Analysis of Selected Business Intelligence Data Visualization Tools

Andrea Toic, Patrizia Poscic, Danijela Jaksic
Faculty of informatics and digital technologies
University of Rijeka
Radmile Matejcic 2, Rijeka, Croatia
{atoic, patrizia, dsubotic}@inf.uniri.hr

Abstract. *This paper presents a detailed overview of business intelligence and analysis tools that enable data-based decision-making. There are many self-service tools on the market today, and the paper compares three that were named leaders in Gartner's 2022 report: Power BI, Tableau, and Qlik. The research aims to compare these tools based on defined criteria and show their advantages and disadvantages, with a special focus on the use for educational purposes.*

Keywords. Business Intelligence, BI tools, data Analytics, Data Visualization, Data Reports, Qlik, Microsoft Power BI, Tableau

1 Introduction

In 2021, 79 billion terabytes (TB) of data were created in the world, which is 60 times more than the amount of data produced in 2010 and 6 times more than in 2017 (Statista Research Department 2021). To discover those relevant to their business in this sea of information, companies have begun a business analytics-oriented business transformation to meet the demands for faster and more comprehensive access to data, related analytics, and insights (Vesset et al. 2020). Unlike many other IT areas, business intelligence and analytics services continued to grow exponentially despite the pandemic. Faced with the new situation, organizations are turning to insights and intelligent automation solutions to maintain positive business continuity despite the COVID-19 crisis (Hamel 2021).

Nearly 50% of McKinsey study respondents agreed that analytics and Big Data have fundamentally changed the way things work in sales and marketing across all organizations (McKinsey Analytics 2018). Despite the increase in the number of tools designed to facilitate data collection, transformation, and processing, many companies are still unsure how best to handle them and whether they get feedback from data and analytics (Cardoso et al. 2020). Managers require information in the decision-making process, but research shows that, despite the information available, business decisions are still often made based on feelings and experience (Delen, Moscato, and Toma 2018). Companies maintain market competitiveness by using predictive analytics to predict maintenance and performance problems before they become larger and riskier (KPMG 2019).

The "rule of thumb" is gradually giving way to decision-making based on insights gathered from predictive analytics. Self-service is a group of BI and analytical tools that allow users to perform data processing and analysis without having a statistical and technological background. Data visualizations provide a clearer insight than the classic, tabular presentation from which it is difficult to identify relevant, hidden information in the data and improve the decision-making process and strategic planning. This lowers operating costs and enables higher profits thanks to accurate analysis and forecasting (Zhao Yifan 2021). Over the next five years, Cloud computing, Internet of Things (IoT), and artificial intelligence / machine learning (AI / ML) are projected to have the largest impact on enterprise analytics initiatives, with 65% planning to increase their analytics spending (MicroStrategy 2020). The result is a departure from traditional BI platform markets and a focus on data science, machine learning software, and cloud data analysis tools. Business intelligence in the cloud provides an agile way to access BI applications. Most tools on the market also offer their service in the cloud, which allows availability on multiple devices and a web browser, reduces costs and allows better accessibility and faster implementation so the need to access data anytime and anywhere is becoming a top priority for business leaders. According to Gartner's 2020 study, by 2025, data stories will be the most widespread way of consuming analytics, and 75% of stories will be automatically generated using extended analytics techniques (Richardson et al. 2020).

Based on an analysis of business software solutions for 2021, Gartner (Richardson et al. 2021) and Forrester (Evelson et al. 2021) ranked business intelligence tools by customer ratings and unbiased methodology.

The latest report for 2022 shows that for the second-straight year, there are again only three tools in the Leaders quadrant - Microsoft Power BI (Power BI documentation n.d.), Tableau which is now a part of Salesforce (Tableau n.d.), and Qlik (Qlik Help n.d.).

This paper seeks to facilitate the selection of the most appropriate of these tools for business intelligence and analysis based on selected criteria, with a special focus on educational usage.

