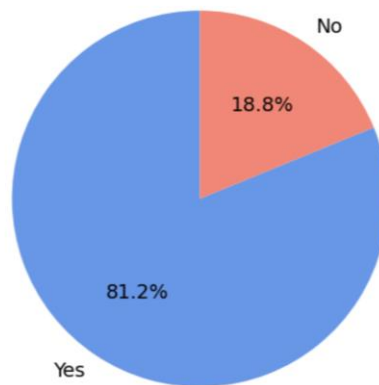
4.3 Visualization

Advanced data visualizations were employed to enhance the interpretability of findings and convey insights effectively. Box plots were created to showcase salary distributions, with annotations highlighting key influencers such as education and experience. Pair plots illustrate relationships between multiple variables, such as salary, education level, and years of experience, offering a holistic view of their interactions. Bar charts were developed to display the top five salary job titles and most popular job titles for each educational level, revealing clear trends in the labor market. Pie charts and bar charts were also used to visualize survey data, showing the percentage of students confident in their career choices and the factors influencing those decisions.

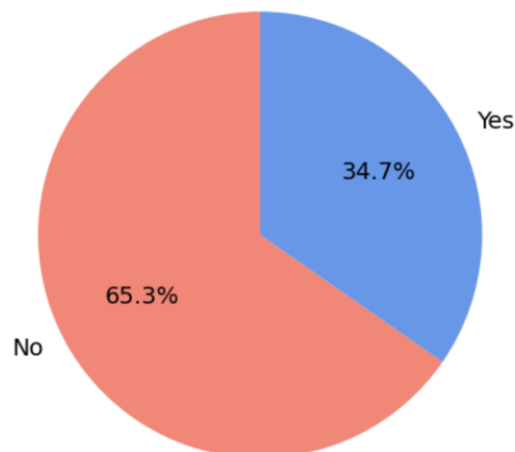
5. Experimental Results

5.1 Understanding Career Path Selection Challenges and Their Impact on Academic Journey

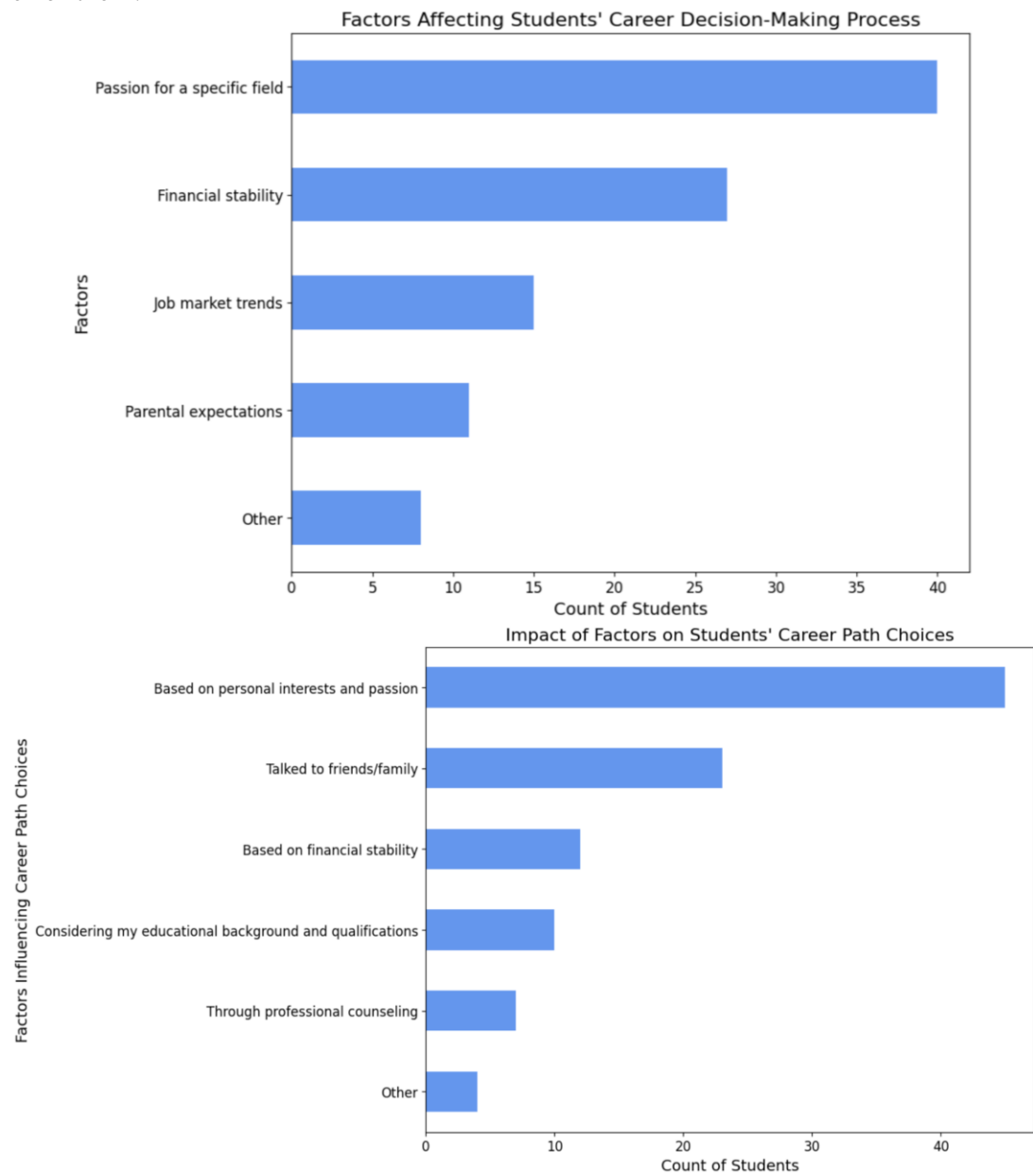
Proportion of Students Feeling Confident in Their Chosen Career Path



