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Data Visualization in Tableau Using a Hypothetical Dataset

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Abstract

This article examines how students can play and visualise their hypothetical data on Tableau and learn data-driven decision-making by creating a dashboard. The objective is to apply data visualisation concepts on Tableau to a real-world business system in a way that leads to pragmatic business decision-making. This article teaches students to clean, organise, analyse, and build a dashboard on Tableau and identify and interpret the ramp-up/ramp-down patterns in the data. This article indicates that the exercise effectively teaches skills in Tableau visualisation and raises awareness of important aspects of dashboard design. The Author emphasized that data patterns and trends can only be understood when we have a solid understanding of the domain/business system and its behaviours. Furthermore, students reported and largely observed that the exercise was useful and interesting and met the learning goals.

Keywords

Tableau, Visualisation, Data-driven decision-making, Dashboard design, Data patterns and trends

I. Introduction

Data visualisation is embraced by organisations and even individuals enthusiastically like never before because it is envisioned as a complementary tool of data analysis that helps to identify relationships. Organisations have realised that understanding the essence and patterns of massive data through visual forms is essential for better business decision-making. In today's tech-savvy world, data emerges across industries ranging from construction, telecom, banking, information and communication technology (ICT), educational institutions, manufacturing, etc. Therefore, organisations seek better data visualisation tools and knowledge to make their essential information load easier to understand. Tableau data visualization presents information or data through visuals in different pictorial representations. Over the centuries, it has been human nature to represent things in a graphical form, and our ancestors have used visualisations such as charts and maps to understand information more quickly and easily. We know that a single diagram speaks a thousand words; moreover, the human brain recognizes visual data more rapidly than textual data and numbers. We see the accumulation of data in different forms daily, so the crucial step to draw inferences out of it is to visualise

with a Tableau system. It helps the decision-makers determine the relevance and crux of data from the large chunk of variables and communicate the concepts and themes succinctly. There is also a higher level of data visualisation dynamically called interactive visualisation. This method goes one step ahead of the standard data visualisation with Tableau. It moves beyond the display of just static data representation. Instead, it interacts with the users, changing the data immediately and letting them know how it is processed. Many science branches view data visualisation as a typical modern business communication equivalent (Roy 2019). In data visualisation, we can create a visual representation of information or data and study the behaviours and characteristics of the variables. Further, Roy also says that Tableau is a powerful and effective data visualisation tool in business intelligence, business analytics, and the data analytics industry. She further clarifies that Tableau helps simplify raw data into a new format that is easy to understand and grasp. In real-time scenarios, raw data is unavailable in a form we can directly visualise or model. Tableau helps us clean, transform, and modify the raw data in a user-required form to visualise and model. "Data visualisation is the graphical representation of data and information," the Author says further; she also elaborates that data visualisation tools help us to discern and understand data trends, patterns, and insights. Data analysts, data scientists, data engineers, business intelligence developers, etc., extensively use advanced visualisation tools to deal with large volumes of data that help employees interpret and analyze information or data more effectively. In today's business ecosystem, data are accumulated extensively in organisations; therefore, it is an excellent opportunity for them to convert an intelligent business decision-making system from it. Though the available business intelligence tools cater to certain types of decision-makers, Tableau helps to visualise the data to make business analytics insights available to a broader audience. On the other hand, organisations compete to develop better and faster visualisation tools to suit industry customization. Generally, the best way to analyze a problem is to represent its data visually. Humans take more time to understand data encoded in texts and numbers than visual representations. Data is the raw material in this data-savvy world, and decisions are data-driven; hence, data visualisation tools and techniques are essential to analyse and interpret data. Data dashboards are imperative to monitor the performance of projects, programs, teams, organisations, and all other stakeholders of business systems for evidence-based decision-making. Organizations' performance can be tracked effectively and agilely through attractive dashboards and provide timely intervention if necessary. Data dashboards provide a brief system overview and facilitate decision-making more easily. Data visualisation is interacting with raw data to understand meaningful patterns, trends, and insights by transforming them into a visual context. Data visualization helps users understand and see the data in any form, like tables, graphs, charts, maps, images, patterns, movies, etc. According to Shuai et al. (2019), Tableau is a business intelligence tool that cleverly develops and implements data visualisation. Moreover, the Authors also elaborate that Tableau tools help visualize data and share information more intuitively, prune the information and impress the learners more deeply. In tandem with this, Mahatma et al. (2018) say that Tableau is a business intelligence and data analytics tools product that produces interactive data visualization dashboards using a drag-and-drop interface with a powerful data engine. Therefore, in data visualisation, visual elements like charts, graphs, maps, etc., are used to visualise data to discover unknown facts, insights, outliers, trends and patterns, and relations. As a result, it enables users to visualise, draw insights and understand the data better. It can turn small and large datasets into visuals; datasets and data visualisation tools are the key elements of data visualisation. According to H.S. Saini et al. (2022), "Tableau", "Zoho Analytics", "Looker", and "IBM Cognos Analytics" are the commonly used data visualisation tools. The Authors further explained that Tableau offers diverse products such as Tableau Desktop, Tableau Public, Tableau Reader, Tableau Server, and

