



VNR Vignana Jyothi Institute of Engineering and Technology
(Affiliated to J.N.T.U, Hyderabad)
Bachupally(v), Hyderabad, Telangana, India.

Student Performance Analysis

A course project submitted in complete requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

Submitted by

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CERTIFICATE

This is to certify that K.Tanmayee(220710538), Madhurisha.V(22071A0540), M.Srinath(22071A044), P.Yashwanth(22071A0552) have completed their course project work at CSE Department of VNR VJIET, Hyderabad entitled "**Student Performance Analysis** " in complete fulfillment of the requirements for the award of B.Tech degree during the academic year 2023-2024. This work is carried out under my supervision and has not been submitted to any other University/Institute for award of any degree/diploma.

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DECLARATION

This is to certify that our project report titled “**Student Performance Analysis**” submitted to Vallurupalli Nageswara Rao Institute of Engineering and Technology in complete fulfilment of the requirement for the award of Bachelor of Technology in Computer Science and Engineering is a bonafide report to the work carried out by us under the guidance and supervision of Dr.I.Ravindhar Kumar, Assistant Professor, Department of Computer Science, Mrs K.Hari Priya, Assistant Professor, Department of Computer Science and Engineering, Vallurupalli Nageswara Rao Institute of Engineering and Technology. To the best of our knowledge, this has not been submitted in any form to other universities or institutions for the award of any degree or diploma.

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ABSTRACT

This Power BI data visualization project delves into a thorough analysis of student performance. Using a rich dataset covering academic scores, attendance, extracurriculars, and demographics, the project employs diverse visualizations in Power BI. Through meticulous data exploration and preprocessing, the aim is to unveil patterns and correlations within the student dataset. Key visualizations, such as interactive dashboards and dynamic reports, leverage Power BI features like bar charts, line graphs, and pie charts to spotlight trends and factors influencing academic outcomes. The project goes further by exploring predictive modeling to forecast future student performance within the Power BI framework. Ultimately, the goal is to equip educational stakeholders with evidence-based insights derived from Power BI visualizations. These insights aim to facilitate informed decision-making, intervention strategies, and an overall enhancement of the academic experience for students.

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Introduction

In the dynamic and rapidly evolving landscape of education, the imperative to harness data for actionable insights has become increasingly pronounced. Educational institutions are navigating a complex terrain where the ability to make informed decisions, tailored to individual student needs, is paramount. The "Student Performance Analysis in Power BI" project emerges as a beacon of innovation, addressing this need within the academic realm with a laser-focused approach. By leveraging the robust capabilities of Power BI, a potent business analytics tool, this project aspires to revolutionize the way educators and administrators engage with and derive insights from student academic performance data.

The integration of Power BI serves as the linchpin of this transformative initiative. It offers more than just a technical solution; it is an enabler of a versatile and user-friendly environment where raw data undergoes a metamorphosis into visually compelling and actionable dashboards. The power lies not only in the presentation of a comprehensive overview of student performance but also in the creation of an immersive experience. Stakeholders are invited to explore beyond the surface, dig into specific details, and uncover nuanced patterns that might otherwise remain hidden in the vast sea of data.

In the realm of education, where individual student journeys are diverse and multifaceted, the importance of personalized insights cannot be overstated. The Power BI project seeks to provide a tailored experience, allowing educators to discern not only collective trends but also the unique pathways and challenges faced by individual students. It is a departure from one-size-fits-all approaches, offering a nuanced understanding of academic performance that can inform targeted interventions and support mechanisms.

Moreover, the project transcends the traditional boundaries of data analysis by incorporating dynamic and interactive elements into the visualizations. This

interactivity facilitates real-time engagement, enabling educators and administrators to respond promptly to emerging trends and evolving student needs. The shift from static representations to dynamic, living dashboards signifies a departure from the retrospective to the proactive, empowering stakeholders to not only analyze historical data but also shape future outcomes.

One of the distinctive features of Power BI lies in its ability to democratize data. The project fosters a culture where data is not confined to the domain of data analysts but is made accessible and comprehensible to all stakeholders. Educators, administrators, and even students can actively participate in the exploration of data, fostering a collaborative approach to understanding academic performance dynamics.

Furthermore, the project recognizes the importance of adaptability in the educational landscape. As methodologies, curriculum, and student demographics evolve, the Power BI project provides a scalable and flexible solution that can grow and adapt to the changing needs of the institution. It is a future-oriented endeavor, ensuring that the tools in place today remain relevant and effective in the face of tomorrow's educational challenges.

Beyond the realm of immediate utility, the Power BI project positions itself as a catalyst for institutional improvement. By arming educators and administrators with a potent analytical tool, the project lays the foundation for evidence-based decision-making. This not only enhances the efficiency of educational processes but also contributes to a culture of continuous improvement, where insights derived from data drive strategic planning, curriculum development, and resource allocation.

In conclusion, the "Student Performance Analysis in Power BI" project is not merely a technical implementation but a holistic reimagining of the intersection between data and education. It is a journey into a future where every data point carries the potential to shape a student's trajectory positively. Through the lens of Power BI, we embark on a transformative expedition, aiming not only to analyze data but to cultivate an environment where data becomes an indispensable ally in the pursuit of educational excellence.

Literature

The realm of data visualization is a vast and dynamic field, shaped by a plethora of influential works that have contributed significantly to its evolution. One of the seminal texts that laid the foundation for modern data visualization is Edward Tufte's "The Visual Display of Quantitative Information" (1983). Tufte's work is revered for its articulation of principles that emphasize clarity, precision, and integrity in presenting quantitative data. The concepts introduced in this classic text continue to shape the discourse on effective data representation.

Stephen Few's "Now You See It: Simple Visualization Techniques for Quantitative Analysis" (2009) delves into the practical aspects of visualization, offering insights into various techniques and providing actionable advice on crafting meaningful displays of data. Few's emphasis on simplicity and utility resonates with practitioners seeking practical guidance in enhancing the impact of their visualizations.

Shifting the focus to the narrative power of data visualization, Cole Nussbaumer Knaflic's "Storytelling with Data: A Data Visualization Guide for Business Professionals" (2015) explores how visualizations can be employed to tell compelling stories that influence decision-making in a business context. Knaflic's work underscores the importance of not just presenting data but crafting narratives that resonate with the audience.

In the realm of web-based data visualization, Scott Murray's "Interactive Data Visualization for the Web" (2017) serves as a comprehensive guide. The book explores tools like D3.js and provides insights into creating interactive visualizations that engage and inform online audiences. Murray's work reflects the increasing importance of dynamic and interactive visualizations in our digitally connected world.

Taking a cognitive perspective, Colin Ware's "Information Visualization: Perception for Design" (2012) investigates how human perception influences the design and effectiveness of visualizations. Ware's exploration of the psychological aspects inherent in data visualization adds a layer of understanding about how viewers interpret and engage with visual representations of data.

Nathan Yau's "Data Points: Visualization That Means Something" (2013) offers a practical approach, providing tips and examples to guide practitioners. Yau emphasizes the significance of context and storytelling in creating impactful visualizations, bridging the gap between theoretical concepts and their real-world application.

Ben Fry's "Visualizing Data" (2008) contributes to the discourse by exploring both the artistic and scientific dimensions of data visualization. Fry's work highlights the creative aspects of designing visualizations while maintaining a strong analytical foundation, showcasing the interdisciplinary nature of the field.

Leland Wilkinson's "The Grammar of Graphics" (1999) introduces a conceptual framework that has become influential in understanding and creating a wide range of statistical graphics. Wilkinson's work provides a theoretical underpinning for those interested in the systematic principles governing the visual representation of data.

Collectively, these works form a rich tapestry of literature that spans theoretical foundations, practical guidance, and interdisciplinary insights. They serve as invaluable resources for both novices and seasoned professionals in the field of data visualization, offering a roadmap to navigate the complexities of transforming data into meaningful and impactful visual narratives. As the field continues to evolve, these foundational texts remain essential touchstones for those seeking to deepen their understanding and proficiency in the art and science of data visualization.

Existing System

Microsoft Excel is a versatile tool for data visualization, offering a user-friendly interface and a range of charting options. With features like PivotTables, users can dynamically analyze and visualize large datasets. Conditional formatting enhances visual interpretation, and Excel's integration capabilities support real-time data updates. While specialized tools excel in complex visualizations, Excel strikes a balance between simplicity and functionality, making it widely adopted for creating impactful visual representations. Its adaptability, seamless data integration, and accessibility make it a practical choice for individuals and organizations seeking to leverage data visualization without the need for extensive training or specialized software.

Advantages:

Ubiquitous Software: Excel is widely used and available, making it a familiar tool for many users. Its ubiquity ensures compatibility across various systems and allows for easy sharing of files.

User-Friendly Interface: Excel offers a relatively intuitive and user-friendly interface, making it accessible to users with varying levels of expertise. The spreadsheet format is familiar to many, facilitating data entry and basic analysis.

Versatile Data Analysis: Excel provides a range of functions and formulas, making it versatile for basic data analysis tasks. Users can perform calculations, create charts, and organize data efficiently within a familiar environment.