Confidence in Shifting to a Different Career Path

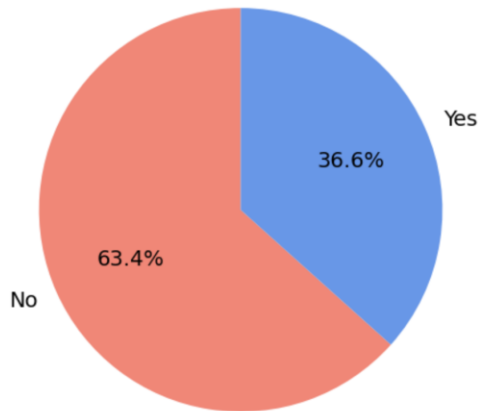


Among the 100 surveyed students, about 80% of students are confident in their career choice. However, 65% of students feel less confident in shifting to a different career path if their initial choice is not suitable for them.

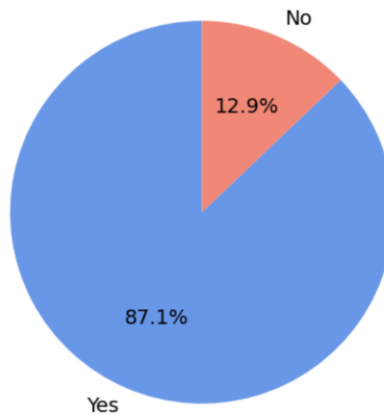


The primary factor influencing students' career decisions is their passion for a specific field, as most students prioritize personal interests when choosing their paths. Financial stability and job market trends are also significant, guiding many toward careers they perceive as secure and in demand. Family and friends play a substantial role as well, with their influence ranking as the second most common factor after personal interests. Professional counseling, though available, impacts relatively few students' choices, suggesting a potential gap in access or perceived relevance that could be explored further.

Have you sought advice from a career counselor or career advisor?



Do you think schools/colleges should offer career counseling and guidance programs?