Tableau Online. Tableau can be connected to files, relational and big data sources, and users can create and distribute interactive and shareable dashboards. Data visualisation mainly aims to represent large datasets visually to quickly understand the hidden relationships within data (H.S. Saini et al. 2022). The Authors also say that Tableau helps analyse, interpret, and predict data. Moreover, Tableau enables users to transform every data element into interactive charts and pictures, making analysis more effective. In addition, the Authors say that scientific visualisation, informative visualisation, and business intelligence data visualisation are extensively used. Most visualisation tools generally come with connectors to data sources like relational databases, Hadoop, and cloud storage platforms. These tools pull data from these data sources and apply graphics to them. Tableau is a data visualisation tool without a programming language that can be connected to various data sources. The reason for the growing popularity of Tableau is its ability to translate data into insightful visual dashboards. Tableau is a strong, safe, end-to-end analytical, easy-to-learn platform; anyone without coding knowledge can easily learn Tableau. The Authors further on, saying that different versions of Tableau are available, and Tableau Public is a free version where files cannot be stored in the system. Tableau Desktop is a licensed version; files can be stored in the system. Tableau reads data from multiple types of data sources and supports a variety of data file formats. Tableau also supports many database interfaces for importing data from online servers. Tableau extracts the header automatically from the imported dataset. When the data users drag and drop these headers into rows and columns and then choose a chart type, the graph is generated immediately. These flexible and interactive graphs in Tableau help to analyse data characteristics from various perspectives. Tableau has many data source options that help us connect and fetch data. It supports many data sources, including on-premise files, spreadsheets, relational databases, non-relational databases, and data warehouses. Moreover, Tableau can securely connect to any data source, and we can merge data from multiple sources to create a combinational view of data. Tableau has plenty of visualisations, including basic visualisations like bar charts and pie charts and advanced visualisations like histograms, Gantt charts, bullet charts, motion charts, tree maps, boxplots, etc. We can select the type of visualisation easily under the visualisation type from the Show Me tab. Similarly, Tableau has a comparative advantage in using multiple large datasets in interactive dashboards to create charts that help the users to drill down in identifying the ramp-up/ramp-down behaviours in the data. Data analytics has become a specialized and powerful tool for business ecosystems to get the spotlight and acquire mainstream status in the 21st century. Business systems that have accumulated large chunks of data from their business transactions differ greatly in their capabilities to extract business patterns and insights from this data (Heart et al. 2021). Similarly, Lu (2020) opinionated that easily and readily accessible/available data escalates the interest in data-driven decision-making approaches in business systems. Furthermore, Klee et al. (2021) discuss that businesses are aware that data sources are the origin to proceed further; however, synthesising them is key to value creation. That means before visualising/modelling the data, we must merge and clean it thoroughly to cater to the needs of the questions we want to answer. Organisations should attract and retain top talent capable of analysing and presenting the data effectively to the decision-makers to be competitive and get an edge over their competitors. Therefore, data analytics skills at higher education levels are essential (Shawver and Shawver 2020). In this regard, today, many universities are offering numerous programs for data scientists and data analysts. The programs comprise students' multiple stages of academic levels starting from undergraduate, post-graduate, etc. Organisations expect their workforce to have adamant data modelling, visualisation, and mining skills to succeed as a scientific workforce. Many topics in data science/data analytics have been taught for years; however, their increased use in real-world applications requires a new focus. Data science/data

analytics adds value to organisations; therefore, training students at multiple stages of their academic curriculum is imperative. There are two learning objectives discussed in this article. The first is demonstrating visuals, filtering, forecasting, creating calculated fields, comparing fields by dragging onto columns/rows and building dashboards and stories. The second objective is to emphasise the focus on dashboard design. Moreover, the main attention is to select elements for the dashboard that are of paramount importance in data-driven analytics decision-making and not aesthetics.

II. Benefits of good data visualization

According to Roy (2019), the following are the main reasons business decision-makers use data visualisation.

- *Enhanced assimilation of business information*
- *Quick access to relevant business insights*
- *A better understanding of operational and business activities*
- *Rapid identification of the latest trends*
- *Accurate customer sentiment analysis*
- *Direct interaction with data*
- *Predictive sales analysis*
- *Drill-down sales analysis*
- *Easy comprehension of data*
- *Customized data visualisation*

Fig. 1 Author's illustration of the transformation of raw data into modelling

III. Data sorting

Sorting is essential in Tableau for analysing data. It assists us in arranging data in a required order, viz. ascending or descending or a combination of different features or factors. There are many ways to sort data in Tableau, and when we view visualization, data can be sorted using a single click from an axis, header, or field label. Data can be stored in Tableau's left-side footer's "data source" tab based on user requirements. Data is sorted using "data source order", such as "A to Z ascending", "Z to A descending", "A to Z ascending per table", and "Z to A descending per table" available in the "sort fields" option present in the option which is next to the "rows" option on the right-side top. In other words, data is sorted using the "sort fields" option after the data is connected with Tableau.