Integration with Other Microsoft Products: Excel seamlessly integrates with other Microsoft Office applications, such as Word and PowerPoint. This allows for easy data transfer and collaborative document creation.

Customizable Reporting: Users can create customizable reports and dashboards using Excel. With pivot tables, charts, and conditional formatting, it is possible to present data in a visually appealing manner.

Disadvantages:

Limited Data Handling Capacity: Excel has limitations when dealing with large datasets. Performance issues can arise, leading to slow processing times, crashes, or data integrity problems when handling extensive and complex data.

Manual Data Entry Prone to Errors: Since Excel heavily relies on manual data entry, it is susceptible to human errors. Inaccuracies can occur during data input, and the risk of error increases with the size and complexity of datasets.

Lack of Advanced Analytics: While Excel provides basic analytics capabilities, it lacks advanced features for sophisticated data modeling, predictive analytics, and machine learning. Complex analyses may require additional software.

Limited Collaboration Features: Real-time collaboration features in Excel are limited, especially when compared to more modern collaborative platforms. This can lead to version control issues and challenges in team collaboration.

Static Reporting: Excel reports are typically static, requiring manual updates and modifications. This limitation inhibits real-time insights and may result in outdated information being presented in reports and dashboards.

Security Concerns: Excel files may lack robust security features, and access control can be challenging to manage. This makes it less suitable for handling sensitive or confidential data, especially in a collaborative environment.

In summary, while Excel is a versatile tool for basic data analysis and reporting, it comes with limitations in handling large datasets, susceptibility to errors, and a lack of advanced analytics capabilities. As data requirements become more complex, there is a need for more specialized tools, such as advanced business intelligence platforms, to address these shortcomings.

Proposed System

The proposed Data Visualization System offers a groundbreaking solution to the constraints faced by current educational analytics systems. By leveraging the robust capabilities of Power BI, the system aims to revolutionize how student performance data is aggregated, analyzed, and presented. Unlike conventional systems that often rely on static visualizations, this proposed system introduces a dynamic approach that brings data to life.

Incorporating interactive elements into the visualizations, the proposed system empowers educators to engage with student performance data in real-time. This interactivity not only enhances the accessibility of information but also transforms the analytical experience into a more immersive and responsive process. Educators can now explore and interact with data dynamically, allowing for a deeper understanding of student trends and insights.

The dynamic features of the proposed system represent a paradigm shift in the way educators interpret and respond to student data. The move from static to dynamic visualizations equips educators with a more agile and responsive toolset. This shift allows them to uncover patterns, identify outliers, and make informed decisions on the spot, fostering a proactive and data-driven approach to education.

Moreover, the proposed system's reliance on Power BI not only addresses existing limitations but also opens up new possibilities. Educators gain a comprehensive view of student performance, enabling them to implement timely interventions, tailor teaching strategies, and provide personalized support. The system establishes a foundation for a more adaptive and responsive educational environment, ultimately contributing to improved student outcomes and a more effective educational ecosystem.

Requirements

Functional Requirements

Data acquisition: The system should be able to import student performance data from various sources, such as CSV files, spreadsheets, and databases.

Data cleaning and preprocessing: The system should be able to clean and preprocess the data to ensure that it is accurate and consistent.

Data analysis: The system should be able to analyze the data to identify trends, patterns, and correlations.

Data visualization: The system should be able to create visualizations of the data, such as charts, graphs, and maps.

Reporting: The system should be able to generate reports that summarize the findings of the analysis.

Non-Functional Requirements

Performance: The system should be able to process and visualize large amounts of data efficiently.

Usability: The system should be easy to use for both technical and non-technical users.

Scalability: The system should be able to scale to accommodate increasing amounts of data and users.

Software

Data visualization software: Power BI

Operating system: Windows, macOS, Linux

Hardware

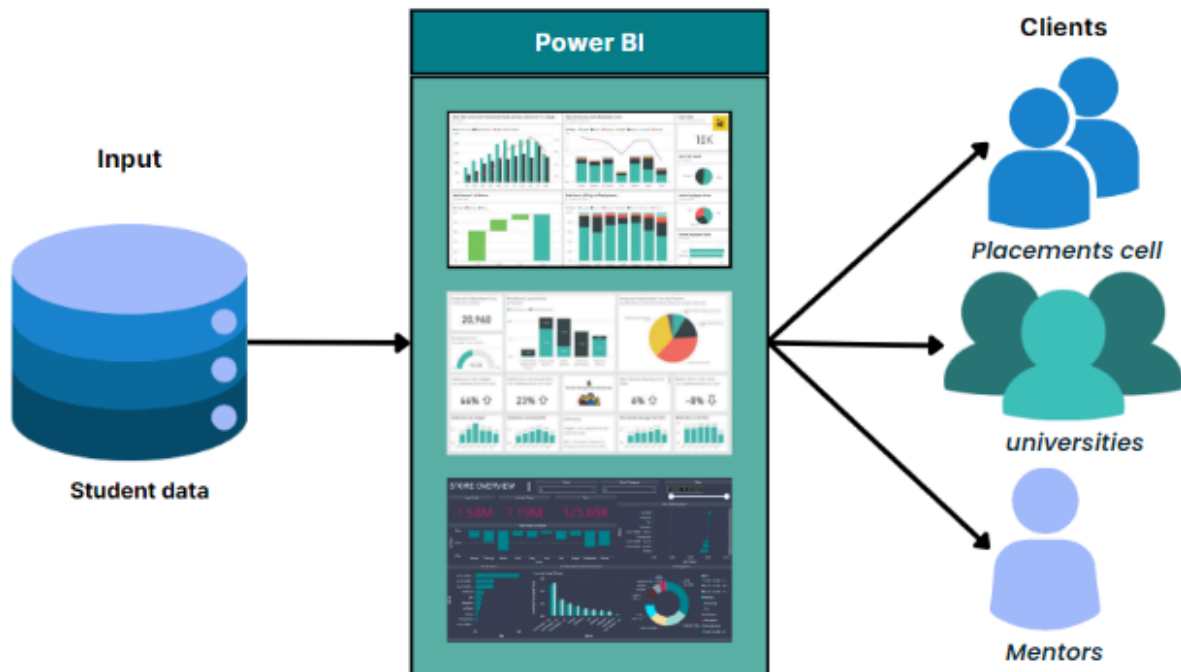
Processor: Intel Core i5 or equivalent

Memory: 8GB RAM

Storage : 500GB SSD

Graphics card : NVIDIA GeForce GTX 1050 or equivalent

Architecture



Model Implementation

Our Student Performance Analysis project using Power BI is driven by the imperative to address the challenges faced by educational institutions in managing and analyzing student performance data effectively. Traditional manual methods often lead to inaccuracies, hindering proactive interventions and decision-making. By leveraging Power BI, our project aims to streamline the collection and analysis of diverse academic data, offering educators and administrators a user-friendly platform with dynamic dashboards. This shift to data-driven insights is poised to revolutionize academic management, ensuring a more informed and proactive approach to student success.

In essence, our project is a technological upgrade to the manual system of student performance analysis, making academic data easily accessible and systematic. It strives to enhance the overall educational experience by promoting data-driven decision-making, ultimately contributing to improved outcomes for students and the educational institution as a whole.

MODULE 1:SECTION WISE ANALYSIS

The Section-wise Analysis Module in Power BI focuses on providing insights into the academic performance of different sections within an educational institution. By aggregating and visualizing data related to student scores, attendance, and other relevant metrics, educators can identify patterns and trends specific to each section. This module facilitates a comparative analysis, enabling educators to recognize consistently high-performing sections and areas that may require targeted interventions. The visualizations within this module empower educators and administrators to make data-driven decisions for optimizing teaching strategies and resource allocation, ultimately enhancing overall academic outcomes.

Donut Chart for Average Section Scores:

Purpose: The donut chart effectively communicates the average scores of each section, offering a quick and visually appealing overview. It allows educators to compare the performance levels of different sections at a glance, emphasizing the distribution of average scores.

Insights: Educators can easily identify sections with higher or lower average scores, helping to recognize trends and patterns in academic performance across the institution.

Pie Chart for Total Section Scores:

Purpose: The pie chart is used to represent the total scores of each section, highlighting the proportional contribution of each section to the overall academic performance. It provides a clear visual representation of the distribution of scores among sections.