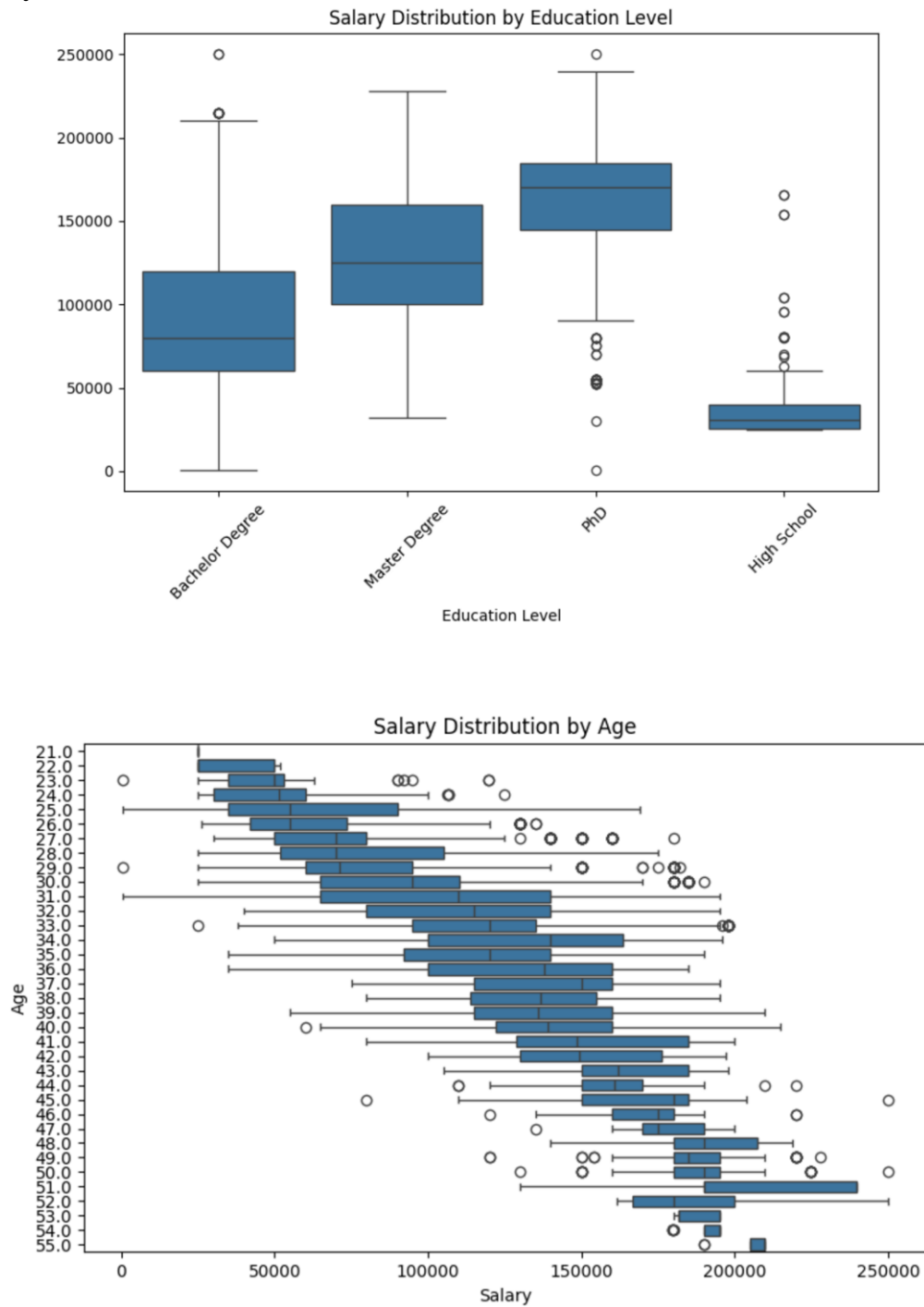


A notable 63% of students have not sought advice from a career counselor, yet many believe that educational institutions should prioritize career counseling and guidance programs to support informed decision-making. Students express the need for frequent counseling sessions to help them explore diverse career options aligned with their interests and skills. Additionally, there is a strong demand for career workshops, seminars, and interactions with professionals to offer insights into real-world applications across various fields. Many students also advocate for internship opportunities and hands-on experiences to gain practical knowledge. They emphasize the importance of early career guidance, starting in high school, with teachers playing a crucial role in fostering students' career interests and helping them align these interests with market demand.

5.2 Salary by Job Title and Country

After data cleaning, descriptive analysis was conducted on the *Salary by job title and country* dataset.