The paper is organized as follows. Section 2 describes Business Intelligence and Analytics. Section 3 contains Related work. Section 4 is about the Power BI tool in general, section 5 is about Tableau, and section 6 is about Qlik tool. Section 7 explains the evaluation criteria used in this study and presents a comparison of tools. Section 8 explains the Future work and Conclusion.

2 Business Intelligence and Analytics

Business intelligence (BI) refers to a set of methods, technologies, and related tools that help gather essential information from a wide range of unstructured data and transform it into actionable information to improve business decision making (Niu, 2021).

Business analytics (BA) uses methods and tools that are faster and more technical than business intelligence, such as data mining, regression analysis, correlation analysis, segmentation, text mining, modeling, and machine learning (Zhao Yifan 2021). In other words, BA is the process of using quantitative methods to extract meaning from data to make more informed business decisions. Advanced analytics through data preparation using machine learning (ML) and artificial intelligence (AI) simplify the creation and explanation of the visualizations obtained, especially thanks to the ability to create queries in natural language (Richardson et al. 2021). For meaningful interpretation and discovery of values from their temporally, spatially, and hierarchically variable forms, Big Data requires real-time analytics (Özdemir and Hekim 2018). Big Data analytics that can be visually presented and interpreted is a management tool for gaining a competitive advantage when making strategic decisions that increase the company's value and revenue (Akter et al. 2016). This change has led to more efficient, accurate, and objective decision-making.

Business intelligence and Analytics (BI&A) is a subfield of decision support systems (DSS) that seeks to turn more data into deeper insight (Phillips-Wren, 2021). DSS are based on artificial intelligence techniques and use data and models to help analyze the problem through visual representation. Data analysis provides an understanding of specific data handling approaches and techniques that include data visualization, research, discovery, or a combination of these approaches. Techniques that support data analysis (Orlovskyi and Kopp 2021) include Reporting, Dashboards, ad-hoc queries, OLAP, Data mining and machine learning, and Scorecards.

Data visualization is preceded by the process of data access, collection, and transformation. The Extract Transform Load (ETL) pipeline is a vital procedure in the Business Intelligence (BI) workflow. It is the process of structuring data for querying or analysis (Machado, 2019).

Working with data is becoming more accessible to a wider audience thanks to the natural language queries (NLQ) implemented in the tools. Self-service tools for analytics and business intelligence mostly have similar features and are no longer compared only based on the ability to create interactive dashboards and key performance indicators (KPIs) but also on how well they support extended analytics.

3 Related work

The Gartner Magic Quadrant is a report on qualitative market research aimed at ranking and evaluating technology suppliers and facilitating the selection of the right tool. The 2022 Magic Quadrant for Analytics and Business Intelligence Platforms report by Gartner assessed the strengths and weaknesses of the 20 most important service providers based on their ability to execute and completeness of vision. The graph is divided into four quadrants: niche players, challengers, visionaries, and leaders. Microsoft Power BI, Tableau (Salesforce), and Qlik took the leading positions in it (Richardson et al. 2021).

Fifteen BI tools were compared with a brief analysis of technical details, the advantages of using business strategy, and testing the features of these BI tools was conducted based on data from twelve different review rating websites so that business users could choose the best tool for the organization (Srivastava et al. 2021). The comparison concluded that Kyubit is the best and most adaptable tool for organizations.

In (Oliveira and Bernardino 2020) the authors compare 5 free solutions including the three most popular free but Closed source solutions (Power BI Free, Qlik View, and Tableau Public) and two open-source solutions (Metabase and Pentaho). The comparison criteria were selected based on 15 critical Self-Service functions according to Gartner and the recommendations of the Predictive Analytics Today Research website. After comparing a set of free features, it turned out that all three Closed source solutions offer more functionality at no cost to SMEs that analyse their data.

A survey on business intelligence tools for marketing, transportation, and financial services presents a comparison of the tools Tableau, Power BI, Pentaho, QlikView, and Micro Strategy Analytical Express (Chavva, Sangam, and Rao 2019) concluded

that Pentaho is the best tool in terms of data processing and services.