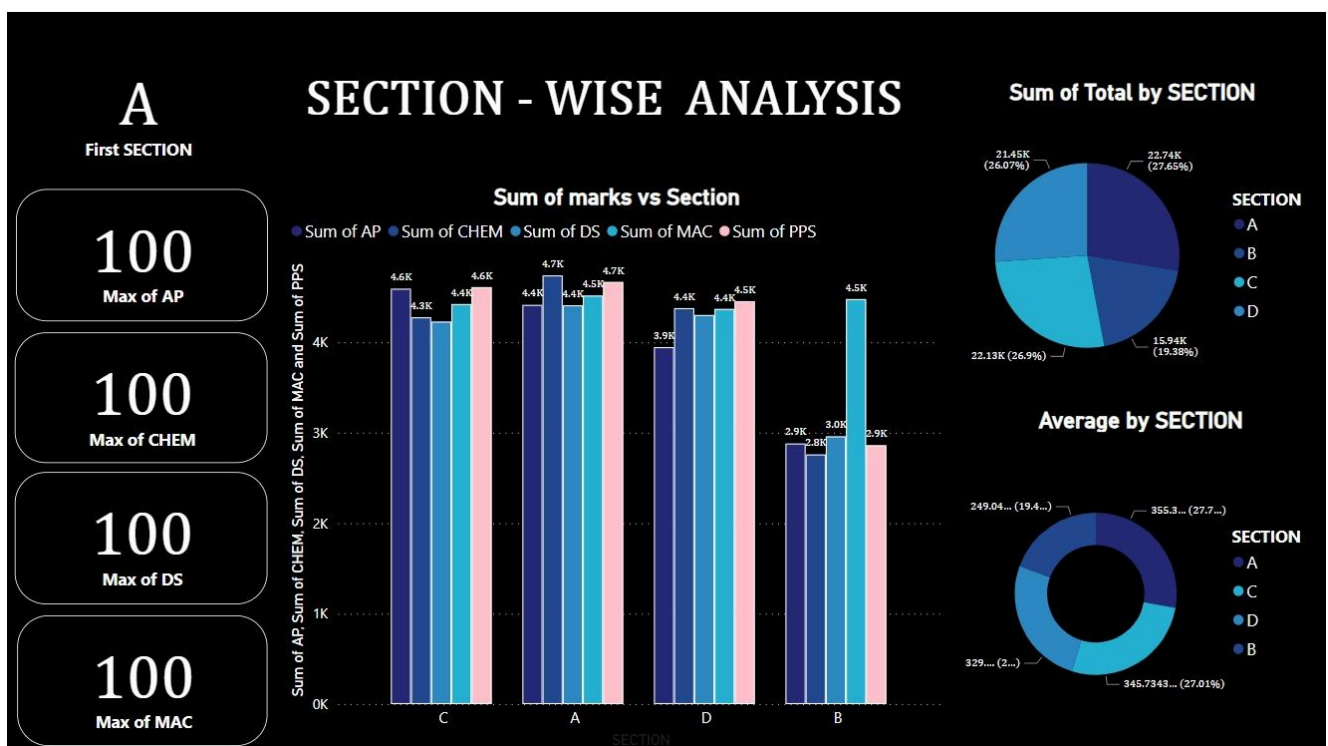
Insights: This chart type allows stakeholders to understand the overall performance distribution, showcasing the relative contribution of each section to the institution's academic landscape.

Clustered Column Chart for Sum of Subjects:

Purpose: The clustered column chart is employed to display the sum of scores for each subject within every section. This chart type allows for a detailed examination of subject-wise performance within each section, facilitating a granular analysis.

Insights: Educators can identify strengths and weaknesses in specific subjects across sections, aiding in the identification of areas that may need additional focus or support.

By combining these chart types, your Section-wise Analysis module provides a holistic view of academic performance, from overall section averages to detailed subject-wise breakdowns. This diverse representation of data enables educators to make informed decisions, recognize patterns, and tailor interventions to specific areas of improvement within each section.



MODULE 2 : STUDENT'S PERFORMANCE REPORT CARD

The Student Report Card Module in Power BI serves as a comprehensive and dynamic tool for presenting individual student performance data. This module integrates various academic metrics, including grades, attendance records, and into customizable dashboards. The interactive nature of the report cards allows stakeholders to delve into specific details, fostering a holistic understanding of each student's academic journey. Real-time updates ensure that the information presented is current, supporting effective communication between educators, administrators, and parents. This module empowers educators to identify areas for improvement, track student progress, and collaboratively work towards enhancing student success.

1.Gauges for Student Attendance and Total Marks:

Purpose: The gauges serve as concise visual indicators of two critical aspects of a student's academic profile – attendance and total marks. These gauges provide an at-a-glance overview, allowing educators and parents to quickly assess the student's commitment to attendance and overall academic achievement.

Insights: By comparing the positions of the needles on the gauges, stakeholders can easily identify students with high attendance, those needing improvement, and those excelling in academic performance.

2.Name Card:

Purpose: The name card acts as a central and personalized element, displaying key information about the student, such as their name, class, and any other relevant details. It serves as a quick reference point and enhances the user experience by providing context to the data being presented.

Insights: The name card ensures that stakeholders can easily identify and relate the visualized data to specific students, fostering a more personalized and engaging experience.

3. Funnel Chart for All Subject Marks:

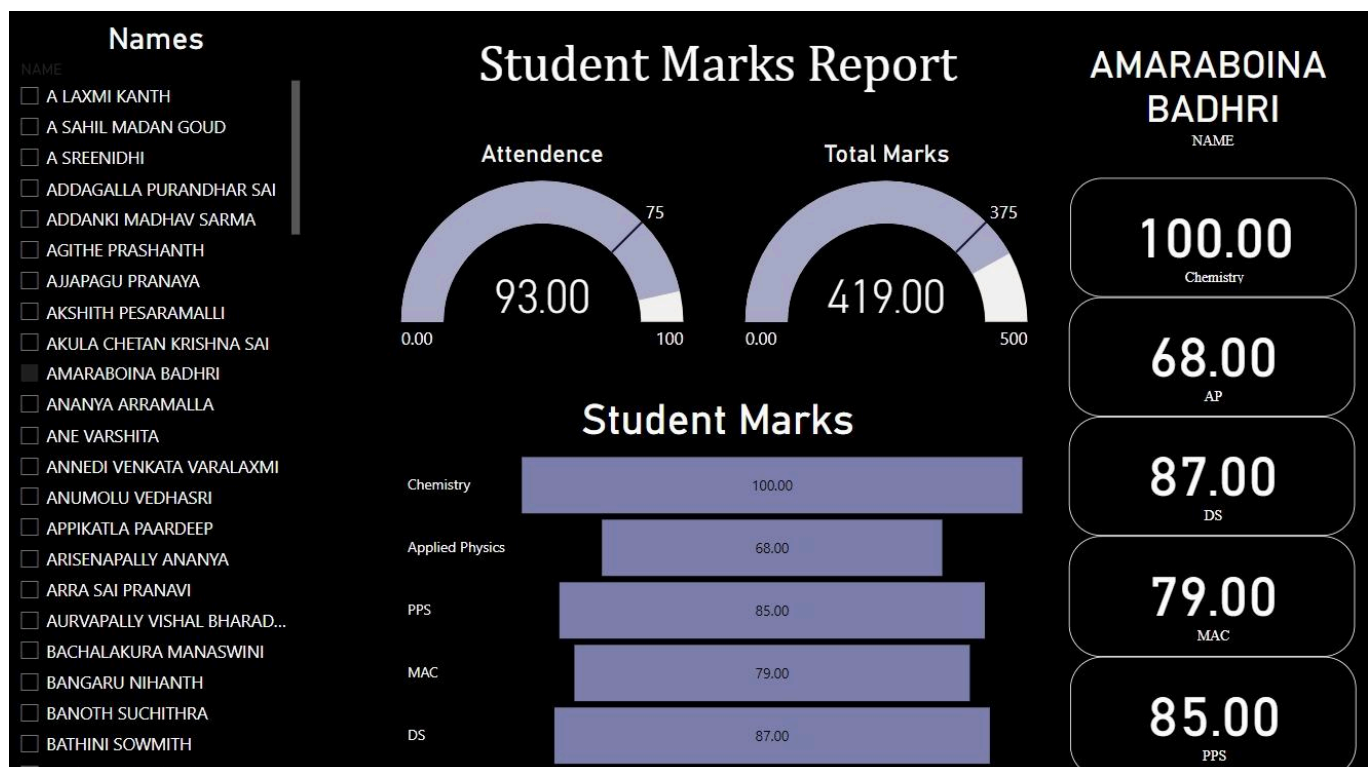
Purpose: The funnel chart is utilized to display the distribution of marks across all subjects, providing a visual representation of the relative performance in each subject. It helps stakeholders understand the progression of marks from one subject to another.

Insights: Educators and parents can identify subjects where a student excels or faces challenges, allowing for targeted support and intervention. The funnel chart enhances the understanding of the overall academic profile.

4. Slicer for Student Selection:

Purpose: The slicer enables users, such as educators or parents, to choose a specific student from the dataset dynamically. It acts as a filter, allowing stakeholders to focus on the report card of an individual student of interest.

Insights: By selecting different students using the slicer, users can quickly switch between report cards, comparing the academic performance and attendance of different individuals. This interactive feature enhances the user experience and facilitates a personalized approach to student data analysis.



MODULE 3 : ACADEMICS SUCCESS Vs ATTENDANCE

The Attendance vs. Academics Module in Power BI focuses on analyzing the relationship between student attendance and academic performance. By correlating attendance data with grades and other academic metrics, this module provides insights into how attendance patterns may impact student success. Visualizations within the module help educators identify trends, such as the effect of consistent attendance on academic achievement or potential correlations between irregular attendance and lower grades. This information can inform targeted interventions to improve attendance rates and, consequently, enhance overall academic outcomes. The module acts as a valuable tool for educators to make informed decisions regarding attendance policies and support mechanisms.

Pie Chart for Attendance Distribution:

Purpose: The pie chart visualizes the distribution of students across low, medium, and high attendance categories, offering a clear overview of attendance patterns within the institution.