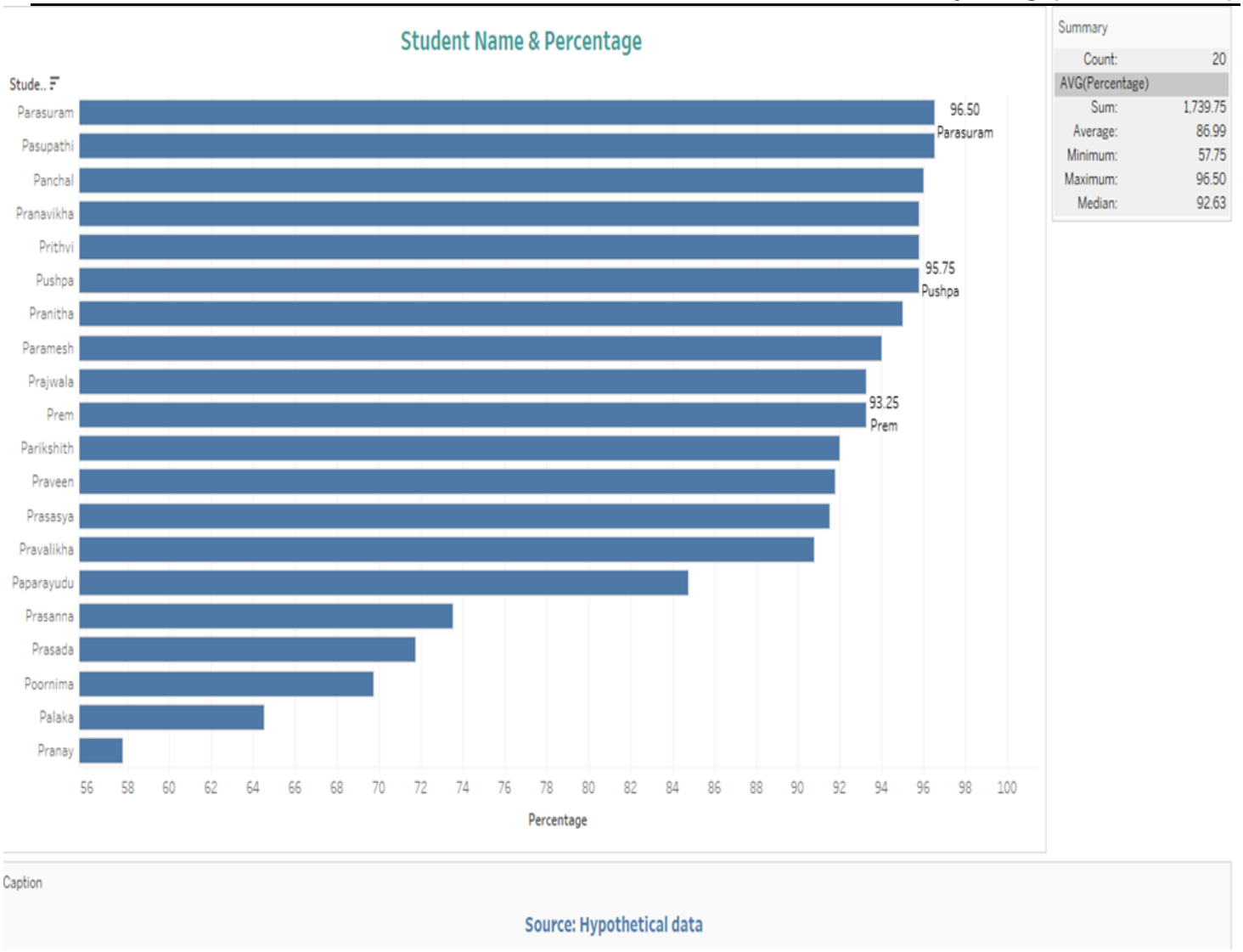

Fig. 2 Author's illustration with hypothetical data on horizontal bars of Tableau Public 2023.2

In Tableau, we can sort the data in four ways, such as "data source order", "Alphabetic", "Field", and "Manual". Choose any string variable from dimensions or measures on the Tableau and drag it onto any of the "Marks"; then it appears down to that pane; right-click on it, click "Sort", and then choose the customised features.

IV. Create calculated field

On top of the "measures" pane, an upside-down triangle symbol appears; click on it and choose "Create Calculated Field", then create the customised variable with the help of the existing variables. Creating a calculated field from the existing fields helps the user create a new variable that might help lucidly visualise the visualisation's data granularity.

V. Types of filters

In data visualisation and analysis, Tableau is one of the popular and essential tools that enables users to draw insights and patterns from a large chunk of complex and messy data. Tableau has the seamless capability to yield readable insights and simplified dashboards. Tableau has been instrumental to non-technical users for customised dashboards. Tableau filters help businesses extensively present insightful data to stakeholders and clients for better business decision-making. Tableau filters filter out sensitive data and share it only with those authorized people. Tableau filters change the information or content of the data that may enter a Tableau workbook, dashboard, or view. Tableau has multiple filter types, with each type having its different purpose. In Tableau, we can filter individual views or entire data sources based on dimensions, measures, or sets. Filtering is a helpful way in databases