Tableau, Power BI, Sisense, and Qlikview (Lousa, Pedrosa, and Bernardino 2019) were compared based on the criteria from (Caldarola and Rinaldi 2017).

Based on the analysis, it was concluded that the choice of the most appropriate tool depends on the type of organization, but that Tableau and Power BI are the leading tools in the field of visualization.

The authors reached different conclusions, which shows that all tools have many commonalities and that nuances play a role in choosing the best tool for a particular type of business. In the fifth chapter, comparisons are made according to the most important criteria for use in education.

4. BI tools

The following subsections provide a brief overview of the history, versions, and functionality of the BI tools that are ranked best in Gartner's Magic Quadrant - Power BI, Tableau, and Qlik.

4.1 Power BI

Power BI (Power BI Documentation, n.d.) was conceptualized by Ruler and Dhers Netz of the SQL server coverage services team at Microsoft, and the first version was released in 2015. It was originally designed as an add-on to Excel, but due to a significant increase in functions, the tool was launched as a separate application based on Power Query, Power Pivot, and Power View concepts from Excel.

Power BI offers the following products: Power BI Desktop (free application) and Power BI Service (SaaS segment used to collaborate and distribute Power BI reports) for creating visualizations and reports. Power BI Report Builder is a tool for creating paginated reports published to Power BI services, and Power BI Embedded is a service to embed visuals, reports, and dashboards into an application. Users can view on-premises Power BI reports on Power BI Report Server and all these reports and dashboards are also available in the Power BI mobile apps.

Microsoft does not offer customers a choice, so the tool is only available as a SaaS service running in the Azure cloud. Power BI is currently available as part of the Office 365 E5 Cloud suite of applications, which has given it a huge market reach. By integrating tools into Microsoft Teams, users can access data and dashboards from a centralized location and make business decisions together with co-workers.

4.2 Tableau

Tableau (Tableau n.d.) is one of the oldest self-service platforms for visual analytics, founded in 2003 in Mountain View, California. In 2019 the company was bought by Salesforce. Co-founders Chris Stolte, Pat Hanrahan, and Christian Chabot developed and patented the VizQL, a visual query language that allows users to create and customize visualizations more than any other BI platform. Through a graphical interface, the tool converts user drag-and-drop actions into database queries, giving non-technical users the ability to create custom dashboards quickly and easily.

The Tableau platform supports the entire cycle from access and data preparation to analysis and sharing. Tableau data analytics can be divided into two categories, developer tools, and sharing tools. The developer tools include Tableau Desktop and Public, which are used to develop dashboards and create reports, visualizations, and charts. Sharing tools include Tableau Online, Server, and Reader whose function is to share existing visualizations and reports. In addition to computer versions, there are also mobile Tableau iOS and Android applications that allow users to monitor dashboards from mobile devices.

4.3 Qlik

Qlik (“Qlik”, n.d.) was founded by Staffan Gestreliu and Bjorn Berg in 1993 in Sweden and offers two BI tools on the market, traditional Qlik View and modern data exploration platform Qlik Sense. QlikView is used for providing analytical solutions, data visualization, delivering insights, and for business growth and monitoring. It is also used to generate models, applications, and dashboards for data analytics, and for understanding the data trends. On the other hand, Qlik Sense is the next version of QlikView launched in 2014. Qlik Sense has some advanced features specifically used for visualizing and analyzing the data. It helps build interactive dashboards and reports, extract data from a variety of data sources, and thanks to expanded analytics enable better and more efficient data visualizations.

The Qlik Analytics Modernization Program encourages and helps existing Qlik View users to switch to Qlik Sense and use its next-generation BI capabilities.

According to Gartner’s research, Qlik’s market momentum remains the lowest compared to the other two tools. Although they provide customer support to existing customers when switching to Qlik Sense, many users choose to modernize their business by choosing competing tools (Richardson et al. 2021).

