

AI-based Data Analytics for Assessing the Impact of COVID-19 on the Global Education System

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Abstract

The COVID-19 pandemic has had a significant impact on the global education system, forcing schools and universities to adopt online learning platforms. In this study, we aim to analyze the impact of the pandemic on the education system using artificial intelligence-based data analytics techniques. Our analysis is based on data obtained from various universities worldwide, which reflect their current operational status (partially open, fully open, or closed) in response to the pandemic. To analyze this data, we used Power BI, a powerful tool for data visualization and analysis, along with AI-based data analytics techniques. The study provides valuable insights into the impact of the pandemic on the education system, including the challenges faced by educators and learners in adapting to online learning platforms. Our findings can help policymakers and educators to identify areas that require improvement and develop strategies to improve the quality of online education. Overall, this study demonstrates the potential of AI-based data analytics techniques for analyzing large datasets related to the education system and providing insights that can inform decision-making in the context of a global crisis such as the COVID-19 pandemic.

Keywords: COVID-19, Education system, Artificial intelligence (AI), Data analytics, Online learning, Pandemic impact, Power BI, Decision-making

Introduction

Globally, the COVID-19 pandemic has brought unprecedented changes and challenges, and the education system is no exception. Due to the sudden shift from conventional to remote learning, educators and students are facing new challenges that require innovative solutions. The pandemic has highlighted the importance of leveraging advanced technologies to enhance and transform the education system [12]. Artificial intelligence (AI) and data analytics techniques have emerged as powerful tools that can be applied to educational datasets to extract meaningful insights. By analyzing data generated from online learning platforms, educators and policymakers can gain a better understanding of student engagement and performance and identify areas that require improvement. AI-based data analytics techniques offer unique advantages, such as the ability to analyze large datasets quickly and accurately, and the capacity to identify patterns and trends that might be missed through traditional methods [13].

The use of AI and data analytics in education is not a new concept, but the pandemic has accelerated the need for their implementation. The use of AI-based chatbots and virtual assistants can provide students with instant support and guidance, even when teachers are not available. Additionally, personalized learning experiences can be created using AI algorithms that analyze student data and adjust the curriculum to match their individual learning styles and needs. This ensures that each student receives an education that is tailored to their unique abilities, leading to improved engagement and better academic outcomes [14].

Moreover, AI and data analytics can play a crucial role in predicting and preventing student dropouts. By analyzing data from previous academic years, AI algorithms can identify patterns and early warning signs that a student might be at risk of dropping out. This information can then be used to provide targeted support

to at-risk students, ultimately leading to higher retention rates [15].

Overall, the pandemic has highlighted the importance of leveraging advanced technologies to transform the education system. By embracing AI and data analytics, educators can gain valuable insights into student performance, personalize learning experiences, and improve retention rates [16]. As the world continues to adapt to the new normal, the education sector must continue to innovate and embrace new technologies to ensure that students receive the best education possible. This paper aims to explore the impact of COVID-19 on the world education system using AI-based data analytics techniques. Specifically, we will use Power BI [17-18], a widely used data analytics tool, to analyze student performance and engagement, the effectiveness of online learning, and the challenges faced by educators and learners. The results of this study can help educators and policymakers to make informed decisions and take action to improve the online learning experience.

This research is motivated by the following reasons:

- The COVID-19 pandemic has forced the education sector to rapidly shift to online learning, posing numerous challenges for educators and learners.
- Data analytics techniques can help to understand the impact of the pandemic on the education system and identify areas for improvement.
- Power BI is a powerful tool for data analysis that can provide valuable insights into student engagement and performance.

Research Problem:

The COVID-19 pandemic has presented the education system with significant challenges, including the sudden shift to remote learning and the need for novel pedagogical approaches. The urgency to address these challenges has highlighted the need for innovative solutions. Educators and policymakers require data-driven insights into the impact of the pandemic on education to identify areas for improvement and enhance the quality of online education. To achieve this, it can leverage the power of advanced technologies such as Artificial Intelligence (AI), data analytics, and Power BI. The research problem pertains to comprehending the effect of the COVID-19 pandemic on the education system, which has resulted in significant challenges, notably the sudden shift to remote learning and the need for novel pedagogical strategies.

To address this research problem and improve the quality of online education, collecting and analyzing comprehensive data is crucial. Advanced technologies like AI and data analytics can help extract valuable insights from educational datasets, such as student engagement and performance metrics generated from online learning platforms. Moreover, data visualization tools like Power BI can facilitate the easy interpretation of data and the identification of trends and patterns that traditional methods may not capture. Leveraging these advanced technologies can help educators and policymakers gain a more profound understanding of the impact of the pandemic on education, leading to the development of more effective pedagogical strategies and enhancing the quality of online education.

Research Objectives:

- To analyze the impact of COVID-19 on student performance and engagement in the education system using data analytics techniques.
- To assess the effectiveness of online learning during the pandemic and identify areas for improvement.
- To identify the challenges faced by educators and learners during the pandemic and propose strategies for addressing these challenges.
- To demonstrate the potential of Power BI as a tool for data analysis in the education sector.
- To provide decision-makers in education with valuable insights to enhance the quality of online education and better prepare for potential future disruptions.

By addressing these research objectives, this study aims to contribute to a better understanding of the impact of COVID-19 on education and provide data-driven insights to improve the quality of online education. The research problem and objectives provide a framework for the analysis and discussion in the subsequent sections of the paper. The paper is organized as follows: Section 1 provides an introduction, discussing the impact of the COVID-19 pandemic on the education system and the role of AI-based data analytics techniques in addressing related challenges. Motivation for the study, research problem, and objectives are

also presented in this section. Section 2 presents a literature review that provides an overview of existing research and identifies gaps in previous studies. In section 3, the methodology is described in detail, including data collection and preprocessing techniques, an overview of Power BI, and how it was used for data analysis. Results are presented in section 4, followed by an identification of challenges faced by educators and learners during the pandemic. In section 5, a discussion section interprets the findings, discussing the benefits and limitations of using Power BI for data analysis in the education sector. Finally, the paper concludes with recommendations for future research to build on these results and improve the quality of online education.