that lets users see the required data. Visualising the data in a readable, understandable, adaptable, and actionable format assists business organisations in informed decision-making. Tableau filters help users to highlight any underlying patterns or insights from the data. Tableau filters work on a condition to limit the number of records in the database. Fig. 3 explains that the higher the percentage a student gets, the bigger the bubble size. In other words, the lower the bubble size, the lower the student percentage compared to other students in the dataset. Furthermore, Fig. 4 discerns an increase in the Maths marks; we can also draw an increase in the Physics marks, except for the Maths marks range between 58 to 65. In another way, there is a linear relation between Maths and Physics on average. Also, Fig. 5 elaborates on a single case of the dataset by applying the filter. Fig. 6 explains how to add an interactive filter to the view for a field, and it can be done by right-clicking on the field in the data pane and then selecting "Show Filter". In this way, Tableau filters help minimise the data dimensionality in a customised and efficient manner. Tableau filters organise and simplify data, like cleaning up underlying data conditions, removing irrelevant members from the data, setting the range of the data for analysis, etc. Additionally, Fig. 7 discerns a density plot for the linear relationship between Maths and Percentages. As we can see, with an increase in the Maths marks, there is an increase in the Percentage, which means, on average, we can say that a student who scores more in Maths is likely to get a better Percentage. Similarly, Fig. 8 ascertains a linear relationship exists between the Percentage and that of Chemistry, Physics, and Maths, which means all these three subjects contribute significantly to determining the percentage of a student over English, which has an inverse relationship with the Percentage. Here, we can expect that English cannot be a deciding subject to determine the percentage of a student, whereas the other three subjects are considered in doing so. Moreover, Fig. 9 and Fig. 10 illustrate a dual axis for the variables' relationship.

Fig. 3 Author's illustration with hypothetical data on packed bubbles of Tableau Public 2023.2 for Percentage and Student Name