5 Comparison

To assess the potential of visualization tools for educational purposes and student projects, they were compared based on specific characteristics important to students and professors - prices and types of licenses, supported operating systems, storage capacity, existing training, certification, and community and user support. The most important thing for new users is the existence of an academic or trial

version of the tool and the availability of many learning materials and customer support.

A critical review of available tools for real-time information processing and their application in production was also conducted. The study of related works also identified several criteria for comparing the most sought-after functionalities based on the needs and requirements of the industry, which are compared in subchapter 5.6.

5.1 Prices and types of licenses

Tools were compared based on price and license duration.

The price for Power BI depends on the selected product. Power BI Desktop comes free if you are already licensed with Office 365. Power BI Pro (for collaboration, included in Microsoft 365 E5) and Power BI Premium (use for business purposes, includes auto scale and all the features available with Power BI Pro) are paid and most of the widely used functionalities are only available in the Premium version. Licenses are paid monthly per dedicated cloud compute and storage resource and the free trial period lasts 60 days.

While Microsoft offers a lot of features at a relatively low price, Tableau has a reputation for being expensive. Tableau Public is the free version of the tool with limited capabilities. Tableau license prices are not based on a standard model for the entire organization but the role of the user. Each role has a different level of access and rights. There are three types of users – Creator (includes Tableau Desktop, Tableau Prep Builder, and one Creator license of Tableau Server or Tableau Online), Explorer (includes One Explorer license of Tableau Online), and Viewer (includes One Viewer license of Tableau Online). Tableau offers to students a free one-year license, while start-ups get a 20% discount on the license price. Tableau Desktop trial lasts 14 days.

Qlik offers a choice of SaaS solutions for use in groups and teams or a multi-cloud solution to make the most of an organization's data analytics. Prices are fixed per individual and per month, and for users of Qlik View and Qlik Sense tools there is a reduced dual-use offer. The limited resource version is free, and the free business trial lasts 30 days.

Table 1. Price and license comparison

VERSION	PRICE	FOR
Power BI Pro	$9.99 per user/ month	For individuals
Power BI Premium	$20 per user/ month	For individuals
	$4,995 Per capacity/month	For Teams & Organizations
Tableau Creator	€70 user/month billed annually	For individuals, Teams & Organizations
Tableau Explorer	€42 user/month billed annually	For Teams & Organizations
Tableau Viewer	€15 user/month billed annually	For Teams & Organizations
Qlik Sense Business	$30/user/month, billed annually	For individuals, Teams & Organizations
Qlik Sense Enterprise SaaS	Price is individually negotiated	For Teams & Organizations

5.2 Operating systems

Table 2 lists the requirements that must be fulfilled by the target system to successfully install and run desktop versions of Power BI, Tableau, and Qlik Sense. Power BI and Qlik don't run on Mac while Tableau supports Windows and Mac OS.

Table 2. Hardware/software requirements

	Power BI Desktop	Tableau Desktop	Qlik Sense
OS	Windows 8.1 or later	Windows 8/8.1 or later, Mac	Windows 10 (x64)
Server	Windows Server 2012 R2, or later	Microsoft Windows Server 2016/ 2019	Microsoft Windows Server 2012 R2 /2016 /2019
RAM	2 GB min, 4 GB or more recommended	2 GB	8 GB min
CPU	1 gigahertz (GHz) 64-bit (x64) processor or better	Must support SSE4.2 and POPCNT instruction sets	Multi-core x64 compatible processors with AVX support

Table 3. Supported web browsers and mobile OS

	Power BI	Tableau	Qlik Sense
Web browser	Internet Explorer 11 or later	Chrome, Microsoft Edge, Mozilla Firefox & Firefox ESR, Apple Safari	Microsoft Edge, Google Chrome, Mozilla Firefox, Apple Safari
Mobile	iOS 12.2 or later or Android 6.0 or later	iOS 13 or later and Android 8 or later	iOS 14/, iPadOS 14 or later, Android 10 or later

All three tools can create data visualizations directly in a browser with data connectors and view them in the mobile app. Table 3 shows supported web browsers and mobile apps for Android and iOS.