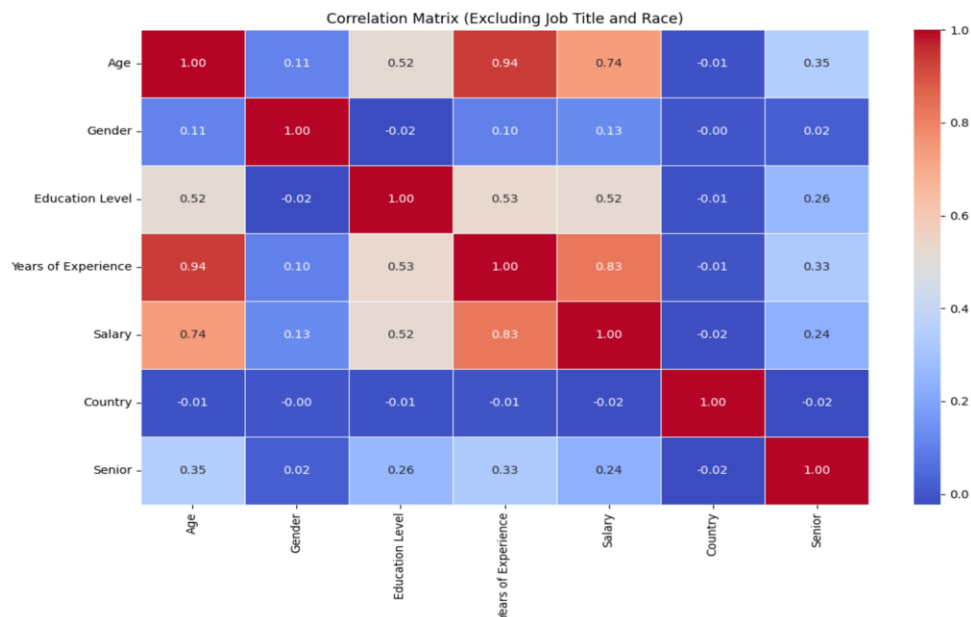
5.2.1 Salary Distribution Box Plot





From the salary distribution box plots, we can notice that "Age", "Education Level", and "Years of Experience" have the biggest influence on employees' salary rates. Next, we will build a correlation matrix to investigate the degree of correlation between these variables and the target variable salary.

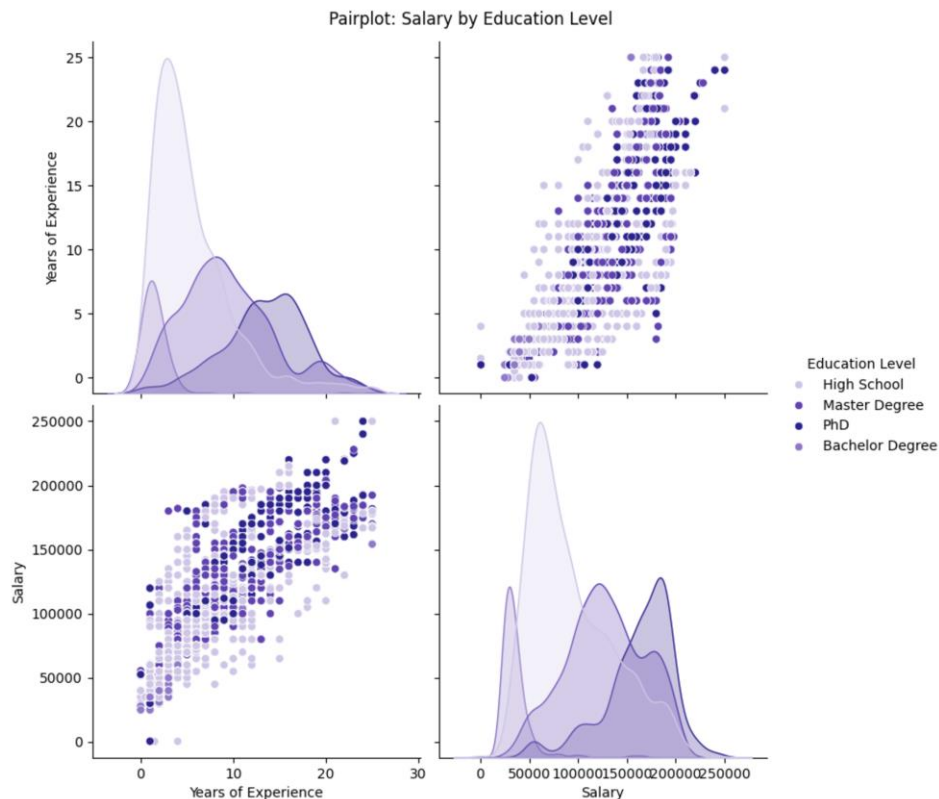
5.2.2 Salary Factor Correlation Matrix



From the correlation matrix results, we can observe that salary has a correlation coefficient of 0.74 with age, 0.83 with years of experience, and 0.51 with education level. Age has a correlation coefficient of 0.94 with years of experience. Education level has a correlation coefficient of 0.53 with years of

experience. This suggests that age is collinear with years of experience. Therefore, logically, it is years of experience, rather than age, that primarily determines salary.