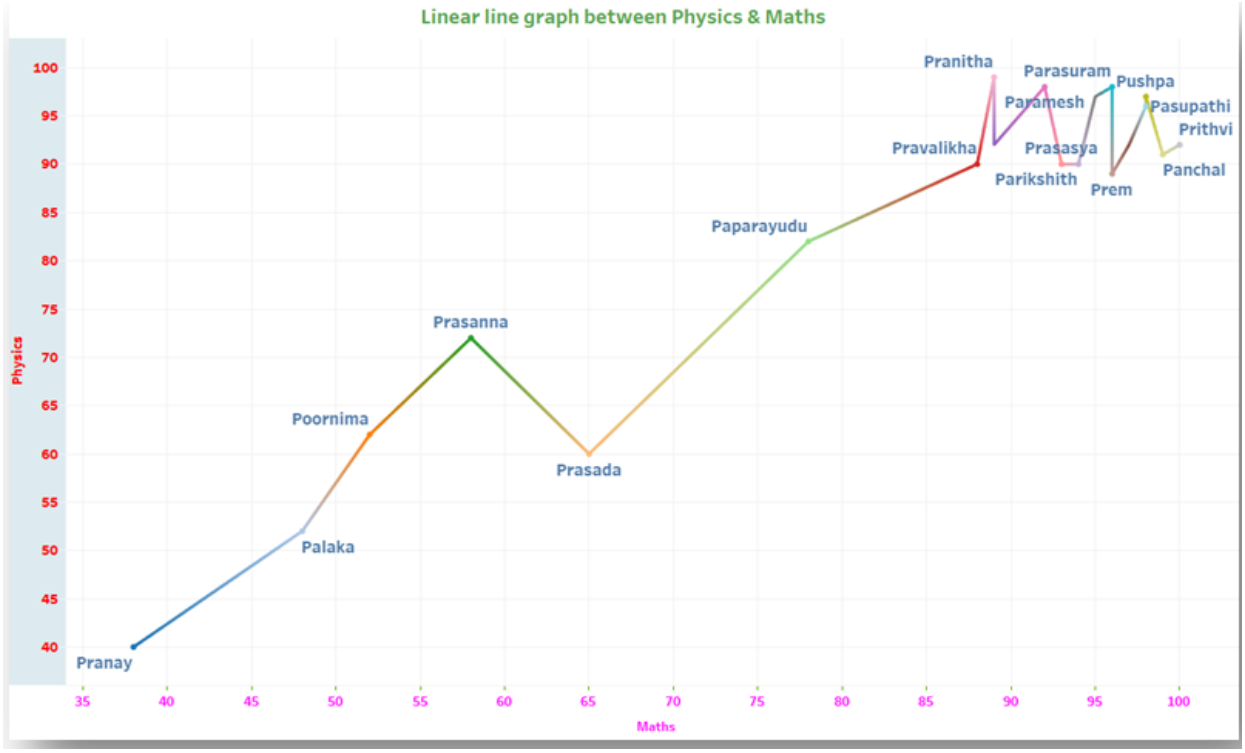

Fig. 4 Author's illustration with hypothetical data on Tableau Public 2023.2

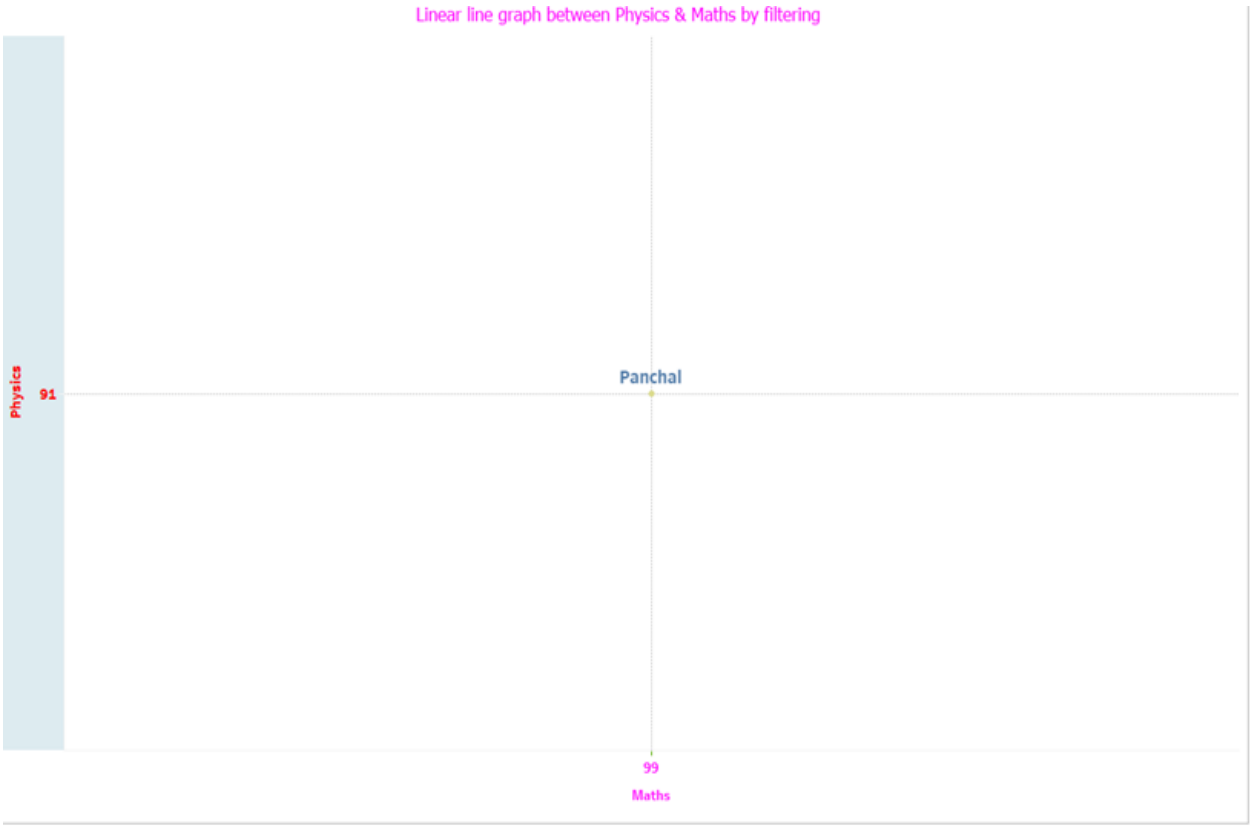

Fig. 5 Author's illustration with hypothetical data on Tableau Public 2023.2

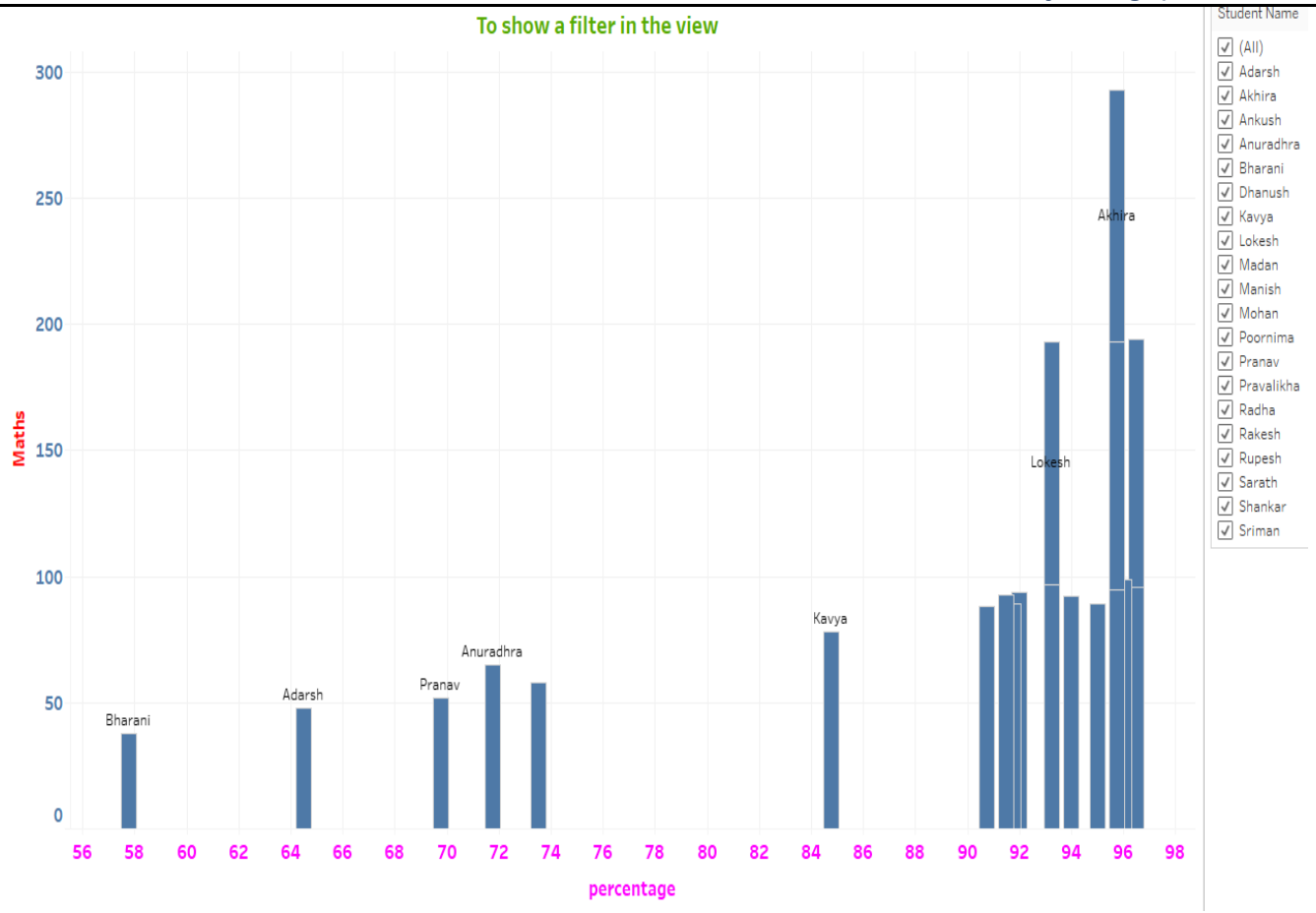

Fig. 6 Author's illustration with hypothetical data on Tableau Public 2023.2

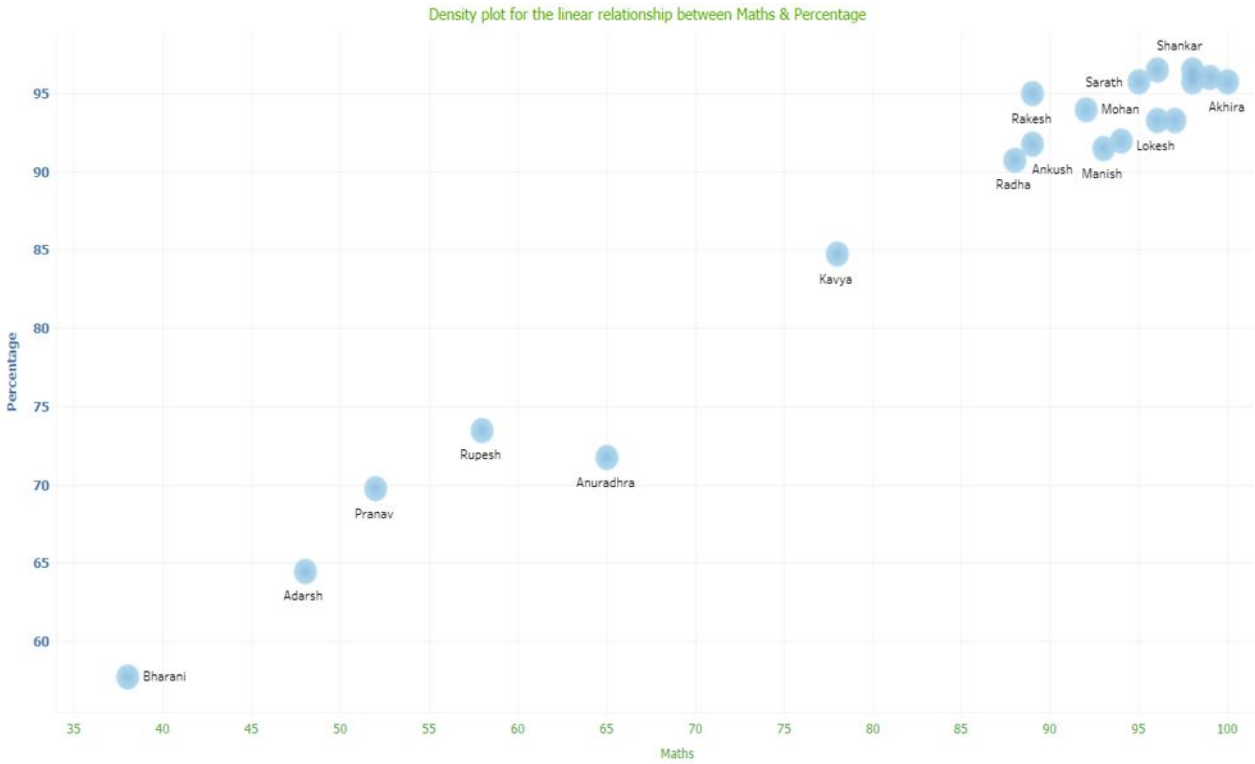

Fig. 7 Author's illustration with hypothetical data on Tableau Public 2023.2