Insights: Stakeholders can quickly grasp the proportion of students falling into each attendance category, aiding in identifying trends and potential areas for intervention.

Multi-Row Name Cards for Average Marks:

Purpose: The multi-row name cards provide a detailed view of the average marks for each subject within the low, medium, and high attendance groups.

Insights: Educators and administrators can easily compare the average marks across different attendance categories, identifying subject-specific performance trends associated with attendance levels.

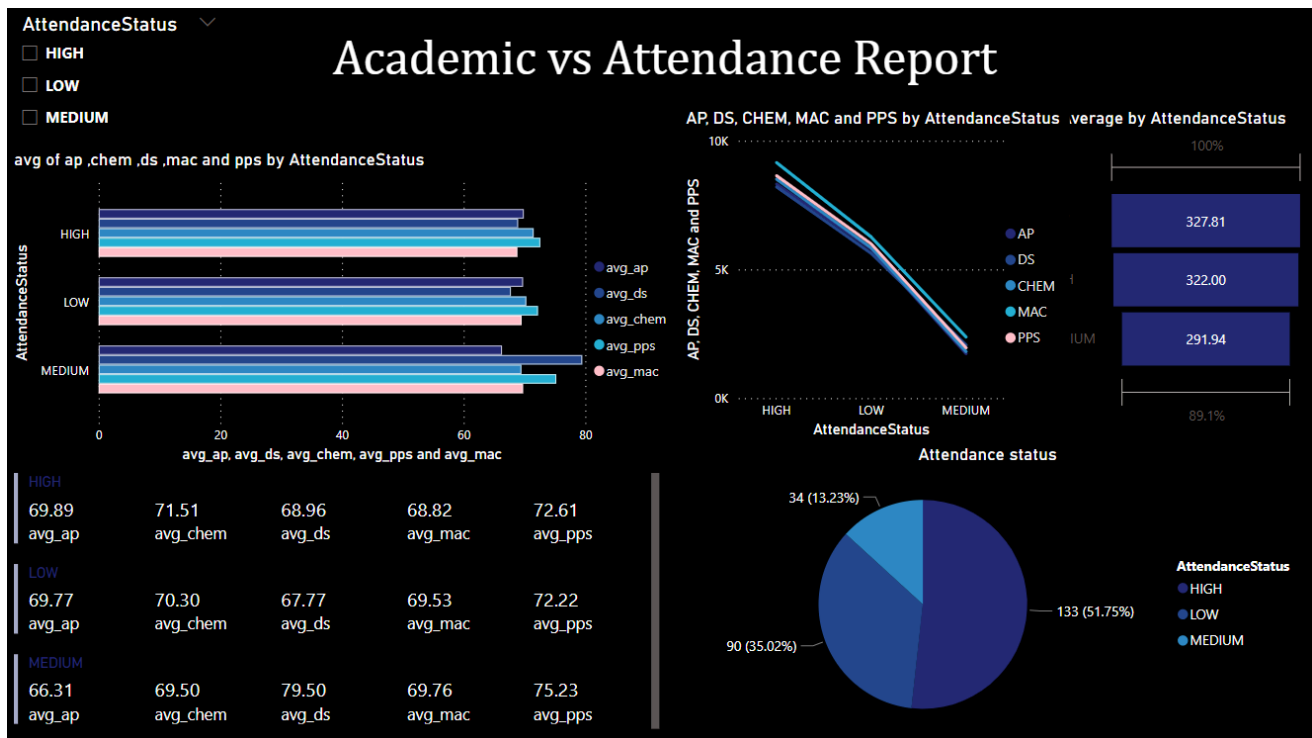
Clustered Bar Chart for Subject-wise Analysis:

Purpose: The clustered bar chart is employed to display the marks for each subject within the low, medium, and high attendance groups, allowing for a granular analysis of academic performance.

Insights: This chart enables educators to identify subject-specific performance variations across different attendance categories, aiding in the development of targeted strategies for improvement.

By incorporating these elements into the Attendance vs. Academics module, your Power BI report offers a comprehensive view of the relationship between attendance levels and

academic performance. This multi-faceted approach enables educators and administrators to identify trends, make data-driven decisions, and implement targeted interventions to enhance both attendance and overall academic outcomes.