5.2.3 Salary and Years of Experience by Education Level PairPlot

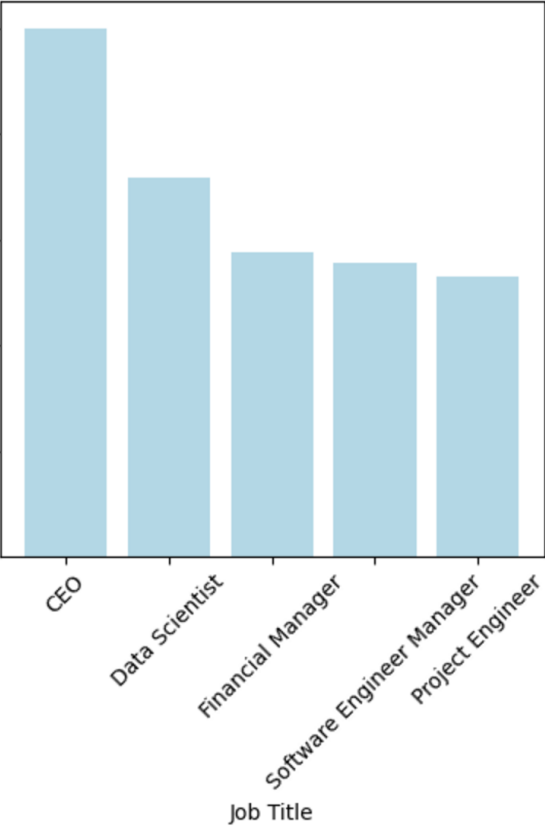


As education levels increase, so does the number of years of experience. PhD holders generally have the most years of experience, followed by individuals with Master's degrees, High School graduates, and Bachelor's degree holders. The distribution of experience is more concentrated among those with Master's and PhD degrees, while it is broader and more variable for High School and Bachelor's degree holders.

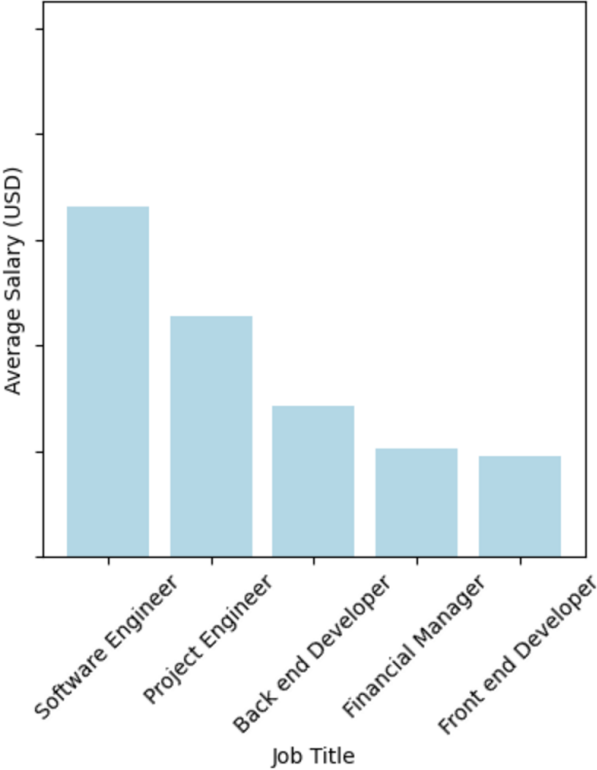
In terms of salary, higher education levels are associated with higher average salaries. PhD holders earn the highest salaries, followed by those with Master's degrees, High School graduates, and Bachelor's degree holders. The salary means progressively increases from High School to Bachelor's and Master's degrees. The variation in salary is greatest among High School graduates, with a larger standard deviation, while PhDs show moderate salary variation.

5.2.4 Top 5 Salary Job Titles For Each Educational Level

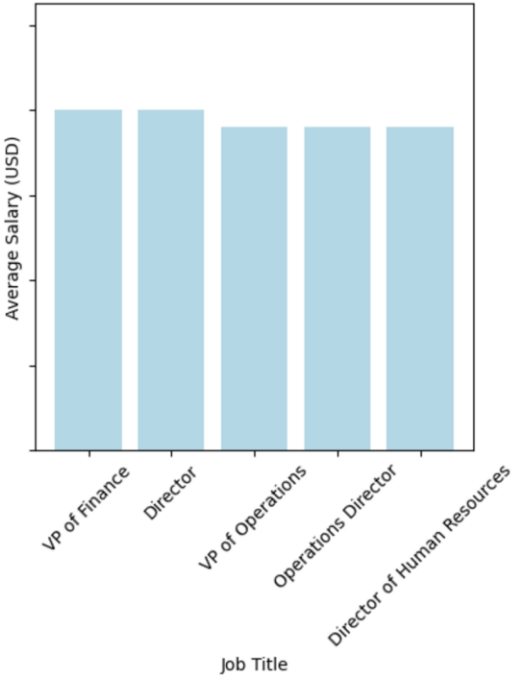
Top 5 Salary Job Titles for Bachelor Degree