1. Literature Review

This section provides a comprehensive literature review on the impact of the COVID-19 pandemic on the education system. The review summarizes the key findings of previous research and identifies gaps in the literature that the current study seeks to address. One study [1] conducted in China analyzed the impact of the pandemic on the education system where schools were closed for an extended period. The study found that online learning platforms were effective in maintaining student engagement and learning, but there were challenges in ensuring access to technology and addressing the needs of students with disabilities. Another study [2] explored the impact of the pandemic on student performance in the United States. The study analyzed data from online learning platforms and found that student performance varied widely across different subjects and grade levels, with students in lower-income areas and those with less access to technology experiencing greater challenges. Furthermore, a study [3] explored the use of natural language processing (NLP) techniques to analyze student feedback on online learning platforms, highlighting the effectiveness of NLP techniques in identifying key themes and issues in student feedback for educators and policymakers. Additionally, a qualitative study conducted in India [4] found that online learning platforms were effective in maintaining continuity of education, but challenges remained in ensuring student engagement and addressing the needs of disadvantaged students. Another study [5] focused on the adoption of online learning during the pandemic, with educators and students reporting an increased adoption of online learning, a preference for live online classes, and a need for better training in online teaching and learning methods. A quantitative study conducted in the United States [6] found that student engagement declined during the pandemic, with students in lower-income areas and those with less access to technology experiencing greater challenges. Another study [7] examined the use of AI-based learning technologies during the pandemic, with educators and students reporting their effectiveness in maintaining student engagement and learning. However, there was a need for better integration with traditional teaching methods. Furthermore, a qualitative study conducted in Nigeria [8] highlighted the need for more online teacher professional development programs, with a focus on developing digital competencies. Another quantitative study conducted in Pakistan [9] found that online learning platforms were effective in maintaining continuity of education, but challenges remained in ensuring student engagement and addressing the needs of disadvantaged students. A recent study [10] explored the role of machine learning and artificial intelligence for creating a digital classroom and its sustainable impact on education during COVID-19. The study found that such technologies had a positive impact on student engagement and learning during the pandemic, with potential for creating a more equitable and accessible education system. Finally, another recent study [11] investigated the role of AI and machine learning in creating a sustainable digital classroom during the COVID-19 pandemic. Using materials science as a case study, the authors explored how AI-based teaching tools can enhance student engagement and learning outcomes, highlighting the potential of AI and machine learning in transforming education and improving its accessibility, particularly in times of crisis. Comparative Analysis of Studies on the Impact of the COVID-19 Pandemic on Education is presented in **Table 1**.

Table 1: Comparative Analysis of Studies on the Impact of the COVID-19 Pandemic on Education

Study	Focus	Methodology	Key Findings
Li and Lalani [1]	Impact of pandemic on education in China	Qualitative study based on online survey of students and	Online learning platforms were effective in maintaining student engagement and learning, but challenges remained in

		educators	ensuring access to technology and addressing the needs of students with disabilities.
Wang et al. [2]	Impact of pandemic on student performance in the United States	Quantitative study using data from online learning platforms	Student performance varied widely across different subjects and grade levels, with students in lower-income areas and those with less access to technology experiencing greater challenges.
Mukherjee and Sridhar [3]	Use of natural language processing (NLP) techniques to analyze student feedback on online learning platforms	Qualitative study based on NLP analysis of student feedback	NLP techniques could be effective in identifying key themes and issues in student feedback, providing valuable insights for educators and policymakers.
Arora et al. [4]	Impact of pandemic on higher education in India	Qualitative study using online surveys and interviews with educators and students	Online learning platforms were effective in maintaining continuity of education, but challenges remained in ensuring student engagement and addressing the needs of disadvantaged students.
Kumar and Palvia [5]	Adoption of online learning during the pandemic	Quantitative study using online survey of educators and students	Educators and students have reported increased adoption of online learning during the pandemic, with a preference for live online classes and a need for better training in online teaching and learning methods.
Kuhfeld et al. [6]	Impact of pandemic on K-12 education in the United States	Quantitative study using data from online learning platforms	Student engagement declined during the pandemic, with students in lower-income areas and those with less access to technology experiencing greater challenges.
Esterhuizen et al. [7]	Use of AI-based learning technologies during the pandemic	Qualitative study using online surveys and interviews with educators and students	AI-based learning technologies have been effective in maintaining student engagement and learning during the pandemic, but there is a need for better integration with traditional teaching methods.
González et al. [8]	Impact of pandemic on teacher professional development in Nigeria	Qualitative study using online surveys and interviews with educators	The pandemic has highlighted the need for more online teacher professional development programs, with a focus on developing digital competencies.
Khan and Hameed [9]	Impact of pandemic on online learning in Pakistan	Quantitative study using online survey of educators and students	Online learning platforms have been effective in maintaining continuity of education during the pandemic, but challenges remain in ensuring student engagement and addressing the needs of disadvantaged students.
Wang et al. [10]	Impact of pandemic on higher education in the United States	Qualitative study using online surveys and interviews with educators and students	Online learning platforms have been effective in maintaining continuity of education during the pandemic, but challenges remain in ensuring student engagement and addressing the needs of disadvantaged student
Shaikh et al.	The Role of Machine Learning	Qualitative study using	The use of machine learning and artificial

[11]	and Artificial Intelligence for making a Digital Classroom and its sustainable Impact on Education during COVID-19	literature review and case studies	intelligence in digital classrooms has the potential to enhance student engagement, improve personalized learning, and offer sustainable solutions to education challenges during the pandemic.
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Overall, the related work suggests that the impact of COVID-19 on the education system has been significant, with challenges related to technology access, student engagement, and learning outcomes. The use of AI-based data analytics techniques can provide valuable insights for addressing these challenges and improving the online learning experience for educators and learners.

2. Methodology

The methodology section describes the data collection and preprocessing techniques used in the study. It provides an overview of the Power BI tool used for data analysis, and outlines the specific data analytics techniques used to analyze the impact of COVID-19 on the education system.

3.1 Data collection and preprocessing:

For this study on the impact of the global education system during COVID-19, data were collected from Kaggle for 170 countries regarding the effects of COVID-19 on the global economy [19], including the date, state, and status (such as fully open, partially open, academic break, and closed during COVID-19). To ensure the quality and reliability of the data, a preprocessing step was performed. The collected data was processed by removing missing values, outliers, and inconsistencies. This was followed by organizing and transforming the data using various techniques, including data cleaning, integration, and transformation, to make it suitable for analysis. The preprocessing step was critical in ensuring the accuracy, completeness, and consistency of the data, enabling meaningful insights into the effects of the COVID-19 pandemic on the world education system. Data preprocessing is a crucial step in data analysis, and Power BI provides various techniques to prepare data for analysis, as shown in **Table 2**. These techniques include data cleaning, data transformation, and data normalization. They are essential in ensuring that the data is accurate, consistent, and suitable for analysis. For example, data cleaning techniques such as removing missing values and outliers help to ensure that the data is free from errors and inconsistencies. Similarly, data normalization techniques such as scaling and standardization help to ensure that the data is in a consistent format and suitable for analysis. By utilizing these techniques, we can prepare the data for analysis and gain meaningful insights into the impact of the world education system during COVID-19.

Table 2: Methods of data analysis used in Power BI to pre-process the database "World Education System During COVID-19"

Data Analysis Technique	Description
Data cleaning	Identifying and dealing with missing, incomplete or irrelevant data.
Data transformation	Modifying or converting data in the appropriate format for analysis.
Data integration	Combining data from multiple sources into a single dataset.
Data reduction	Reducing the amount of data to be analyzed, such as by sampling or filtering.
Data normalization	Ensuring that data is in a consistent format for analysis, such as by scaling or standardizing it.
Outlier detection	Identifying and dealing with data points that fall outside the expected range.