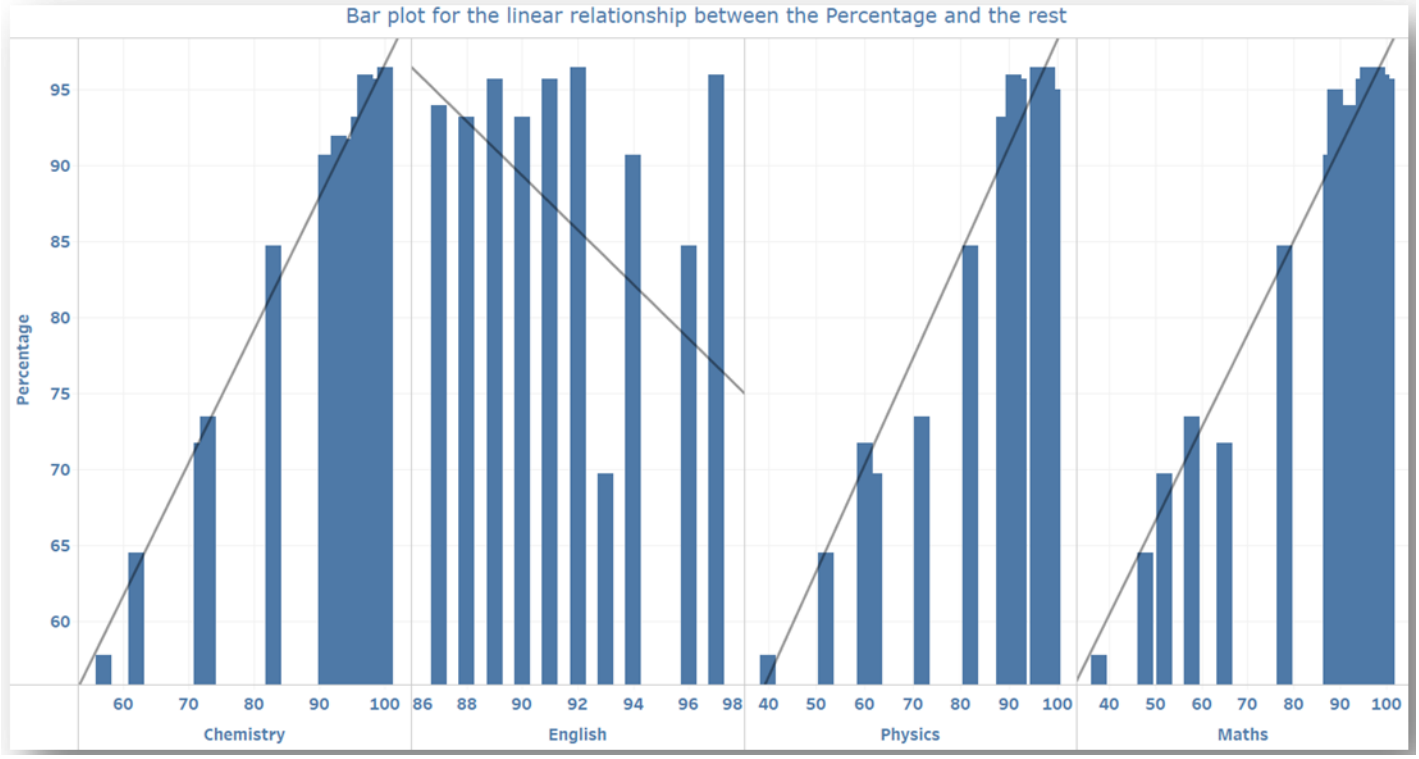

Fig. 8 Author's illustration with hypothetical data on Tableau Public 2023.2

VI. Chart types

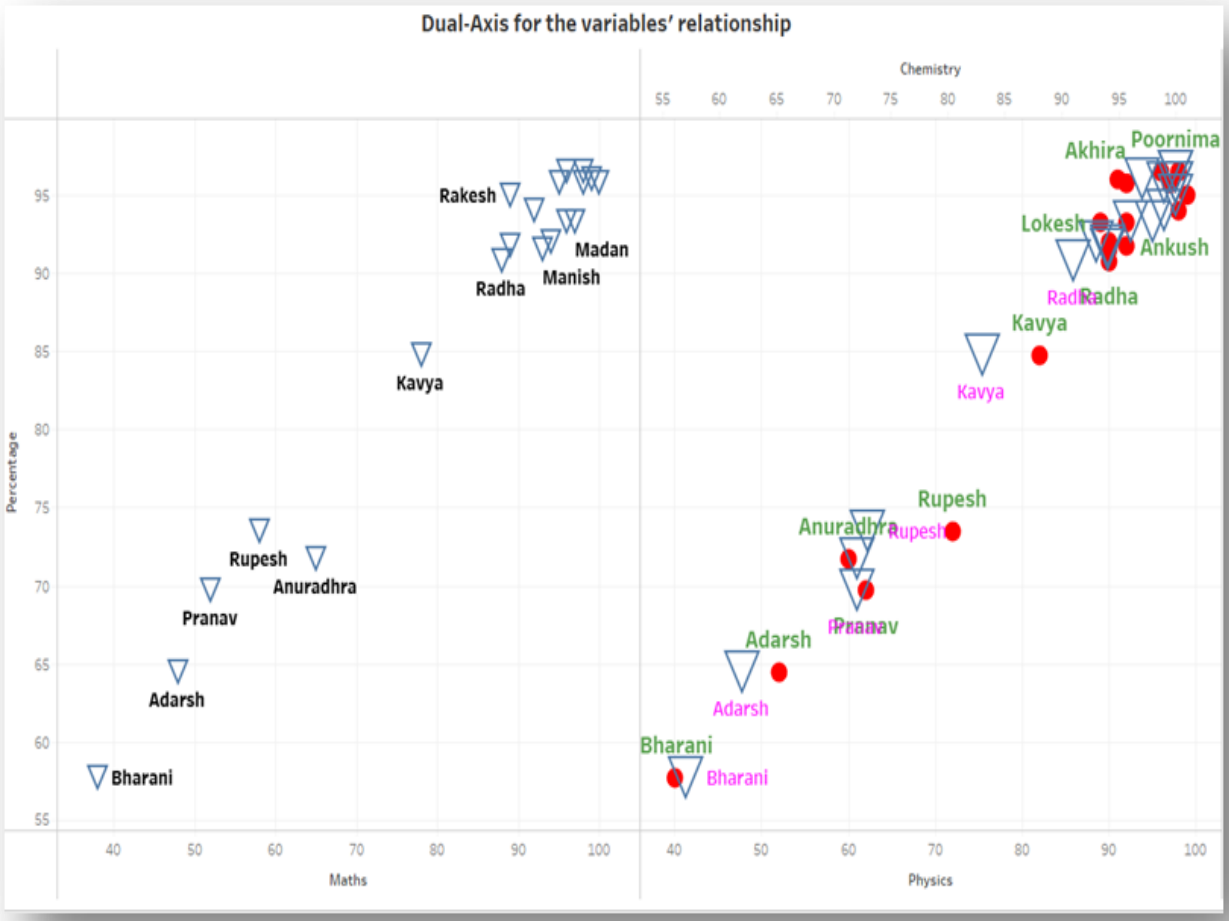

Fig. 9 Author's illustration with hypothetical data on Tableau Public 2023.2

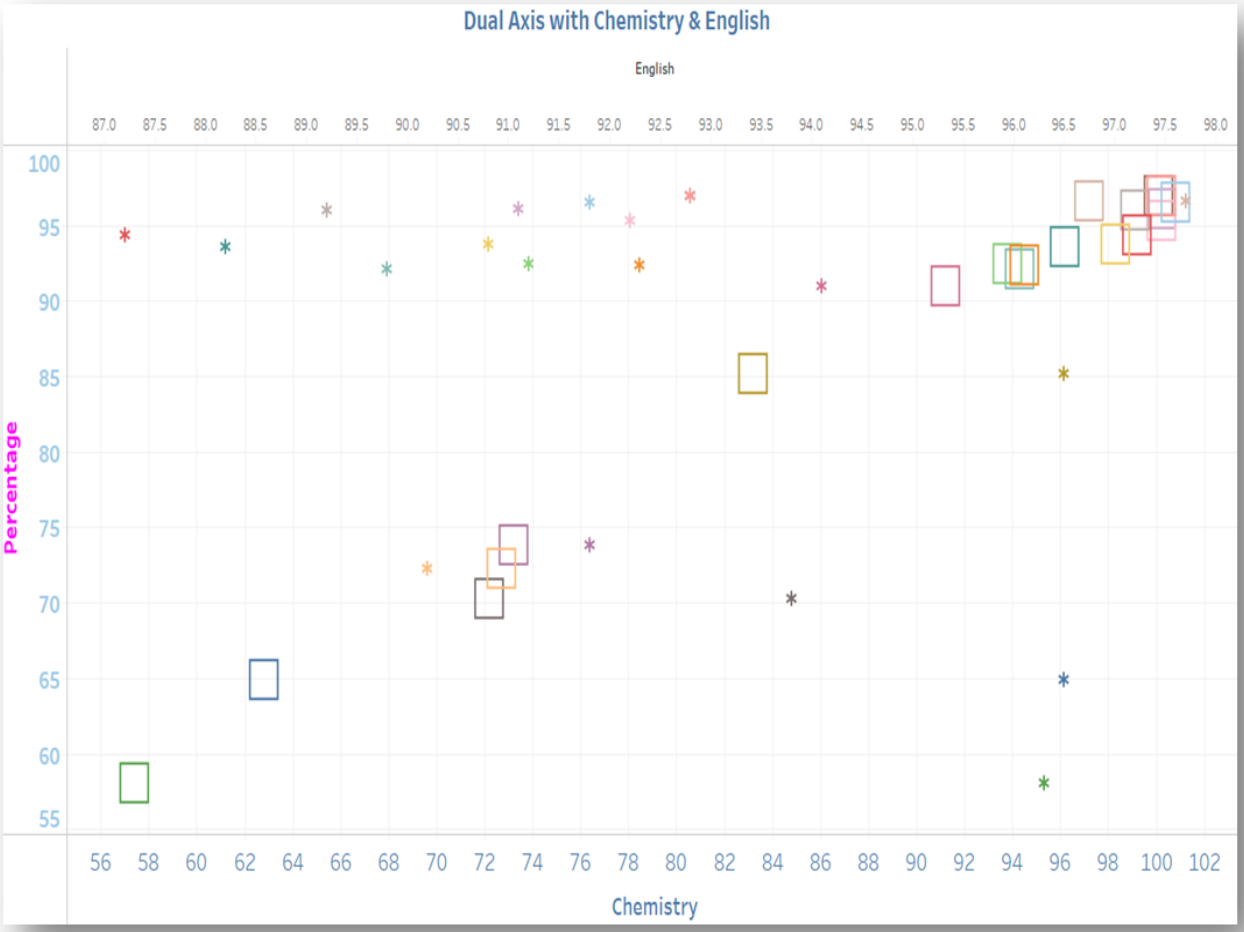

Fig. 10 Author's illustration with hypothetical data on Tableau Public 2023.2

VII. Discussion

This exercise extenuates students' strenuous perception of playing with data visualisation in Tableau and galvanises them to plot a hatch for seamless execution of their data visualisations. The explanations given in the exercise for different visualisation plots will benefit novice learners better. The entire exercise was carried out on hypothetical data; however, the modus operandi could also be applied to a real-time context. The Author encourages the students to spend quality time manoeuvring with different datasets and observe the ramp-up/ramp-down patterns. More light has been thrown on how a novice learner can drag-drop the variables through a user interface system on Tableau and draw insights quickly. The objectives of this article were met, and the Author encourages the learners to explore further and add more nuanced variants of data visualisation to their projects.

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Additional online resources

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https://public.tableau.com/app/discover/viz-of-the-day