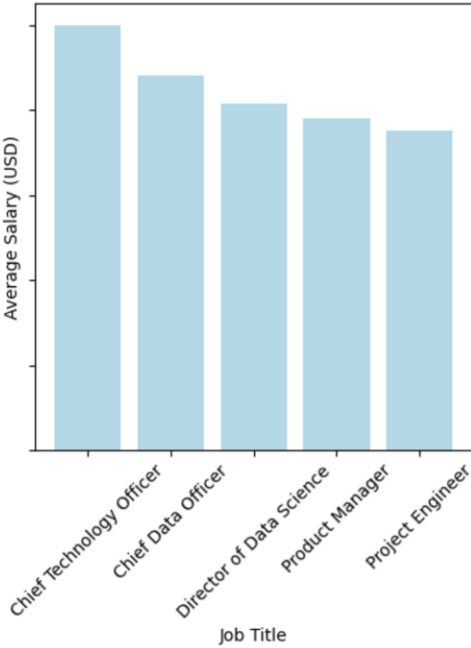
Top 5 Salary Job Titles for High School



Top 5 Salary Job Titles for Master Degree



Top 5 Salary Job Titles for PhD



The analysis of salary differences across education levels reveals a distinct correlation between higher educational qualifications and higher-paying positions, although exceptions exist. For individuals with only a Bachelor's Degree, surprisingly, some of the highest-paying roles are available, including positions such as CEO and Data Scientist, with salaries ranging from \$132,583 to \$250,000. This finding suggests that in certain industries, experience, leadership, and specialized skills can outweigh formal educational credentials. Roles like CEO often require years of industry experience and a proven track record in management, which may command salaries comparable to those with higher educational qualifications.

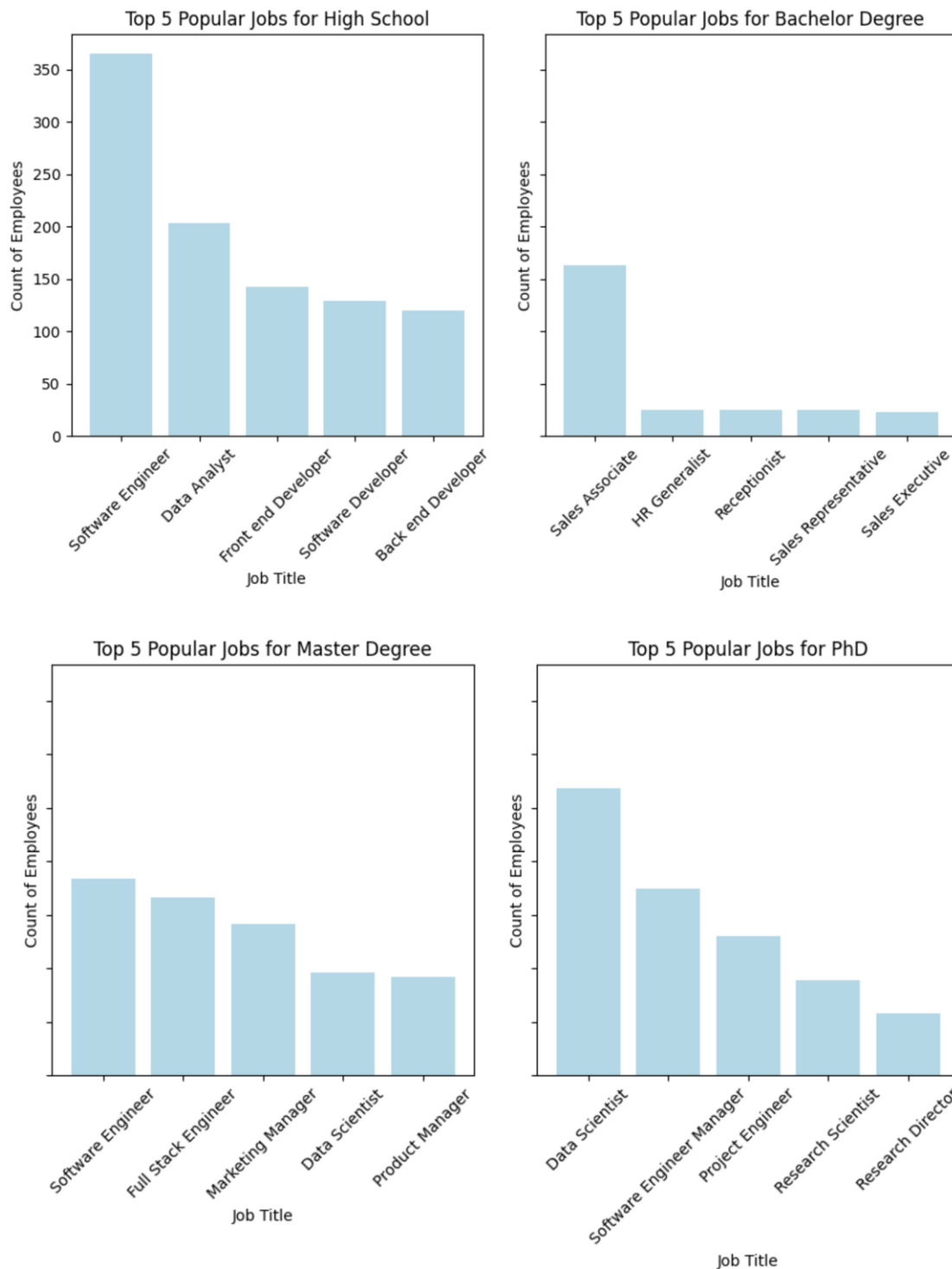
On the other hand, individuals with a High School Degree occupy roles such as Software Engineers and Project Engineers, which offer decent salaries. However, the average salaries for High School degree holders are generally lower than those for individuals with higher degrees. For example, Front End Developers and Financial Managers earn between \$47,898 and \$51,000. These lower salary ranges may indicate that while a High School degree provides essential technical and professional skills, it may not command the same premium as higher education levels, particularly when competing for senior positions that require specialized knowledge or experience.