5.3 Storage capacity

Capacity includes storing your own and shared reports to which the user is connected, dashboards, uploaded images, etc. Power BI is compatible with Microsoft Azure, Tableau is compatible with modern cloud platforms including Azure and AWS, and Qlik Sense offers a SaaS cloud product.

Table 4 shows the Cloud storage capacity of each of the tools depending on the license.

Table 4. Data capacity

	Capacity Type	Capacity
Power BI	Pro	10 GB
	Premium	100 TB
Tableau	Online	100 GB
Qlik Sense	Business	250 GB
	Enterprise SaaS	500 GB

5.4 Training

Microsoft Power BI, Tableau, and Qlik provide great learning opportunities officially for free to get started with the tools. Their websites provide links to documentation that includes a variety of tutorials, webinar recordings, and blogs with helpful tips on new features. All these programs offer academic programs and discounts.

While Power BI has one exam that covers all the main functionalities of the platform, Tableau and Qlik offer a wide range of certification options designed for specific professions.

Table 5. Available types of training

TRAINING	Power BI	Tabelau	Qlik
In-Person	No	Yes	Yes
Live Online	No	Yes	Yes
Webinars	Yes	Yes	Yes
Documentation	Yes	Yes	Yes
Videos	Yes	Yes	Yes

5.5 Community and Customer Support

Power BI is limited in terms of customer support and has a smaller community that is active on forums. Each year they organize a Power BI Summit with more than 100 sessions and regularly explain new features on the blog and Twitter. Training in the form of short videos on Youtube and personal lab training are also available.

Tableau has the most inclusive community and dedicated Customer support for questions related to the tool. Its inclusive community forum for discussions with over 220,000 users provides many resources and posts on forums and over 500 global user groups. Tableau organizes numerous conferences as well as virtual events such as the Tableau Live discussion panel.

The Qlik community consists of about 150,000 users and has an active forum. In addition to the Knowledge base, a Q&A chat with experts is organized every Tuesday, and once a month there is a Techspert Talks, a free webinar on important topics where experts answer questions. Qlik Fix is a series of short videos on various functionalities, and Support Chat, webinars, blogs, and articles provide answers in the way that best suits users.

Table 6. Customer support available

SUPPORT	Power BI	Tabelau	Qlik
Email/Help Desk	Yes	Yes	Yes
FAQs/Forum	Yes	Yes	Yes
Knowledge Base	Yes	Yes	Yes
Phone Support	No	Yes	Yes
24/7 (Live Rep)	No	Yes	Yes
Chat	Yes	Yes	Yes

5.6 Functions and functionalities

For a data analysis visualization tool to be at the forefront of an analyst's choice, the following criteria can be usually considered. Table 7 shows a comparison of tools and the leader of some category.

Techniques that support data analysis are Reporting, Dashboards, ad-hoc queries, OLAP, Data mining and machine learning, and Scorecards.

Table 7. Comparison

	Power BI	Tableau	Qlik
Ad-hoc analysis	+	+	+
Advanced analytics capabilities	Lead	+	-
Analytics	+	Lead	+
Augmented Analytics	Lead	+	+
Associative engine	-	-	+
Connectivity	+	+	+
Dashboards	+	Lead	+
Data management	+	+	+
Data preparation tools	Lead	+	+
Data visualization	+	Lead	+
Document Management	+	+	+
Embedded analytics	+	Lead	+
OLAP	+	+	+

Ad-hoc analysis
Ad-hoc analyses are intended for business analysts, to determine the measures and dimensions of data with the help of SQL queries but without the use of OLAP servers, ie without OLAP cubes, with which we create arbitrary derived tables in the next phase. In this category, all three tools proved equally successful.
Advanced analytics capabilities
In terms of software integration, Tableau is the best solution for visual analytics and reporting that connects directly to R, Python, and other statistical or data mining environments. Power BI supports R-based visualization while Qlik does not support R or Python-based projects.
Analytics
Power BI becomes slow when handling large amounts of data but proves to be the best tool for live data analysis (performing database queries and retrieving results in real-time). Power BI Desktop provides the following out-of-the-box analytics functionalities: Statistical Summary that includes Histogram, Top N, Outliers using Scatter plot, Grouping and Binning, Clustering, and Time series analysis.