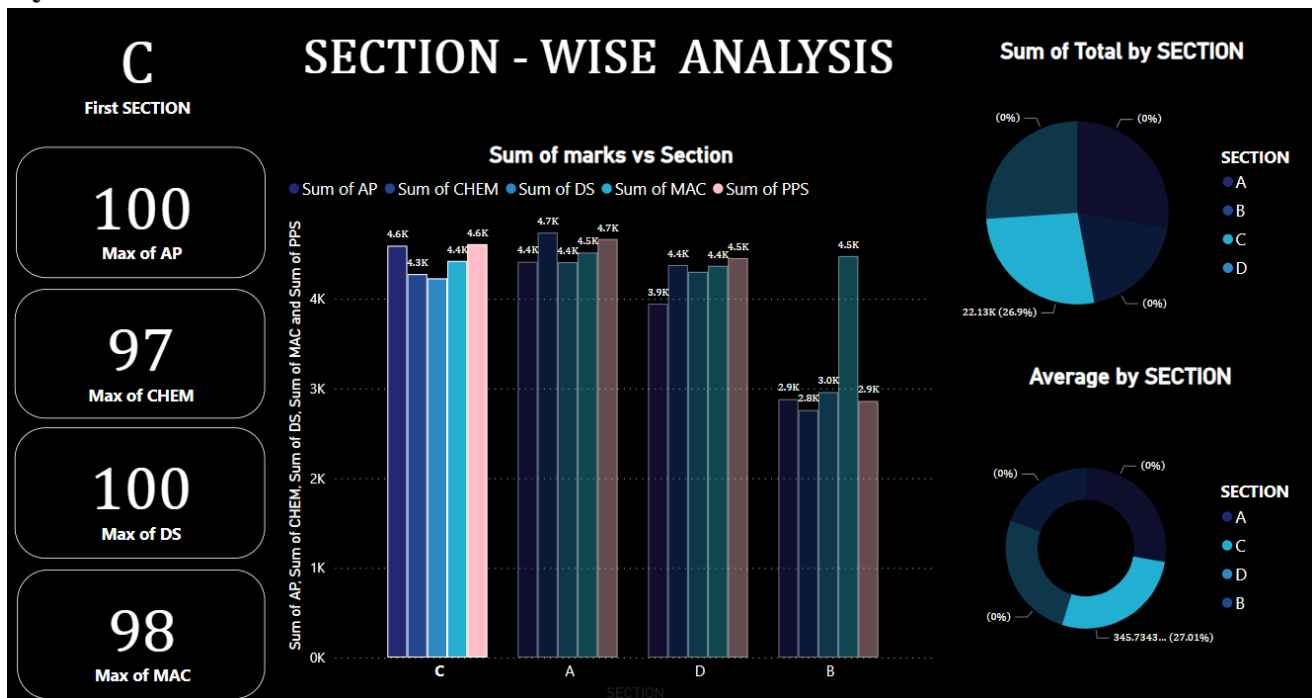


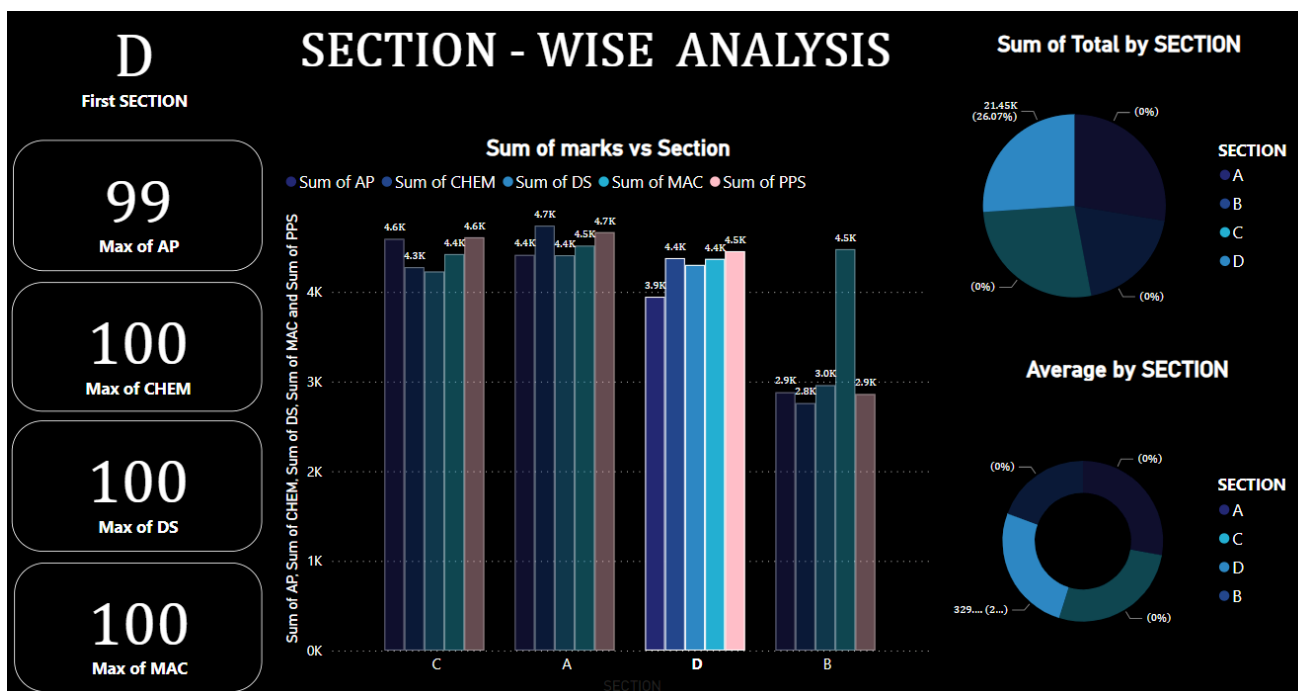
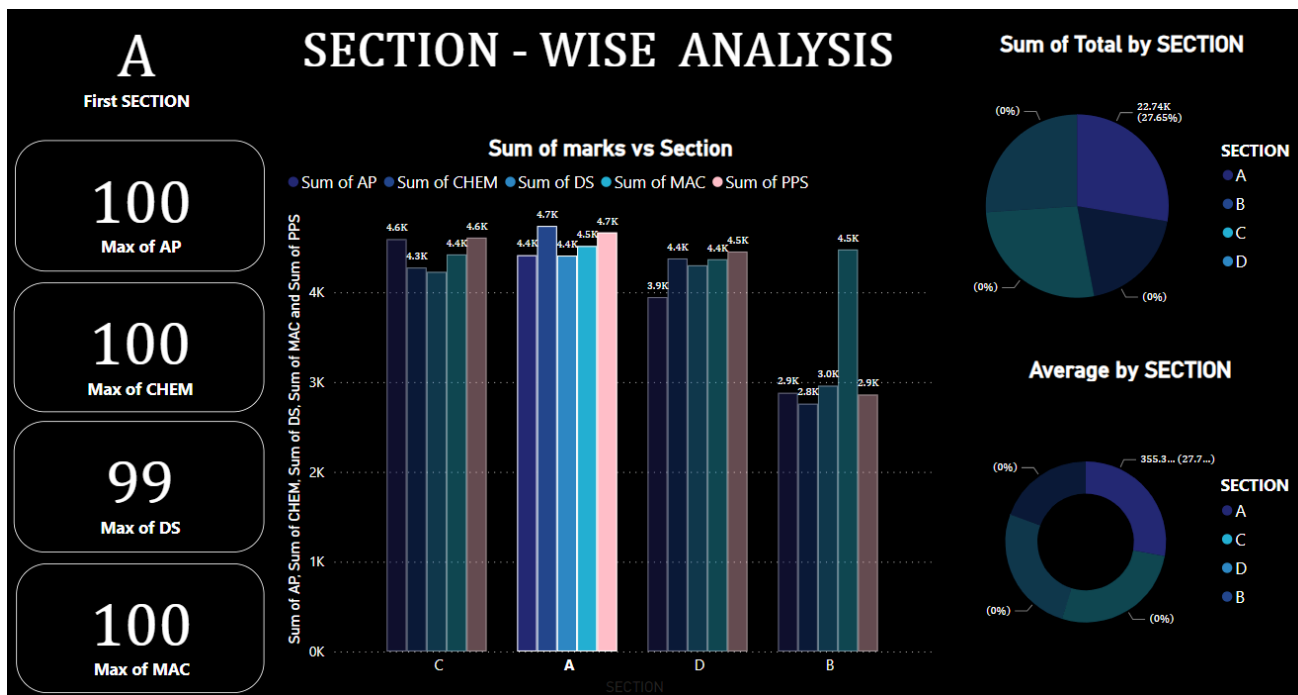
Result

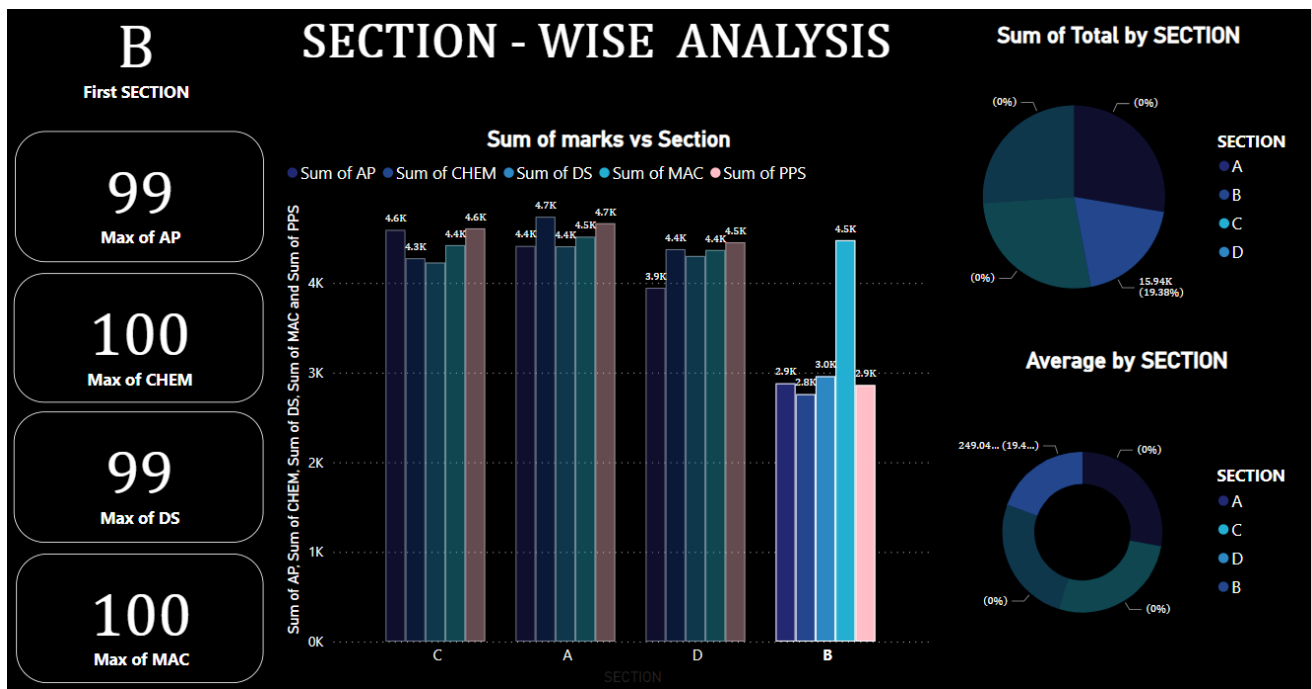
MODULE 1:SECTION WISE ANALYSIS



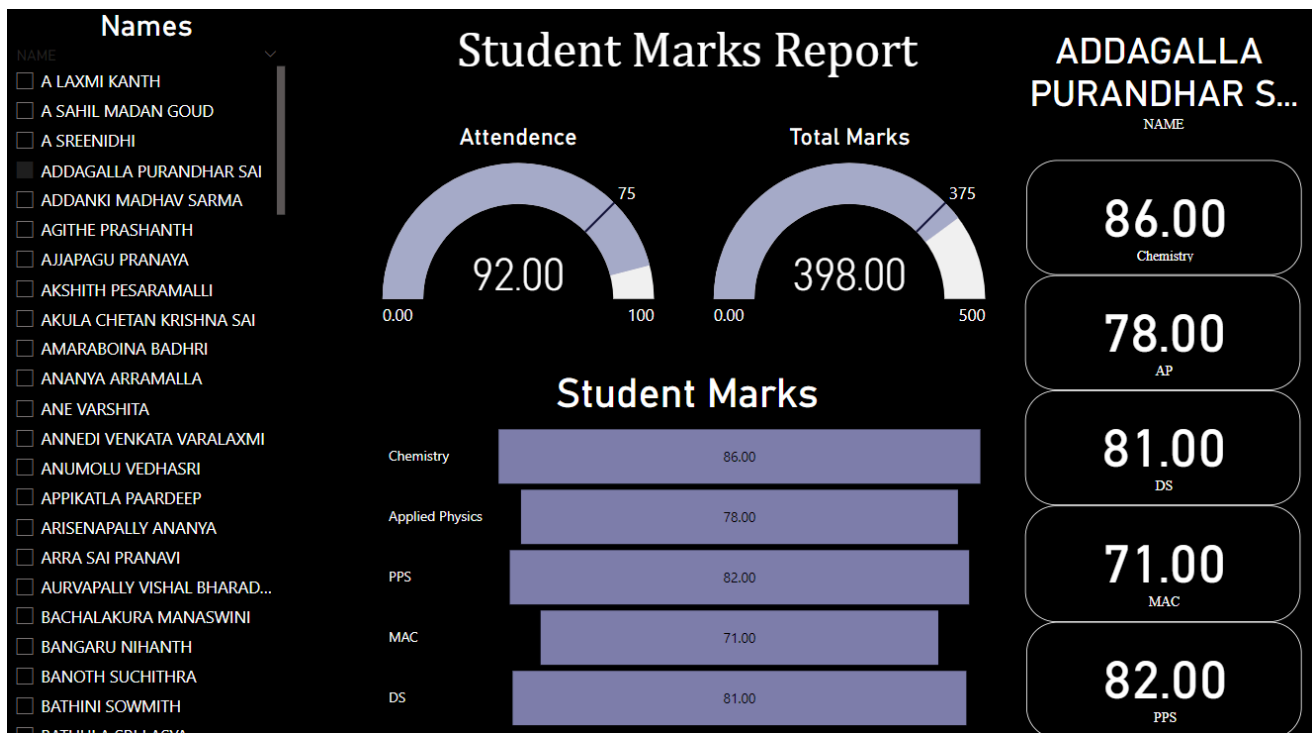
Dynamic charts:



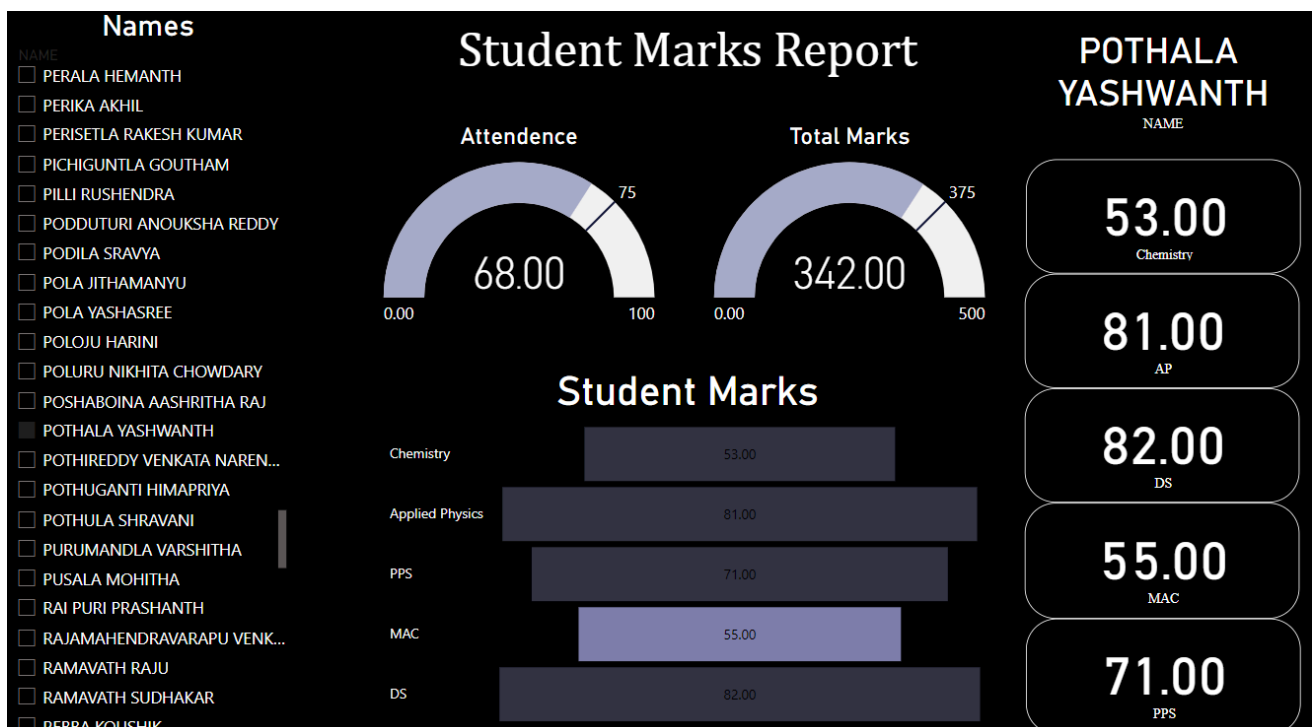
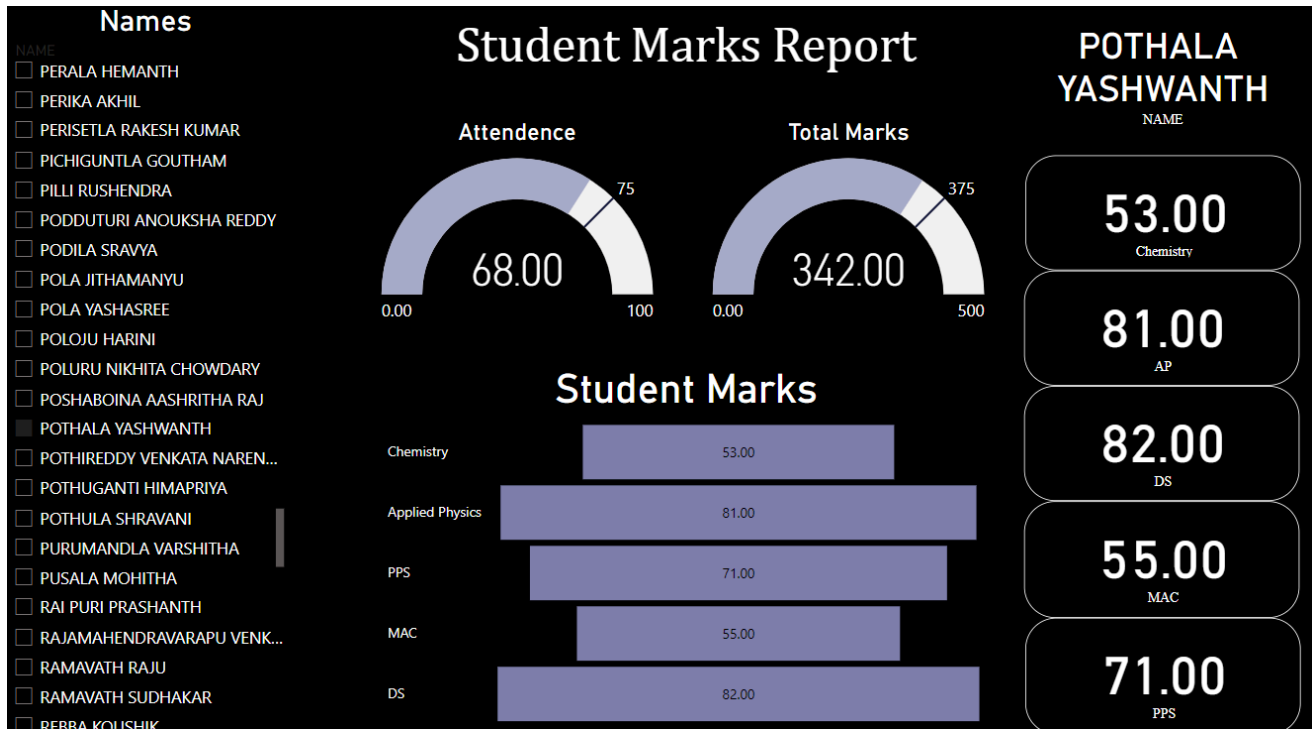