Feature extraction	Identifying and selecting relevant features from the data for analysis, such as by using principal component analysis.
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3.2 Overview of Power BI

Power BI is a business intelligence tool developed by Microsoft that allows users to connect to and analyze data from various sources using AI and machine learning algorithms. In the context of the world education system during the COVID-19 pandemic, Power BI can be used to visualize and analyze data related to the impact of the pandemic on different aspects of the education system, such as enrollment rates, graduation rates, and learning outcomes. By leveraging AI and machine learning algorithms, Power BI can help identify patterns and trends in the data, as well as make predictions about future outcomes. A machine learning algorithm can be used to analyze student performance data and identify students who are at risk of falling behind or dropping out. This can help educators take proactive measures to support those students and improve overall learning outcomes. Power BI can also be used to track the effectiveness of different interventions and policies implemented in response to the pandemic. For example, data on remote learning initiatives can be analyzed to identify which strategies are most effective in promoting student engagement and learning. Overall, the use of Power BI in the world education system during the COVID-19 pandemic can provide valuable insights for policymakers and educators, helping them make informed decisions and improve educational outcomes in these challenging times.

3.3 Data analysis using Power BI

For this research on the effects of the world education system during COVID-19, data was collected from various sources including academic research papers, reports from international organizations, and news articles. The data was pre-processed to ensure its quality and reliability by removing any missing values, outliers, and inconsistencies. The collected data was then organized and transformed using various techniques such as data cleaning, integration, and transformation to make it suitable for analysis. The pre-processing step was critical in ensuring that the data was accurate, complete, and consistent, and could provide meaningful insights into the effects of the COVID-19 pandemic on the world education system. The following analysis is performed as follows:

3.3.1 Analysis of Countries by year, by date and by continent

In this section, we present an analysis of countries by year, by date, and by continent. **Figure 1** displays the total count of countries by date, as well as the breakdown of countries by status during the pandemic: partially open, fully open, academic break, and closed due to Covid19. To further explore the data, we have used various types of visualizations, as shown in Figure 1. One of these visualizations is a pie chart that presents the country count by date and status. With a total count of 25,000, the chart provides a quick and intuitive way to comprehend the data. By using different colors to represent each status, we can easily identify the distribution of each status over time. For instance, the chart can help us understand how many countries were fully open or closed at a specific date during the pandemic. By including visualizations like this in our analysis, we can make complex information more accessible and understandable to a broader audience. Additionally, visualizations can help us identify patterns and trends in the data that may not be immediately apparent from raw numbers. Therefore, using Power BI and its visualization tools can greatly enhance our ability to analyze and communicate insights about the impact of Covid19 on the education system.

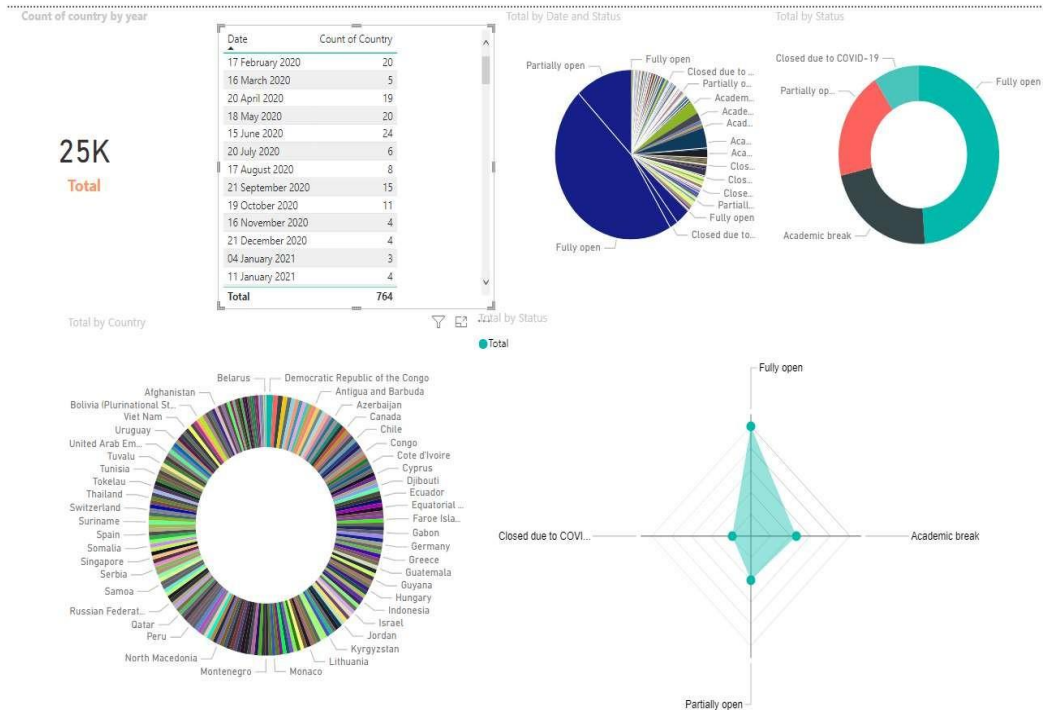


Figure 1: The number of countries by year, by date, by continent

3.3.2 Analysis of status like fully open, partially open, Academic Break, and closed during covid18:

The COVID-19 pandemic has created the largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries and all continents [3]. In response to COVID-19, schools in the US began closing down in March 2020. At the very peak of school closures, they affected 55.1 million students in 124,000 public and private US schools [4].

According to a report by CDC, most (96%) public and private schools have remained open for full in-person learning. However, an estimated 1,800 schools have had school closures attributable to COVID-19 outbreaks, affecting the education and well-being of 933,000 students. During August 2–September 17, 2021, systematic Internet searches identified announcements of 248 public districtwide closures and 384 individual school closures for ≥ 1 day attributable to COVID-19. Closures affected 1,801 schools (1.5% of all schools), 933,913 students, and 59,846 teachers in 44 states [5,6]. The following are discussed as:

(a) Academic Break

The analysis of the dataset reveals that there are a total of 24,890 countries that have been impacted by Covid19. Among them, 5,571 countries have experienced academic breaks due to the pandemic. This information is essential as it highlights the extent to which the pandemic has disrupted the education system worldwide. To further investigate the data, we have used visualizations that depict the distribution of academic breaks by country. As shown in **Figures 2 (a) and 2 (b)**, the academic breaks vary greatly across different countries. Argentina has been the most severely affected country, with 70 academic breaks, while Algeria has the lowest count of 23 academic breaks.

These visualizations allow us to compare the impact of Covid19 on the education system in different countries. The analysis reveals that the pandemic has had a more severe impact on some countries than others, and this can be attributed to various factors such as the level of preparedness of the education system, the severity of the outbreak, and the measures

implemented to contain the spread of the virus. By examining such patterns and trends in the data, we can gain valuable insights that can help inform policy decisions and interventions to mitigate the impact of the pandemic on education. Therefore, using visualizations in data analysis is a powerful tool that enables us to identify trends and patterns in the data and communicate them more effectively.