Thanks to its VizQL engine, Tableau is suitable for working with large amounts of data and offers extensive data visualization features. Despite the slower ability to analyze real-time data, the tool has proven to be good in terms of live query capabilities and extracts. Tableau has the following analytics functions: Summary Statistics, Trend analysis, Basic Forecasting, and Clustering.

Qlik has the best analytical features thanks to a flexible platform that can be combined without the need for initial preparation. Guided analytics and an associative engine help user discover information hidden among data.
Augmented Analytics
Augmented Analytics is a class of artificial intelligence and machine learning that help users to prepare data, generate insights and explain insights to increase the way people research and analyze data in analytics and BI platforms.

With Cognitive Services in Power BI, it is possible to apply various algorithms from Azure Cognitive Services for data enrichment. Power BI Premium also supports emotion analysis, key phrase extraction, language detection, and image tagging services.

As part of its expanded intelligence, Tableau offers Ask Data and Explain Data functions. Ask Data is the functionality of writing questions in natural language and creating visualizations in response to the query. Explain Data is based on advanced statistical models and suggests possible explanations for the selected label. Einstein Discovery is machine learning-driven and delivers predictions and recommendations of prediction models without the need to write algorithms.

Qlik also allows users to ask questions in natural language and automatically suggests insights and new links for research. Qlik's Cognitive Engine uses artificial intelligence and ML to automatically offer the user the best visualizations for selected data and minimize cognitive bias by learning from data.
Connectivity
Gartner defines connectivity as "Capabilities that enable users to connect to, query and zing for performance". Data source support is broadly categorized into the following: File, Database (on-premises and cloud), Online data sources (apps), and Others (web services).

Both Tableau and Power BI easily integrate with third-party data sources. As Power BI was developed by Microsoft it ensures easy integration with Azure and the PowerApps ecosystem. On the other hand, Tableau was recently acquired by Salesforce, so their integration runs more smoothly than with other tools. Qlik also has a wide range of connectors and other data connection types but lags behind the other two tools.
Dashboard
The dashboard is a set of several views that allows the user to compare different data at the same time instead of viewing separate sheets. Due to the built-in animations and dashboard templates in this category, Tableau has an advantage.
Data engine
Most data engines are based on linear search patterns – the user makes a query, and the data engine searches predetermined data sets for the solution. Power BI and Tableau run on an SQL database, which means that queries follow a predefined linear path, giving solutions from query-based searches.

Qlik Sense, on the other hand, uses a non-query-based associative engine. The associative engine combines all the data, maps the relationships between the data, and creates a compressed binary index optimized for interactive analytics so users can see connections or patterns that a typical data engine would probably have missed.
Data management
The BI tool should allow users the freedom to research data while preventing user error and data contamination. Working on a local computer allows more flexibility for the individual while working on a central server allows for collaboration and validation of changes, but users cannot work offline.

Power BI allows offline work on a local computer and sending finished books to a single server to pass a pre-release check. Tableau also allows you to work on the user's hard drives and check through a central server. Qlik Sense, unlike previous tools, offers only cloud work. All users work on the same server, which prevents the circulation of old content or its pollution.
Data preparation tools
All three compared tools contain ETL functionalities. Using these applications, data analysts can easily create data flows using well-known self-service tools, which reduces the time required and the cost of data transformation.