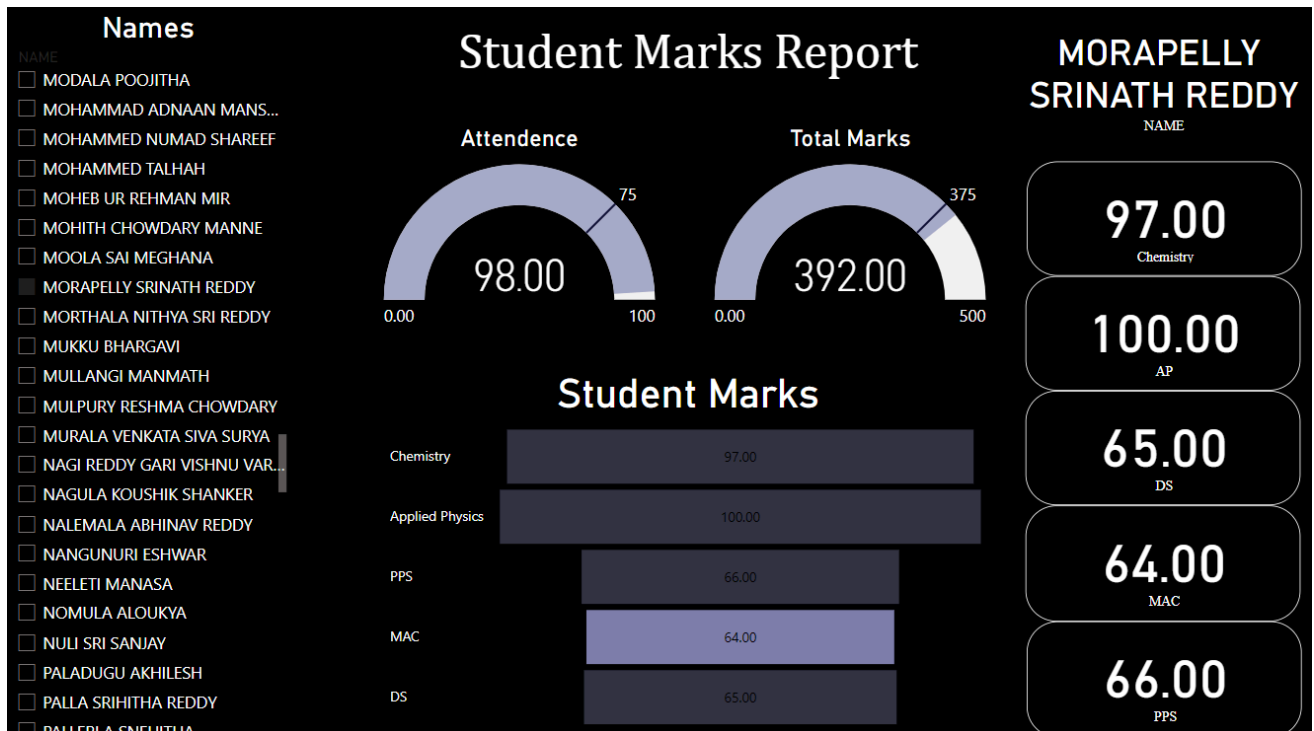


MODULE 2 : STUDENT'S PERFORMANCE REPORT CARD

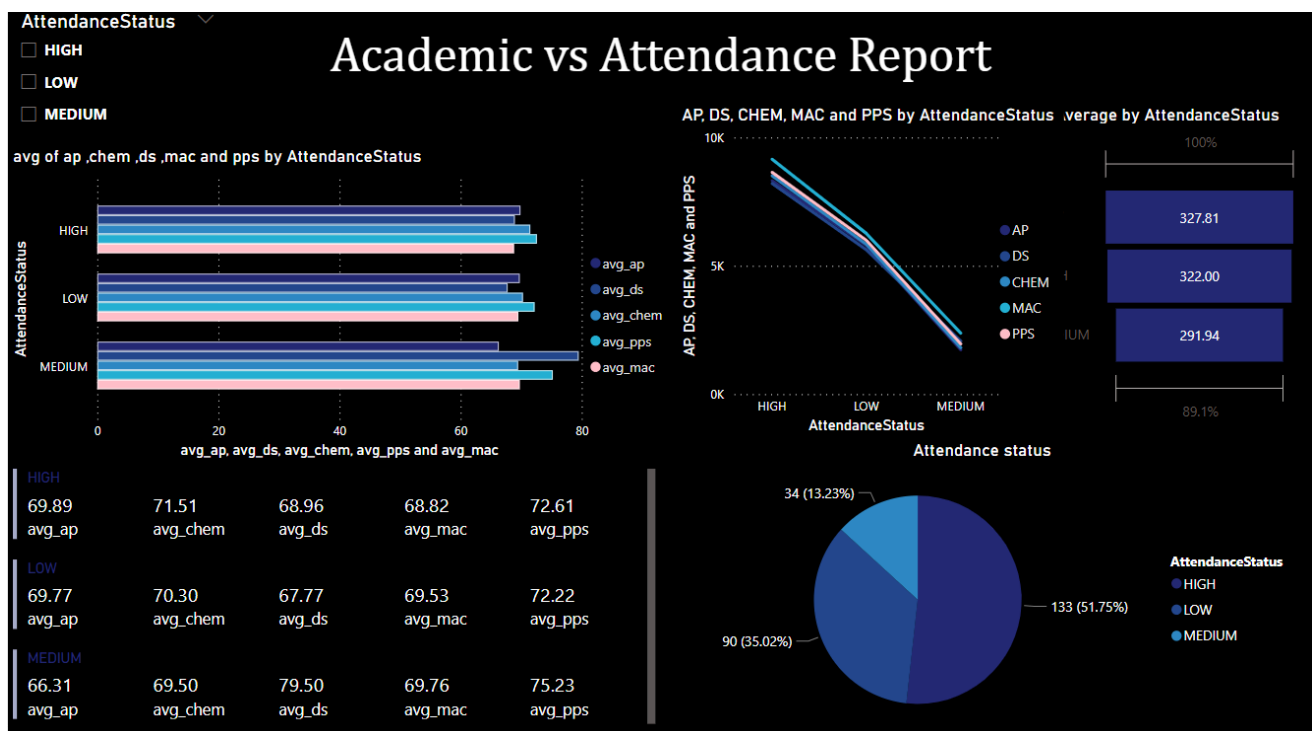


Dynamic charts:

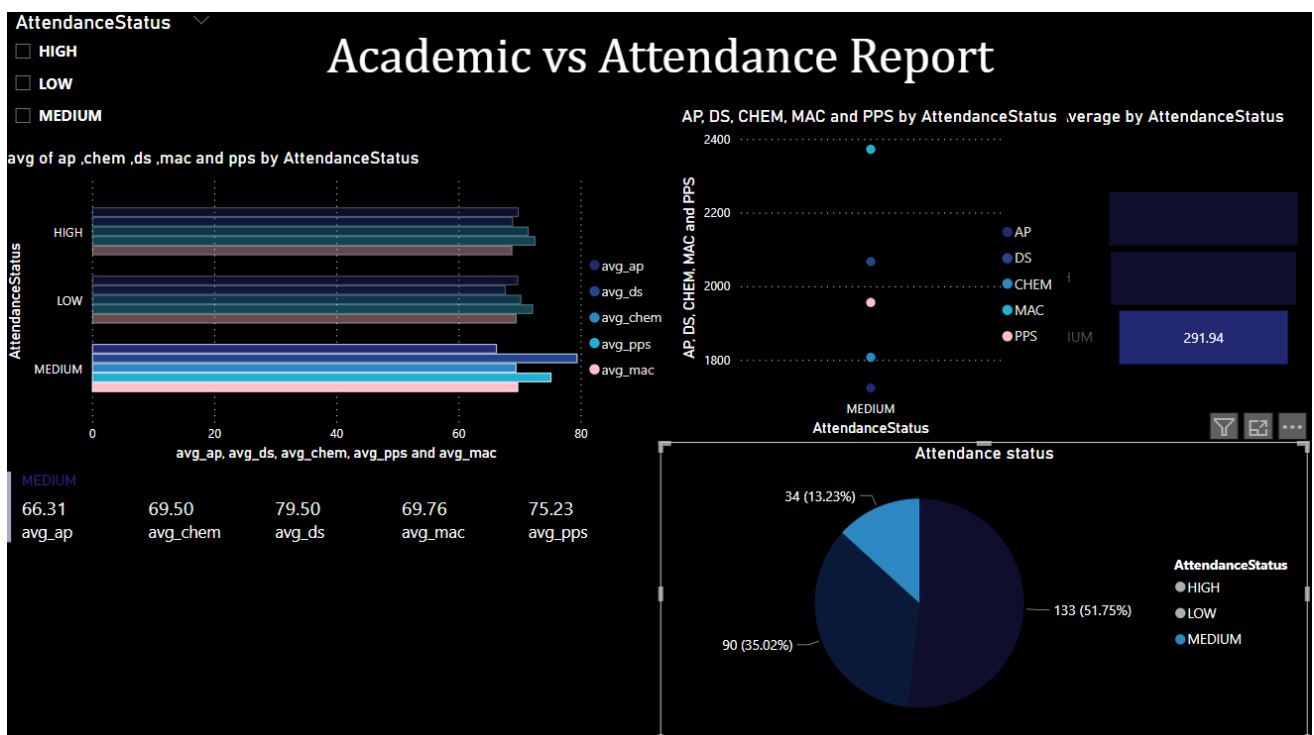
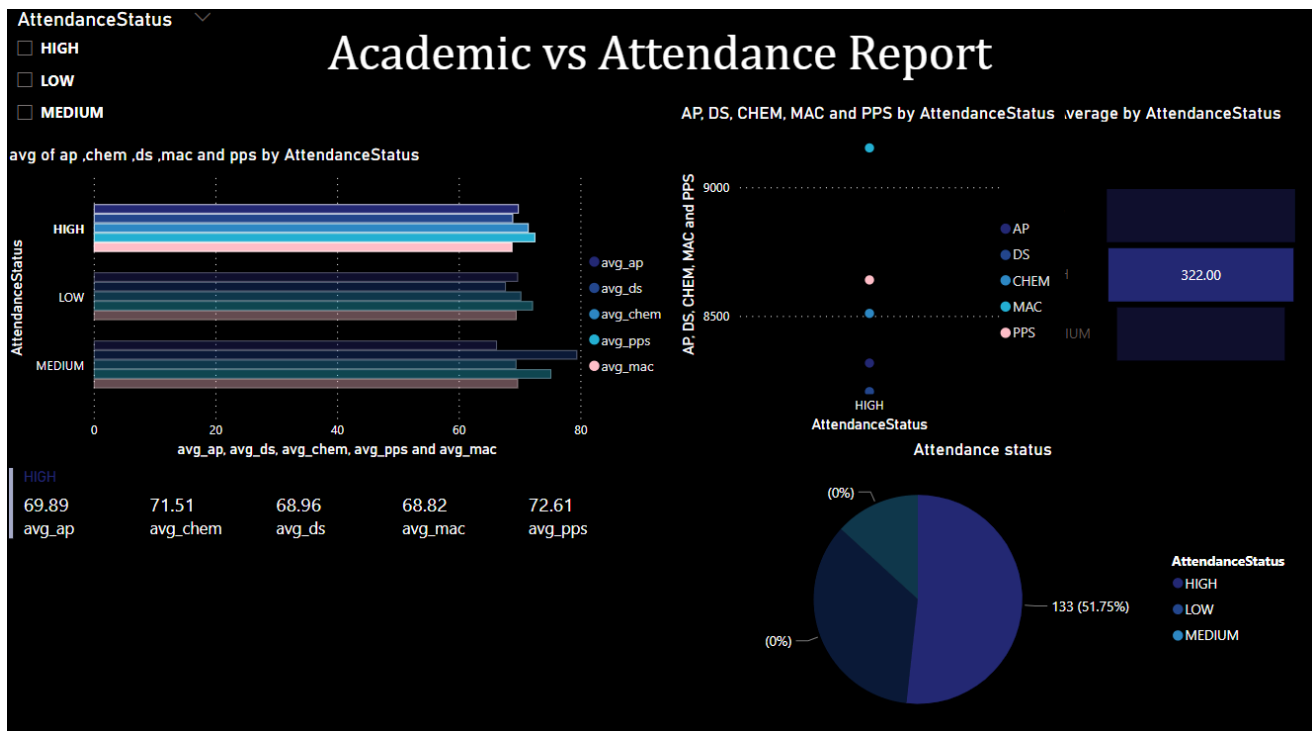