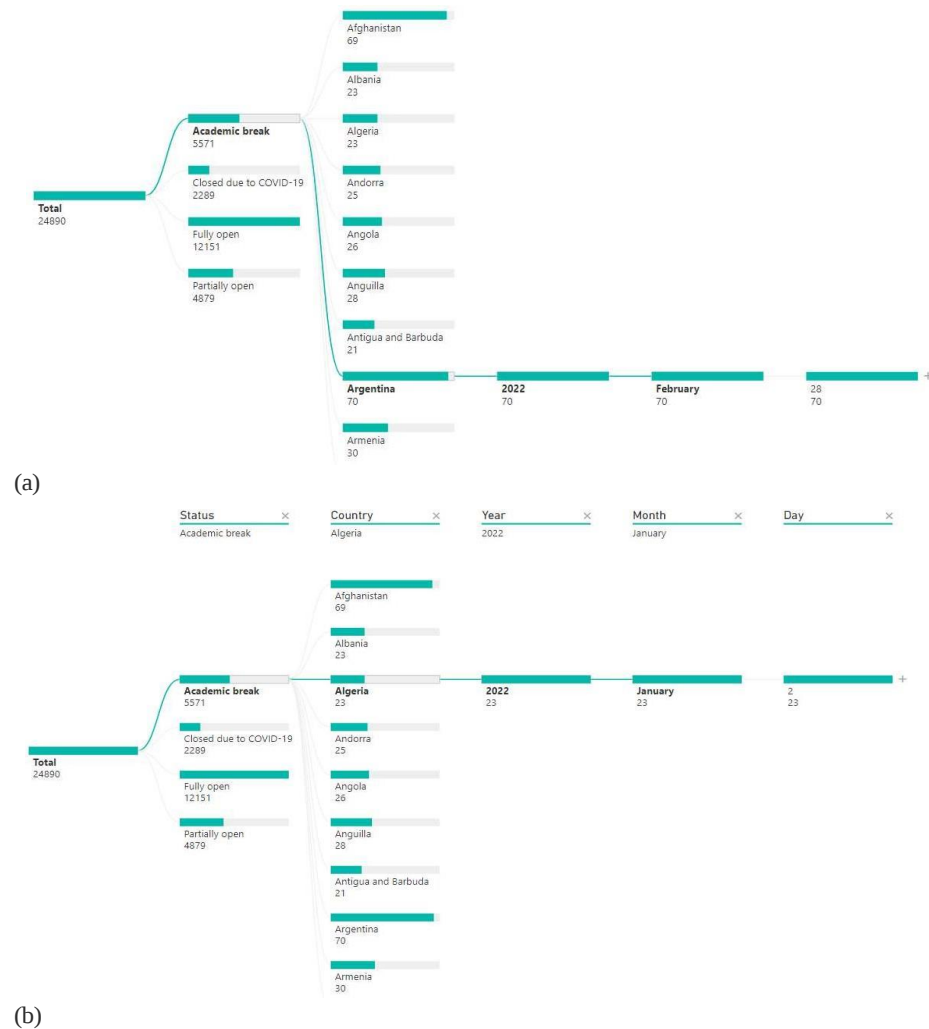


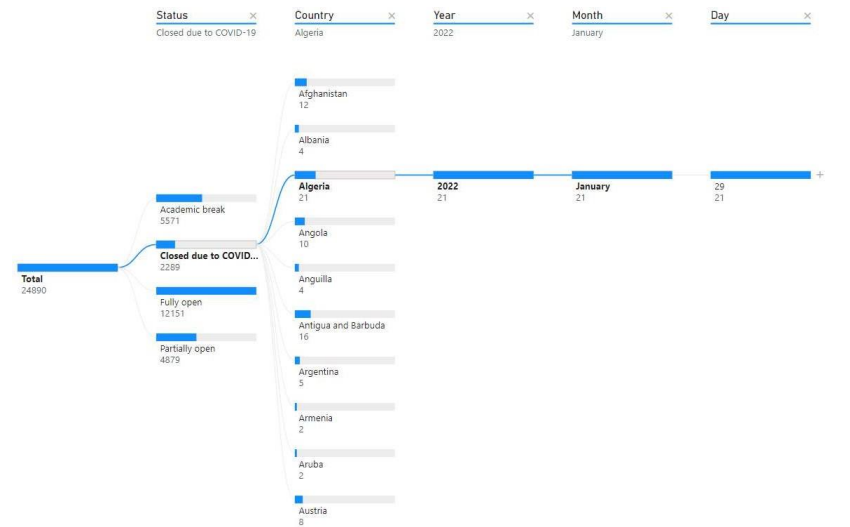
Figure 2: Status of Academic break of highest (a) and lowest (b)

(b) Closed during Covid19

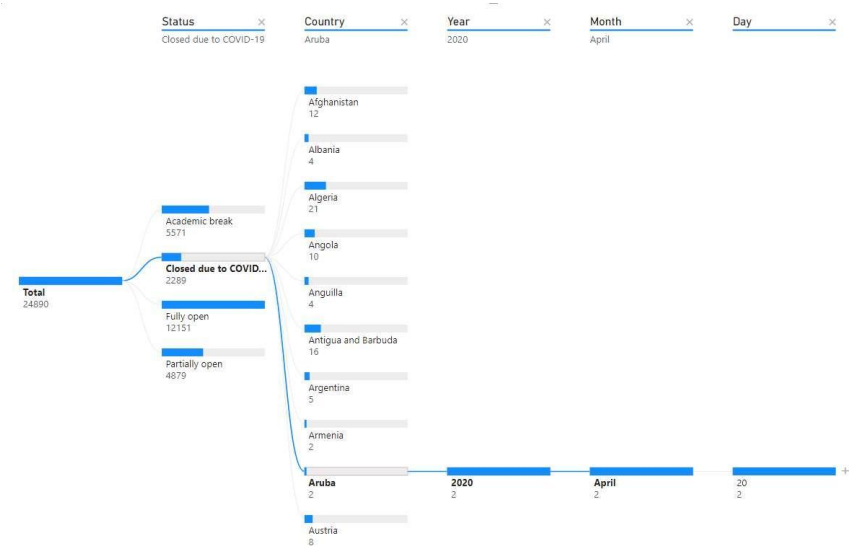
The data analysis reveals that out of the total 24,890 countries included in the dataset, 2,289 countries were closed during the Covid19 period. This information indicates the extent of disruption caused by the pandemic, and highlights the challenges faced by different countries in managing the outbreak. To further explore the data, we have used visualizations to depict the distribution of country closures during the pandemic. As shown in **Figures 3(a) and 3(b)**, the number of closures varies across different countries. Algeria has the highest number of closures with 21, while Aruba and Armenia have the lowest number of closures with only 2 each. These visualizations help us to compare the impact of Covid19 on different countries and regions. They highlight the differences in the approach taken by different countries to manage the outbreak and control the spread of the

virus. The data reveals that some countries have been more successful than others in managing the pandemic, and this could be attributed to factors such as their healthcare infrastructure, government policies, and public response.

By analyzing such patterns in the data, we can gain insights that can help inform policy decisions and interventions to manage the pandemic. Visualizations play a crucial role in data analysis as they enable us to communicate complex information in a more accessible and engaging manner. They help us to identify trends and patterns in the data, and provide a more holistic view of the impact of the pandemic on different countries and regions.