Power BI has an inbuild data preparation and cleaning functions tool Power Query that offers data flow creation, permission management, scheduled

reporting, etc. Also provides options natively for users to model their data which includes defining relationships between different data sources and writing code (or using drag-drop functionalities) to clean data. Tableau for data modification opens a separate program called Tableau Prep Builder which allows operations such as filtering, sharing, renaming, rotating, merging, and more to clean and format data. Qlik Compose is an agile platform for data warehouse automation and transformation. Integration with Qlik Replicate enables real-time ETL by combining real-time source data integration with automated ETL generation and supports the broadest ecosystem of heterogeneous data sources, including relational, legacy, and NoSQL data warehouses.

Data visualization

All tools offer traditional business visualizations out of the box, such as bar, line, area, histograms, bullet charts, treemaps, scatterplots, tables, and map-based visuals.

In the data visualization category, Tableau leads with an intuitive interface tailored to non-technical users that enables data aggregation, grouping, segmentation, and real-time analytics.

Document Management

All programs can convert analytical reports to a variety of formats including PDFs, spreadsheets, images, and crosstabs.

Embedded analytics

BI tools enable the implementation of built-in analytics into existing workflows. In this way, it is possible to improve insights without losing efficiency by implementing them in existing applications, portals, and workflows.

Power BI does not give priority to the API, which initially makes it difficult for users to implement, but the tool offers several objects, not just built-in dashboards. Tableau users can only install dashboards into their applications and processes, while other objects such as metrics or individual values are not available for deployment. Qlik Sense allows users to embed metrics, individual values, numbers, and full or partial dashboards in edge devices, portals, and workflows. The Qlik API is quite intuitive for users to use.

OLAP

OLAP (Online Analytical Processing) enables faster queries and calculations and different measures/dimensions according to the needs of the end-user. All compared programs share standard OLAP functionalities.

6 Conclusion

Data analysis and visualization are two key skills that can be applied in almost any field of work. An analysis of existing research on the best data visualization tools has shown that there is no comparison of tools based on criteria relevant to students and professors for use in educational purposes. Using open-source tools in teaching instead of trial versions of the most popular tools used in industry is a major drawback when learning this important analytical skill.

In this paper, three tools that occupy the position of a leader according to Gartner's magic quadrant are analyzed and compared based on criteria important for application for educational purposes.

Comparing Power BI, Tableau, and Qlik software, Tableau proved to be the most suitable tool for beginners. Through the Tableau for Students program, the tool offers students a one-year free academic license at accredited academic institutions, including the Tableau Desktop, Tableau Prep, and Tableau Public tools. The license can be renewed every year as long as the student status is active. In addition to free software, they also provide students with a 20% discount on the Tableau certificate. Student Resources Page is available for each product as well as on-demand training videos. Tableau Desktop and Tableau Prep are available for Windows and Mac operating systems and Android and iOS mobile devices. The Tableau program for students does not include access to Tableau Online or Tableau Server but visualizations can be shared with colleagues using the free Tableau Public platform. Of all the tools being compared, Tableau has the largest community of users, and groups such as Student Resource are of great help to first-time data visualization students. Thanks to the simple drag-and-drop interface, the tool has an initial gentle learning curve and is not difficult for beginners to understand to use the basic functionalities. All the compared tools have similar functionalities, and it is difficult to give preference to one of them without an exact specification of the area for which they will be used. Most of the tools have focused their vision of development on ML, AI, and NLP. Some of Tableau's functionalities, such as Querying in natural language with Ask Data, Explain Data, and Einstein Discovery are also innovations that can greatly help new users. Data visualization tools continue to evolve in features that enable user-friendliness, simplified workflows, and predictive analytics and every year they become more accessible to ordinary users in everyday work.

Thanks to the growing intuitiveness of these tools, the skills of business analysts are becoming more and more accessible, and the need for data-based decision-making is crucial for successful business in any sector. All students should be familiar with the basics of using these tools that employers value highly because of their contribution to profitability, data-based decision-making, and business performance. Educational institutions should recognize this and include this software in their curricula.

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