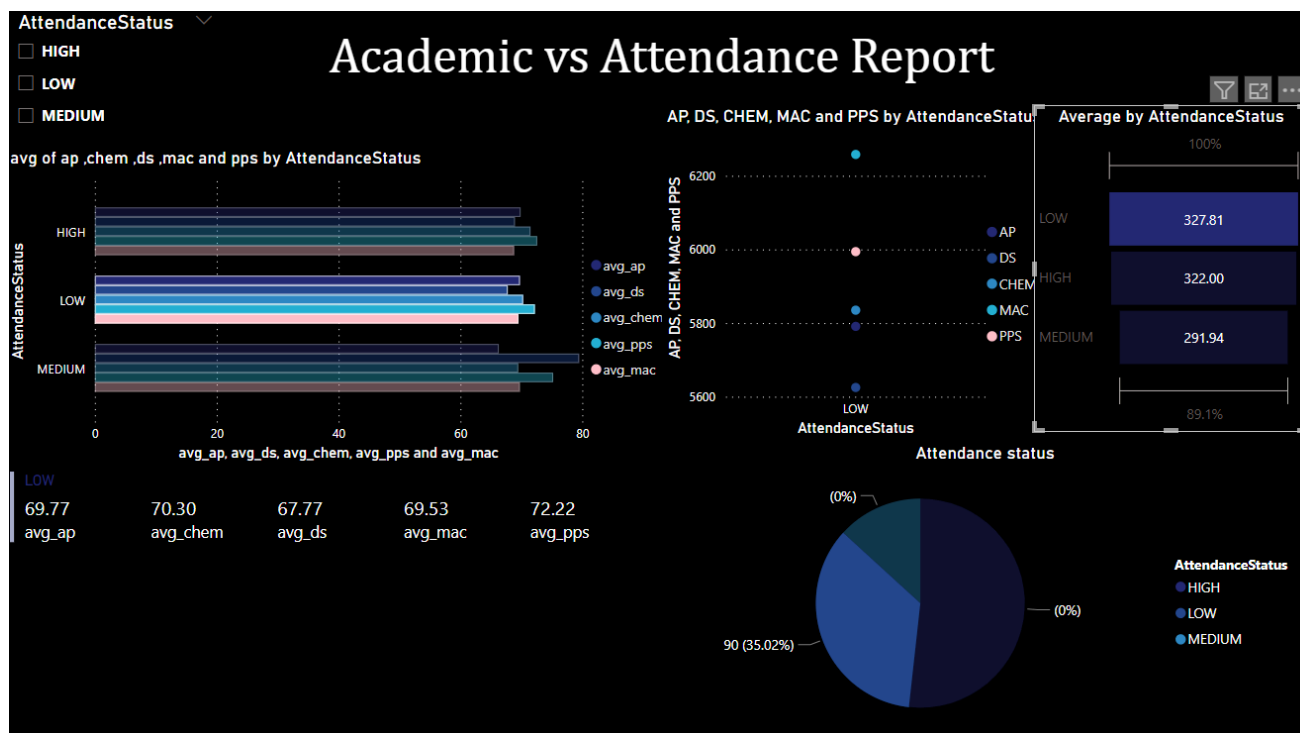


MODULE 3 : ACADEMICS SUCCESS Vs ATTENDANCE

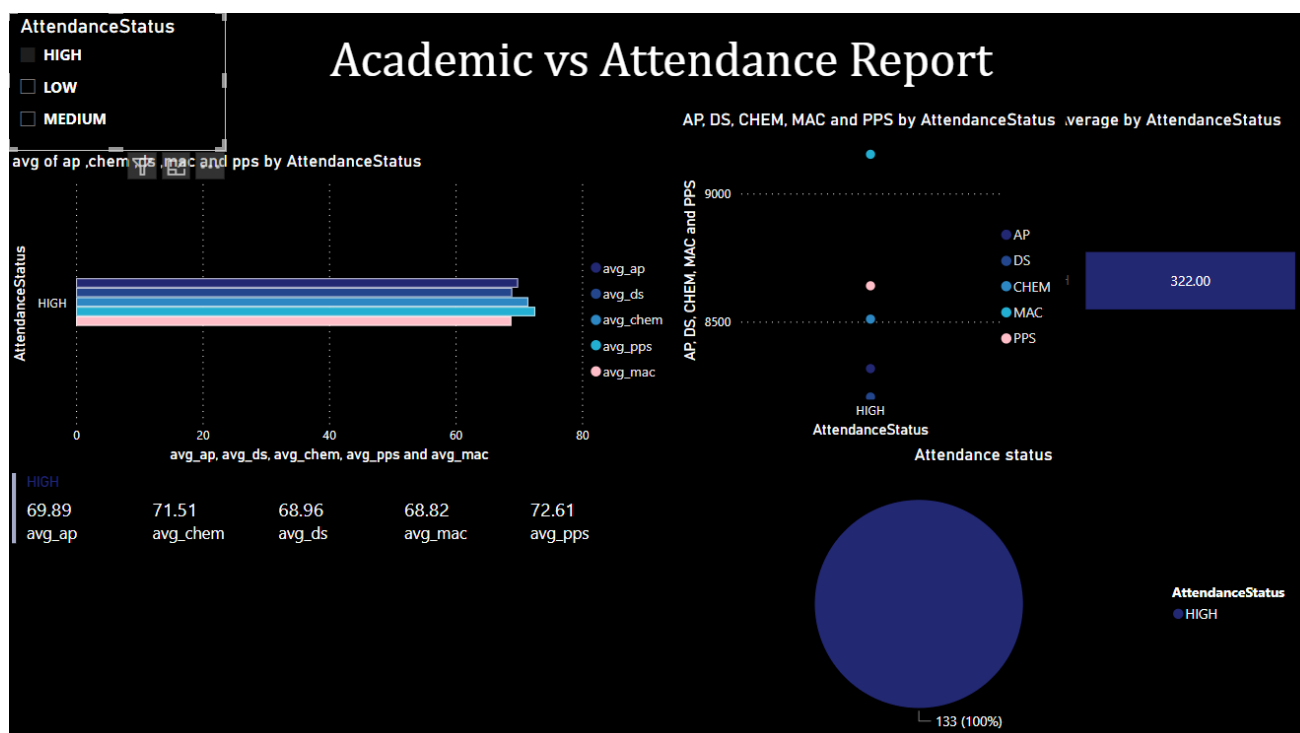


Dynamic charts:





Using slicer:



Conclusion

In conclusion, this data visualization project conducted in Power BI has successfully addressed the complexities of student performance analysis by leveraging the platform's robust features and capabilities. The comprehensive dataset, encompassing academic scores, attendance records, extracurricular activities, and demographics, allowed for a thorough exploration of patterns and correlations within student data.

The key visualizations, ranging from bar charts and line graphs to pie charts, have been strategically employed to highlight trends and factors influencing academic outcomes. The interactive dashboards and dynamic reports go beyond traditional static visualizations, providing educators with a real-time, immersive, and responsive analytical experience. This dynamic approach enhances the interpretability of student performance trends, enabling educators to explore data nuances, identify patterns, and make informed decisions on the fly.

Moreover, the incorporation of predictive modeling within the Power BI framework adds a forward-looking dimension to the analysis, allowing for the forecasting of future student performance. This predictive capability equips educational stakeholders with valuable insights for proactive decision-making and intervention strategies, ultimately contributing to the continuous improvement of the academic experience for students.

The proposed Data Visualization System represents a significant advancement over traditional methods, offering a more agile and responsive tool for understanding and acting upon student performance. By empowering educators with evidence-based insights derived from Power BI visualizations, the system facilitates informed decision-making, and intervention strategies, and, in turn, contributes to the overall enhancement of the academic journey for students. As we embrace the shift from static to dynamic visualizations, this project underscores the importance of technology in transforming data into actionable knowledge within the realm of education.

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- [5] Visualization types in Power BI:
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