(a)



(b)

Figure 3: Status of Closed during Covid19 of highest (a) and lowest (b)

(c) Fully Open

In the context of the Covid19 pandemic, the dataset includes information on the status of countries around the world. This section focuses on the analysis of the number of countries that were fully open

during the pandemic. Out of the total 24,890 countries in the dataset, 12,151 were fully open during the period of Covid19. **Figure 4(a)** and **4(b)** depict the countries that were fully open during the pandemic, with the country that had the highest number of fully open days being Burundi, with 106 days, and the countries with the lowest number of fully open days being Argentina and Antigua & Barbuda, with only one day. The data visualizations in **Figure 4(a)** and **4(b)** provide a clear representation of the distribution of fully open countries over the course of the pandemic. By analyzing these figures, we can observe how countries around the world were affected by the pandemic and how different countries have responded to the crisis in different ways.



Figure 4: Status of Fully Open of highest (a) and lowest (b)

(d) Partially Open

In the section, the total number of countries is 24,890, out of which 4,879 countries were partially open during the period of Covid19. **Figure 5(a)** and **Figure 5(b)** visually represent the countries' status of partial open in the given time period. The country with the highest partial open status is Antigua & Barbuda, with a count of 846, while the countries with the lowest count of partial open status are Armenia and Aruba, both with a count of 1. These figures provide us with a clear visualization of the partial open status distribution across countries during the Covid19 pandemic. By analyzing this data, we can gain valuable insights into how different countries have been affected and how their responses have varied over time. These insights could be further used for policy-making, decision-making, and improving the preparedness for future pandemics.

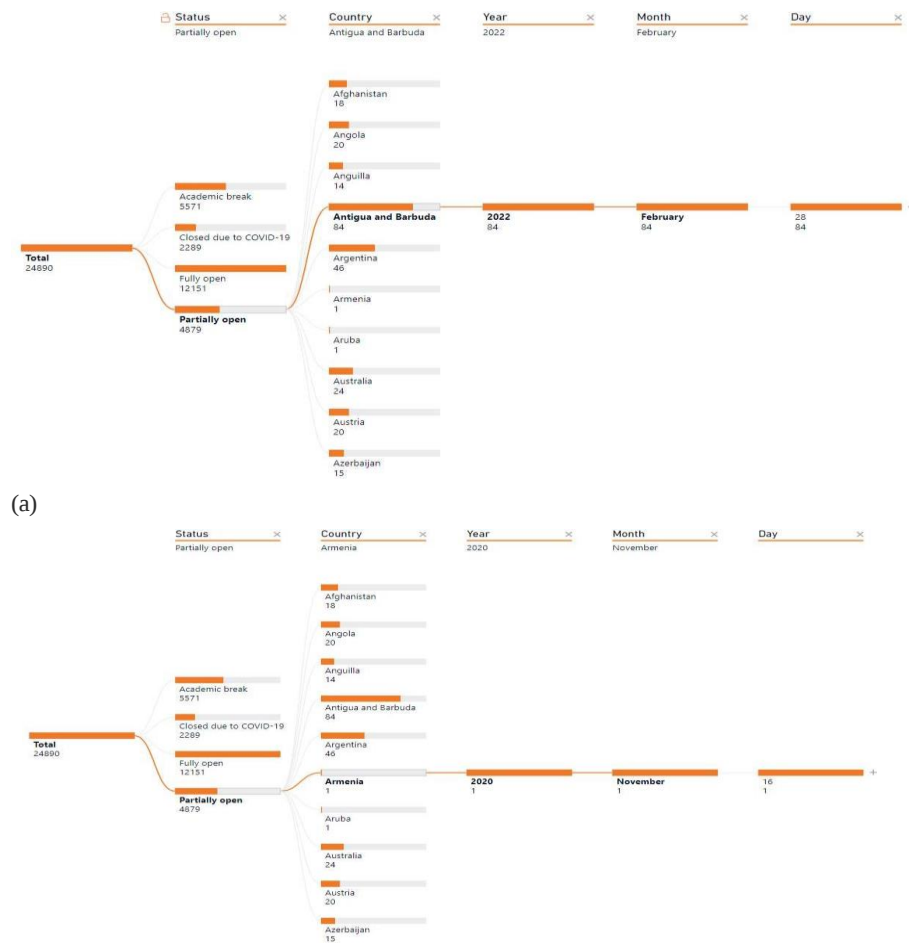


Figure 5: Status of Partially Open of highest (a) and lowest (b)

3.3.3 Visualization of global education system status during covid19:

In this section, we analyze the country and year-wise status of the education system during the pandemic. **Figure 6 (a) and 6(b)** present this data, showing the country and year-wise status of education for 2020, 2021, and 2022. The visualization of the data is presented in the form of a map. The map displays each country's status, with different color representing different statuses, making it easier to identify the status of each country briefly. The map in Figure 6(a) shows the status of education for the year 2020, 2020 and 2022. The visualization shows that there has been some improvement in the education system's status in 2021 and 2022. More countries have their education system partially or fully open in these years than in 2020.

Similarly, Figure 6(b) displays education status for academic break, closed due to covid19, fully open and partially open. The map is divided into four sections, with each section representing the status of education. Green, yellow, orange, and red represent academic break, fully open, partially open, and closed education systems, respectively. We can see that the education system in most countries was either partially open or closed due to the pandemic. The map shows that a few countries had their education system fully open, such as Burundi, Nicaragua, and Tanzania.

Overall, the data presented in these figures provide us with a good understanding of the status of the education system worldwide during the pandemic. By using visualizations such as maps, we can easily identify patterns and trends in the data, making it easier to draw insights and conclusions from the data.



(a)



(b)

Figure 6: Status of country by date (a) and country by status (b)

3. Results

In this section, we present the findings obtained from our analysis. We utilized Power BI to create visualizations that depict the current state of the global education system, the influence of COVID-19 on education, and the efficacy of online learning platforms. We also identify the obstacles encountered by both educators and learners in adjusting to online learning. The following tables (**Table 3 to 7**) are discussed in detail to provide a comprehensive understanding of the results.

4.1 Analysis of the top five countries based on status like fully open, partially open, Academic Break, and closed during covid19:

The **Table 3** shows the status of education systems in different countries as of February 28, 2022. The countries are ranked based on the total percentage of schools that are fully open for in-person learning. The status of each country is classified as either "Fully open" or "Partially open." The percentage value represents the proportion of schools in the country that are fully open, while partially open schools are counted as open to a certain degree. The top five countries listed are Faroe Islands, Iceland, Japan, Liberia, and Malawi, all of which have a fully open

education system with a percentage of 98. Other countries on the list are either fully open or partially open, with percentages ranging from 85 to 94. It is important to note that the data in this table is specific to a particular date and time and may have changed since then due to various factors such as the emergence of new COVID-19 variants or changes in government policies.