For those holding a Master's Degree, higher compensation is associated with senior leadership roles, such as Vice Presidents and Directors. Positions like VP of Finance and Director offer salaries ranging from \$190,000 to \$200,000. These roles often require a combination of advanced technical expertise and strong managerial experience, resulting in higher compensation due to the strategic impact these professionals have within organizations. The increased salary reflects the value of a Master's degree in preparing individuals for leadership positions with broader organizational responsibilities.

Lastly, PhD holders tend to occupy high-level executive or technical positions, such as Chief Technology Officer (CTO) and Chief Data Officer (CDO), where salaries range from \$195,000 to \$250,000. These individuals command premium salaries due to their specialized expertise in complex fields, typically developed through years of advanced research and study. PhD holders are often sought after for their ability to lead innovative projects and drive strategic business decisions, which justifies their higher salaries in both technology-driven and executive roles.

In conclusion, the analysis highlights the significant influence of education level on salary, with higher degrees (Master's and PhD) leading to higher-paying leadership and technical roles. However, high school graduates still find opportunities for decent-paying roles in specific industries, where experience and expertise may outweigh formal education. This underscores the importance of a combination of education, experience, and skills in determining earning potential across various fields.

5.2.5 Top 5 Most Popular Job Titles For Each Educational Level.



For individuals with a High School education, the most popular job titles are primarily in technical fields, with positions such as Software Engineer, Data Analyst, Front End Developer, Software Developer, and Back End Developer. These roles suggest that High School graduates, often with additional technical certifications or vocational training, are entering specialized fields that require technical skills. The

prominence of software development and data analysis positions at this level highlights the growing demand for technical expertise in the labour market, even without a higher education degree. This indicates that technical training can lead to in-demand roles for individuals at the High School education level.

Among individuals with a Bachelor's degree, the most common job titles are centered around sales and administrative roles, including Sales Associate, HR Generalist, Receptionist, Sales Representative, and Sales Executive. These positions require a combination of communication, interpersonal, and organizational skills, all of which are core elements of a Bachelor's education. The presence of administrative roles such as HR Generalist and Receptionist also suggests that Bachelor's degree holders often take on positions that involve managing day-to-day operations and human resources functions within an organization. These roles demonstrate the broad skillset that Bachelor's graduates are equipped with, allowing them to fill positions across a wide range of industries, particularly in business and sales sectors.

Individuals with a Master's degree are most commonly employed in technical and managerial positions. The top job titles include Software Engineer, Full Stack Engineer, Data Scientist, Marketing Manager, and Product Manager. These roles require a high level of technical expertise, particularly in software development and data analytics, as well as advanced management skills. The presence of managerial roles such as Marketing Manager and Product Manager highlights that Master's degree holders are not only qualified for specialized technical roles but also for leadership positions that involve strategic decision-making and overseeing projects. This indicates that individuals with a Master's degree tend to occupy more senior or leadership roles that combine technical knowledge with management and strategy.

PhD holders are most often found in high-level technical, research, and leadership roles, including Data Scientist, Software Engineer Manager, Project Engineer, Research Scientist, and Research Director. These roles require advanced problem-solving capabilities, deep research knowledge, and technical leadership skills. The concentration of PhD holders in roles such as Research Director and Project Engineer suggests that these individuals are often in charge of managing complex projects and conducting cutting-edge research. These positions reflect the specialized knowledge and expertise developed through PhD programs, which prepare graduates to lead in both academic and industry settings.

The analysis shows that higher levels of educational attainment are strongly correlated with more specialized, leadership-oriented roles. High School graduates are more likely to enter technical fields, especially in software development and data analysis. Bachelor's degree holders tend to pursue positions in business, sales, and administrative sectors. Master's degree holders often occupy advanced technical and managerial roles, while PhD holders dominate high-level research, technical, and leadership positions. Across all education levels, there is a clear trend of increasing specialization and leadership responsibilities, with a particularly strong demand for technical expertise in fields like software development and data science. This reflects the growing importance of these skills in the modern workforce.