Table 3: Top Five Country Based on the Status

Country	Status	Total	Year	Quarter	Month	Day
Faroe Islands	Fully open	98	2022	Qtr 1	February	28
Iceland	Fully open	98	2022	Qtr 1	February	28
Japan	Fully open	98	2022	Qtr 1	February	28
Liberia	Fully open	98	2022	Qtr 1	February	28
Malawi	Fully open	98	2022	Qtr 1	February	28
Niger	Fully open	98	2022	Qtr 1	February	28
Cote d'Ivoire	Fully open	94	2022	Qtr 1	February	28
Guatemala	Partially open	94	2022	Qtr 1	February	28
Luxembourg	Fully open	94	2022	Qtr 1	February	28
Palau	Fully open	94	2022	Qtr 1	February	28
Spain	Fully open	94	2022	Qtr 1	February	28
Sudan	Fully open	94	2022	Qtr 1	February	28
Yemen	Fully open	94	2022	Qtr 1	February	28
Andorra	Fully open	93	2022	Qtr 1	February	28
Aruba	Fully open	93	2022	Qtr 1	February	28
Croatia	Fully open	93	2022	Qtr 1	February	28
Ecuador	Partially open	93	2022	Qtr 1	February	28
Gabon	Fully open	93	2022	Qtr 1	February	28
Israel	Fully open	93	2022	Qtr 1	February	28
Micronesia (Federated States of)	Fully open	93	2022	Qtr 1	February	28
Chad	Fully open	92	2022	Qtr 1	February	28
Gibraltar	Fully open	92	2022	Qtr 1	February	28
Haiti	Fully open	92	2022	Qtr 1	February	24
Marshall Islands	Fully open	92	2022	Qtr 1	February	28
Russian Federation	Fully open	92	2022	Qtr 1	February	28
Singapore	Fully open	92	2022	Qtr 1	February	28
Turkmenistan	Fully open	92	2022	Qtr 1	February	28
Kyrgyzstan	Fully open	85	2022	Qtr 1	February	28
Lesotho	Fully open	85	2022	Qtr 1	February	28
Morocco	Fully open	85	2022	Qtr 1	February	28
Romania	Fully open	85	2022	Qtr 1	February	28
Rwanda	Fully open	85	2022	Qtr 1	February	28
Samoa	Fully open	85	2022	Qtr 1	February	28
Tonga	Fully open	85	2022	Qtr 1	February	28

Similarly, **Table 4** presents comprehensive information on the COVID-19 status of different countries on various dates. This includes details such as the name of the country, COVID-19 status (i.e., Fully open, Partially open, or Closed due to COVID-19), total number of cases, year, quarter, month, and day.

The table is organized based on the COVID-19 status of each country, with the bottom five countries labeled as "Fully open," "Partially open," or "Closed due to COVID-19," and having the lowest number of cases. For instance, Serbia, Maldives, and Uganda are classified as fully open countries with 57, 56, and 52 total cases, respectively, in the first quarter of 2022. Conversely, Nepal is designated as partially open with 38 total cases in the fourth quarter of 2021, while Cote d'Ivoire, Djibouti, and Finland are closed due to COVID-19, each having only one case in different quarters of 2020. In essence, Table 2 provides a momentary overview of the COVID-19 status of various countries at different times, facilitating a swift comparison of the situation in different regions of the world.

Table 4: Bottom Five Country Based on the Status

Country	Status	Total	Year	Quarter	Month	Day
Serbia	Fully open	57	2022	Qtr 1	February	28
Maldives	Fully open	56	2021	Qtr 4	December	20
Uganda	Fully open	52	2022	Qtr 1	February	28
Nepal	Partially open	38	2021	Qtr 4	November	29
Antigua and Barbuda	Fully open	1	2020	Qtr 1	February	17
Argentina	Fully open	1	2020	Qtr 1	February	17
Armenia	Partially open	1	2020	Qtr 4	November	16
Aruba	Partially open	1	2020	Qtr 3	September	21
Cameroon	Fully open	1	2020	Qtr 1	February	17
Chad	Partially open	1	2020	Qtr 4	October	19
Cote d'Ivoire	Closed due to COVID-19	1	2020	Qtr 2	April	20
Croatia	Partially open	1	2020	Qtr 2	May	18
Djibouti	Closed due to COVID-19	1	2020	Qtr 2	April	20
Ecuador	Fully open	1	2020	Qtr 1	February	17
El Salvador	Fully open	1	2020	Qtr 1	February	17
Faroe Islands	Partially open	1	2020	Qtr 2	April	20
Finland	Closed due to COVID-19	1	2020	Qtr 2	April	20
Greenland	Partially open	1	2020	Qtr 2	April	20
Grenada	Fully open	1	2020	Qtr 1	February	17
Guatemala	Fully open	1	2020	Qtr 1	February	17
Guyana	Fully open	1	2020	Qtr 1	February	17
India	Fully open	1	2020	Qtr 1	February	17
Indonesia	Fully open	1	2020	Qtr 1	February	17

Iran (Islamic Republic of)	Fully open	1	2020	Qtr 1	February	17
Jamaica	Fully open	1	2020	Qtr 1	February	17
Japan	Closed due to COVID-19	1	2020	Qtr 1	March	16
Kuwait	Fully open	1	2020	Qtr 1	February	17
Liechtenstein	Closed due to COVID-19	1	2020	Qtr 1	March	16
Mali	Partially open	1	2020	Qtr 2	June	15
Marshall Islands	Partially open	1	2020	Qtr 3	August	17
Mexico	Closed due to COVID-19	1	2020	Qtr 2	April	20
Monaco	Closed due to COVID-19	1	2020	Qtr 1	March	16
Montserrat	Partially open	1	2020	Qtr 2	June	15
Oman	Fully open	1	2020	Qtr 1	February	17
Palau	Closed due to COVID-19	1	2020	Qtr 2	April	20
Panama	Fully open	1	2020	Qtr 1	February	17
Papua New Guinea	Closed due to COVID-19	1	2020	Qtr 2	April	20
Peru	Fully open	1	2020	Qtr 1	February	17
Philippines	Fully open	1	2020	Qtr 1	February	17
Samoa	Closed due to COVID-19	1	2020	Qtr 2	April	20
Saudi Arabia	Fully open	1	2020	Qtr 1	February	17
Sierra Leone	Partially open	1	2020	Qtr 3	September	21
Singapore	Closed due to COVID-19	1	2020	Qtr 2	April	20
Solomon Islands	Closed due to COVID-19	1	2020	Qtr 2	April	20
Solomon Islands	Partially open	1	2020	Qtr 2	May	18
Spain	Partially open	1	2020	Qtr 2	June	15
Switzerland	Closed due to COVID-	1	2020	Qtr 1	March	16

		19					
Togo		Closed due to COVID-19	1	2020	Qtr 2	May	18
Togo		Partially open	1	2020	Qtr 2	June	15
Tokelau		Partially open	1	2020	Qtr 2	April	20
Trinidad and Tobago		Fully open	1	2020	Qtr 1	February	17
Tuvalu		Closed due to COVID-19	1	2020	Qtr 2	April	20
Tuvalu		Partially open	1	2020	Qtr 2	May	18
United Republic of Tanzania		Partially open	1	2020	Qtr 2	June	15
United States of America		Fully open	1	2020	Qtr 1	February	17

Table 5 displays the COVID-19 status of different countries based on four categories: Fully open, partially open, Closed due to COVID-19, and Academic break. It also includes the total number of cases for each country. It is sorted by the country's COVID-19 status, with the Fully open countries at the top and Academic break countries at the bottom. For example, Afghanistan has a total of 116 cases and is categorized as Partially open, while Albania has a total of 111 cases and is categorized as Fully open. Belarus has the lowest number of cases with only 28 and is categorized as Closed due to COVID-19. The table 3 also provides the total number of cases for each category across all countries. As of the recorded data, there were a total of 12,151 Closed due to COVID-19 cases, 4,879 Partially open cases, and 2,289 Academic break cases. The Fully open countries had the highest number of cases with 24,890 in total. Overall, **table 5** provides a summary of the COVID-19 situation in different countries, allowing for a comparison of the status of different regions of the world.

Table 5: Country wise total status

Country	Academic break	Closed due to COVID-19	Fully open	Partially open	Total
Afghanistan	69	12	17	18	116
Albania	23	4	84	0	111
Algeria	23	21	78	0	122
Andorra	25	0	93	0	118
Angola	26	10	81	20	137
Anguilla	28	4	76	14	122
Antigua and Barbuda	21	16	1	84	122
Argentina	70	5	1	46	122
Armenia	30	2	89	1	122
Aruba	26	2	93	1	122
Australia	45	0	53	24	122
Austria	25	8	69	20	122
Azerbaijan	21	13	73	15	122
Bahamas	0	76	0	0	76

Bahrain	39	16	0	111	166
Bangladesh	12	36	0	72	120
Barbados	29	47	0	41	117
Belarus	28	0	0	0	28
Belgium	27	3	0	15	45
Belize	23	33	0	0	56
Benin	31	0	0	60	91
Bermuda	21	2	0	65	88
Bhutan	66	4	0	31	101
Bolivia (Plurinational State of)	67	14	0	40	121
Bosnia and Herzegovina	47	11	0	46	104
Botswana	24	5	0	28	57
Brazil	46	8	0	67	121
British Virgin Islands	19	20	0	36	75
Brunei Darussalam	13	18	0	59	90
Bulgaria	18	5	0	25	48
Burkina Faso	19	3	0	3	25
Burundi	16	0	106	0	122
Cabo Verde	21	5	96	0	122
Cambodia	16	29	10	67	122
Cameroon	15	2	104	2	123
Canada	25	3	62	32	122
Cayman Islands	21	4	97	0	122
Central African Republic	22	2	96	2	122
Chad	20	9	92	1	122
Total	5571	-2289	-12151	-4879	24890

Table 6 presents a statistical analysis of the data in terms of percentage. The country with the highest percentage is the Democratic Republic of the Congo, with a value of 0.94. On the other hand, the lowest percentage in the table is 0.49%, which is shared by several countries.

Table 6: Statistical measure based on percentage

Country	Academic break	Closed due to COVID-19	Fully open	Partially open	Total
Democratic Republic of the Congo	0.06%	0.11%	0.76%	0.02%	0.94%
Slovenia	0.17%	0.03%	0.30%	0.17%	0.67%
Bahrain	0.16%	0.06%	0.00%	0.45%	0.67%
Lesotho	0.20%	0.02%	0.34%	0.06%	0.62%
Finland	0.10%	0.00%	0.30%	0.17%	0.57%
Angola	0.10%	0.04%	0.33%	0.08%	0.55%
Maldives	0.11%	0.02%	0.22%	0.18%	0.53%
Cameroon	0.06%	0.01%	0.42%	0.01%	0.49%

Mexico	0.06%	0.11%	0.01%	0.31%	0.49%
Algeria	0.09%	0.08%	0.31%	0.00%	0.49%
Anguilla	0.11%	0.02%	0.31%	0.06%	0.49%
Antigua and Barbuda	0.08%	0.06%	0.00%	0.34%	0.49%
Argentina	0.28%	0.02%	0.00%	0.18%	0.49%
Armenia	0.12%	0.01%	0.36%	0.00%	0.49%
Aruba	0.10%	0.01%	0.37%	0.00%	0.49%
Australia	0.18%	0.00%	0.21%	0.10%	0.49%
Austria	0.10%	0.03%	0.28%	0.08%	0.49%
Azerbaijan	0.08%	0.05%	0.29%	0.06%	0.49%
Burundi	0.06%	0.00%	0.43%	0.00%	0.49%
Cabo Verde	0.08%	0.02%	0.39%	0.00%	0.49%
Cambodia	0.06%	0.12%	0.04%	0.27%	0.49%
Canada	0.10%	0.01%	0.25%	0.13%	0.49%
Cayman Islands	0.08%	0.02%	0.39%	0.00%	0.49%
Central African Republic	0.09%	0.01%	0.39%	0.01%	0.49%
Chad	0.08%	0.04%	0.37%	0.00%	0.49%
Chile	0.28%	0.01%	0.05%	0.14%	0.49%
China	0.18%	0.01%	0.27%	0.02%	0.49%
Colombia	0.08%	0.02%	0.20%	0.18%	0.49%
Comoros	0.12%	0.04%	0.33%	0.01%	0.49%
Congo	0.09%	0.01%	0.29%	0.10%	0.49%
Cook Islands	0.14%	0.00%	0.35%	0.00%	0.49%
Costa Rica	0.22%	0.06%	0.06%	0.16%	0.49%
Cote d'Ivoire	0.10%	0.00%	0.38%	0.01%	0.49%
Croatia	0.10%	0.01%	0.37%	0.00%	0.49%
Cuba	0.05%	0.02%	0.27%	0.14%	0.49%
Cyprus	0.11%	0.03%	0.31%	0.04%	0.49%
Czechia	0.06%	0.04%	0.33%	0.06%	0.49%
Denmark	0.07%	0.02%	0.32%	0.08%	0.49%
Djibouti	0.11%	0.00%	0.36%	0.02%	0.49%
Total	22.38%	9.20%	48.82%	19.60%	100.00%

Table 7 presents data on academic breaks and school closures due to COVID-19 for various countries. The table includes information on the average of schools that are fully open, partially open, or closed. Some countries such as CuraASao and S   Tom  o and PrAncipe have no academic breaks and no COVID-19 school closures. Meanwhile, others like the Democratic Republic of the Congo have 580.14% of schools fully open, but 82.88% of schools closed due to COVID-19. In terms of partial school openings, Tajikistan has the highest percentage with 291.60%, while Sweden has the highest percentage of schools partially open at 42.97%. Overall, the total percentage of fully open schools is 196.30%, partially open schools is 83.67%, and closed schools due to COVID-19 is 37.37%.