5.2.6 Association Rules

When looking for association rules, the confidence value was raised to 0.85 from the default 0.7 for a couple of reasons. One of the reasons was that a large number of rules were initially generated, and the other was that many of these rules provided contradictions. For instance, two rules found were that a person being Female implies that they are non-senior (Confidence: 0.849, Support: 0.387), but also that being Male implies that they are non-senior (Confidence: 0.835, Support: 0.454). This would effectively make every individual in the dataset implied to be non-senior, which would not make sense as there are seniors in the dataset. Raising the minimum confidence helped to prevent these paradoxes and show only the most confident associations that were detected.

Some of the rules with the highest confidence tended to correlate having less than 10 years of experience with having below average salary. For instance, a rule that below average salary & non-senior implied less than 10 years experience had a confidence of about 0.992, and another rule that directly stated that below-average salary implies less than 10 years experience with a confidence of 0.985. The highest support was for the rule that having less than 10 years of experience implies being non-senior (0.621), which also logically makes sense given that senior roles are typically associated with candidates who have more experience in the job field.

No association rules seemed to suggest any correlation between race or country and any other category. It should also be noted that "high school" is the only education level that any association rules were found for and 20s or younger is the only age group that any association rules were found for, both generally implying that it is correlated with having less than 10 years of experience.

Exactly two rules proved to have a confidence of 100% (1.0):

- Below-average salary and person in their 20s or younger implies less than 10 years experience
- Below-average salary, person in their 20s or younger, and non-senior implies less than 10 years experience

This logically makes sense even from the perspective that a person in their 20s is likely too young to have that much experience. However, the confidence for 20s or younger implying less than 10 years of experience is only 0.999 instead of 1.000.

6. Discussion

The research findings provide actionable insights to improve career counseling services and equip students with the skills necessary to align their career trajectories with evolving labor market demands. One of the key observations from the study is that while most students prioritize passion and personal interest in their career choices, a significant portion lacks confidence in transitioning to alternative career paths if their initial choice proves unsuitable. This underscores the need for career counseling programs to focus not only on helping students identify their interests but also on fostering adaptability and resilience in the face of changing job market conditions. Counselors can use this data to guide students in developing transferable skills that allow for career mobility, thereby reducing the anxiety associated with potential career shifts.

The findings also reveal a substantial gap in the utilization of career counseling services, with 63% of students not seeking professional advice despite acknowledging the value of such services. Institutions can leverage this insight to enhance accessibility and outreach efforts by integrating counseling services into the academic experience through mandatory career workshops, one-on-one sessions, and industry-focused seminars. These initiatives can provide students with exposure to real-world career opportunities and help them align their educational paths with industry demands. Additionally, by incorporating insights from the study, career counselors can prioritize areas of high demand, such as technical expertise and leadership skills, and tailor their guidance to prepare students for these roles.

Moreover, the study highlights the strong correlation between education levels and salary outcomes, with advanced degrees often leading to higher-paying leadership or technical roles. Career counselors can use these insights to help students make informed decisions about pursuing further education based on their long-term career aspirations. For instance, students interested in technical fields or research can be encouraged to pursue graduate or doctoral programs, while those inclined toward business or management roles can be directed toward strategic skill-building programs.

Finally, the research emphasizes the importance of early career guidance, starting as early as high school. By incorporating career counseling and skill-building programs into secondary education, institutions can provide students with a strong foundation for exploring diverse career options. This approach ensures that students are better prepared to meet the dynamic demands of the labor market, ultimately enhancing their professional satisfaction and success. These findings offer a roadmap for educational institutions to not only improve career counseling services but also ensure that students are equipped with the skills and knowledge necessary to thrive in an ever-changing global economy.

7. Conclusion

This research sheds light on the intricate relationship between academic choices, career outcomes, and the evolving demands of the labor market. By analyzing key determinants such as education level, years of experience, and industry-specific factors, the findings provide valuable insights into the challenges students face in making informed career decisions. The study underscores the importance of aligning educational paths with market trends, emphasizing the role of career counseling and skill development programs in fostering adaptability and confidence among students.

Through enhanced career services, data-driven guidance, and early intervention, educational institutions can better equip students to navigate their professional journeys, bridging the gap between aspirations and realities. Ultimately, this research highlights the critical need for a holistic approach that integrates personal interests, industry demands, and transferable skills, ensuring long-term success and satisfaction for future graduates in a rapidly changing global workforce.

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5.2 Salary by Job Title and Country Google Colab Link:

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