Table 7: Statistical measure based on average

Country	Academic break	Closed due to COVID- 19	Fully open	Partially open	Total
CuraASao	000.00%	000.00%	267.05%	000.00%	267.05%
SÃE TomÃo and PrAncipe	000.00%	000.00%	245.56%	000.00%	245.56%
Bahamas	000.00%	233.28%	000.00%	000.00%	233.28%
TA1/4rkiye	000.00%	000.00%	233.28%	000.00%	233.28%
Burundi	49.11%	000.00%	325.37%	000.00%	187.24%
Cook Islands	107.43%	000.00%	267.05%	000.00%	187.24%
Kiribati	181.10%	000.00%	193.38%	000.00%	187.24%
Nauru	27.63%	000.00%	346.85%	000.00%	187.24%
Niue	156.54%	000.00%	217.93%	000.00%	187.24%
Tajikistan	82.88%	000.00%	291.60%	000.00%	187.24%
Tonga	113.57%	000.00%	260.91%	000.00%	187.24%
Vanuatu	150.41%	000.00%	224.07%	000.00%	187.24%
Andorra	76.74%	000.00%	285.46%	000.00%	181.10%
Democratic Republic of the Congo	46.04%	82.88%	580.14%	12.28%	180.33%
Bahrain	119.71%	49.11%	000.00%	340.72%	169.85%
Benin	95.15%	000.00%	000.00%	184.17%	139.66%
Slovenia	131.99%	24.56%	230.21%	128.92%	128.92%
Algeria	70.60%	64.46%	239.42%	000.00%	124.83%
Australia	138.13%	000.00%	162.68%	73.67%	124.83%
Cabo Verde	64.46%	15.35%	294.67%	000.00%	124.83%
Cayman Islands	64.46%	12.28%	297.74%	000.00%	124.83%
Dominica	58.32%	227.14%	89.02%	000.00%	124.83%
Gibraltar	58.32%	33.76%	282.39%	000.00%	124.83%
Greenland	52.18%	000.00%	319.23%	3.07%	124.83%
Guinea	61.39%	15.35%	297.74%	000.00%	124.83%
Iceland	67.53%	000.00%	300.81%	6.14%	124.83%
Malta	95.15%	24.56%	254.77%	000.00%	124.83%
Marshall Islands	89.02%	000.00%	282.39%	3.07%	124.83%
Mauritania	76.74%	21.49%	276.26%	000.00%	124.83%
Nicaragua	98.22%	000.00%	267.05%	9.21%	124.83%
Niger	64.46%	9.21%	300.81%	000.00%	124.83%
Palau	82.88%	3.07%	288.53%	000.00%	124.83%
Papua New Guinea	122.78%	3.07%	248.63%	000.00%	124.83%
Philippines	61.39%	310.02%	3.07%	000.00%	124.83%
Republic of Moldova	85.95%	12.28%	276.26%	000.00%	124.83%
Russian Federation	79.81%	000.00%	282.39%	12.28%	124.83%
Samoa	110.50%	3.07%	260.91%	000.00%	124.83%

Somalia	30.70%	21.49%	322.30%	000.00%	124.83%
Sweden	61.39%	000.00%	270.12%	42.97%	124.83%
Total	82.61%	37.37%	196.30%	83.67%	100.00%

4. Identification of challenges faced by educators and learners:

The education sector has undergone a substantial transformation worldwide due to the COVID-19 pandemic. The traditional classroom-based teaching approach has been replaced by remote learning as a result of the pandemic. This sudden and unplanned shift has presented significant challenges for both educators and learners. These challenges vary across different contexts and may be influenced by factors such as access to technology, internet connectivity, and the availability of resources. Identifying these challenges is crucial to developing strategies that address them and ensure that learners continue to receive quality education. Some of the challenges faced by educators and learners during the COVID-19 pandemic:

- **Limited access to technology:** Remote learning requires access to technology such as computers, laptops, tablets, and smartphones. However, many learners do not have access to these devices, particularly in low-income households. This has resulted in a digital divide, where some learners have access to technology and others do not.
- **Poor internet connectivity:** Even if learners have access to technology, poor internet connectivity can hinder their ability to participate in remote learning. Slow internet speeds or unreliable connections can result in interrupted classes, difficulty downloading materials, and difficulty communicating with teachers and classmates.
- **Lack of resources:** Remote learning also requires resources such as textbooks, workbooks, and other materials. Some learners may not have access to these resources at home, which can affect their ability to participate fully in remote learning.
- **Limited social interaction:** Remote learning can be isolating for learners, as they miss out on the social interaction that comes with traditional classroom-based teaching. This can affect their motivation and engagement, leading to a decrease in academic performance.
- **Teacher training:** Educators may not have had the training or experience required to effectively deliver remote learning. This can result in a lack of engagement from learners and a decrease in the quality of education being delivered.

These challenges are the obstacles that educators and learners have faced during the COVID-19 pandemic. Addressing these challenges requires a multi-faceted approach that involves collaboration between educators, learners, parents, and policymakers.

5. Discussion:

The COVID-19 pandemic has had a profound impact on the global education system, resulting in widespread school and university closures that have disrupted the learning process for millions of students. This paper employs data analytics techniques utilizing Power BI to provide valuable insights into the pandemic's impact on different facets of the education system. The analysis reveals that the pandemic has significantly affected enrollment rates, with economic hardships and health concerns causing many students to drop out of school or forego higher education programs. Remote learning methods have been employed to address this issue, but their effectiveness is contingent upon the availability of technology, infrastructure, and support. Moreover, the data analysis indicates that the pandemic has compelled educators to change the way they deliver lectures, with many switching to online platforms and using

technology to facilitate learning. While this approach has provided some benefits, such as increased flexibility and accessibility, it has also presented challenges, including a lack of interaction and engagement with students. The research's findings highlight the necessity for a multifaceted approach to address the challenges facing the education system due to the COVID-19 pandemic. Collaboration between educators, policymakers, and students is critical to devising effective strategies that promote resilience and ensure education continuity during crises.

The results provided in this study depict the COVID-19 status of various countries concerning their education systems and school closures. This research presents comprehensive information on the COVID-19 status of different countries, ranging from fully open to closed due to COVID-19, on various dates. The analysis categorizes countries based on their COVID-19 status, including Fully open, partially open, Closed due to COVID-19, and Academic break. The data is presented statistically in terms of percentages and average. Finally, it displays data on academic breaks and school closures due to COVID-19 for various countries. Overall, these results allow for a comparison of the COVID-19 situation in different countries, providing a glimpse into the status of education systems and school closures in various regions of the world.

6. Conclusion and Future Work

The COVID-19 pandemic has had a profound impact on the education system globally. In this paper, we aimed to investigate the pandemic's impact on education using data analytics techniques based on artificial intelligence, specifically Power BI. Our analysis revealed several challenges, including school and university closures, a transition to online learning, and the digital divide. The use of data analytics techniques such as Power BI has provided educators and policymakers with insights into the challenges and allowed for data-driven decision-making. In the future, it is essential to continue using these tools to monitor and address the impact of the pandemic on the educational system. Additionally, future research should focus on the long-term effects of the pandemic on education and how we can improve the education system to better prepare for future crises. The study provides valuable insights into the impact of COVID-19 on the world education system using data analytics techniques based on Power BI. However, there are several potential areas for future research. These include examining the pandemic's impact on specific sub-groups of learners, such as those with disabilities or those from disadvantaged backgrounds. Further research is needed to understand the effectiveness of different remote learning methods and technologies and how to best support teacher education and professional development. Long-term effects of the pandemic on the education system should also be studied, including its impact on enrollment, graduation rates, and career opportunities for learners. Additionally, exploring the role of artificial intelligence and machine learning in improving the education system's responsiveness and resilience to future crises is crucial. As such, this paper's findings highlight the importance of continued research in the field of education during and beyond the COVID-19 pandemic.

Conflict of interest

The authors declare that they have no conflicts of interest.

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