Unveiling The Virtual Classroom: An In-Depth Analysis of The Online Education System

Project Documentation

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ABSTRACT

Traditional education system revolves around conducting classes in person. Covid outbreak, in the recent past, has transformed the classroom teaching to online starting new era of online education. Online education impacts major stakeholders in various ways. Different tools to facilitate online education evolve that were used by teachers to deliver education to students. Students from varied societies with different demographic characteristics used these tools to learn. It is reflected that the performance in online is related to the economic status of the students and middle-class students perform better.

1. Introduction

Online education system provides facility for delivering education through internet medium. The education content like document, video lectures, assessments are delivered. The main platforms used for lecture delivery are zoom, google meet, google classrooms, other tools like Blackboard, Moodle to provide lecture content. These tools also provide the student engagement like a physical classroom. Online education has been used to deliver education for online or distance learning system. The physical classroom system has always higher weightage as compared to the online education system. During untoward outbreak of Covid-19, the regular classroom teaching was discontinued, and the online education system takes over the education delivery on regular basis.

1.1 Overview

This project report aims to delve deep into the various aspects of online education, examining its strengths, weaknesses, opportunities, and challenges. The outcomes of this project through dashboard and story will providevaluable insights for educational field and online learning.

1.2 Purpose

Using the CSV data provided by IBM and its tool Cognos Analytics, the in-depth analysis of level of satisfaction in online education system is carried out. To perform the analysis, factors like age, gender, location, and economic status of student, time-spent and doubt clearing from faculty are presented and their relationship with the level of satisfaction is presented.

2. THEORETICAL ANALYSIS

2.1 Block Diagram

The proposed solution is divided into three modules as depicted in the Figure 1 below:

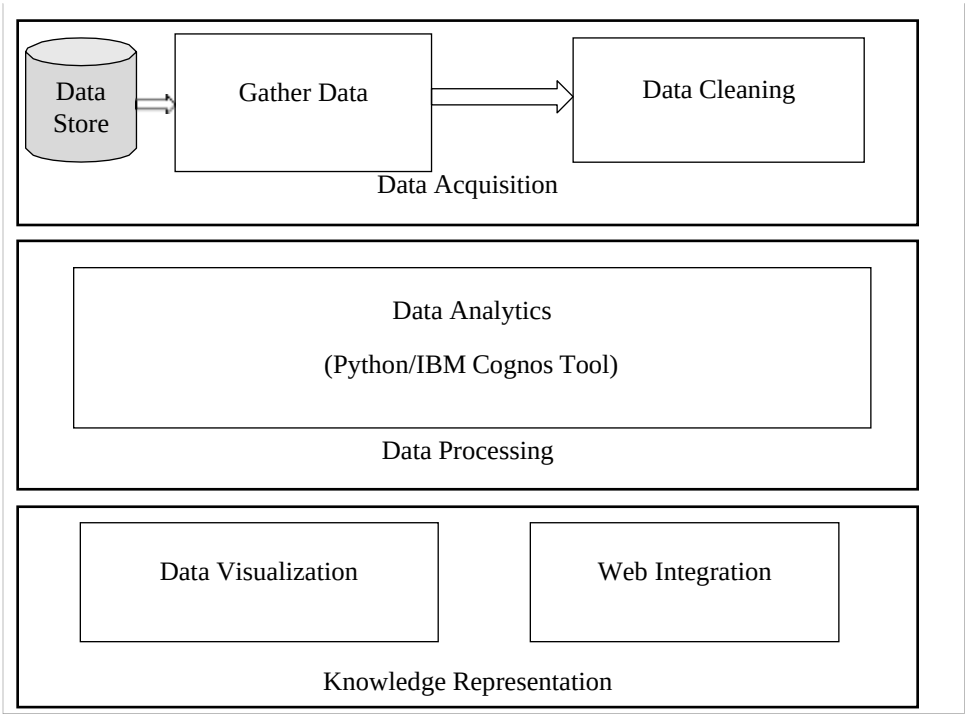

Figure 1: Block diagram of proposed solution

The three modules are: i) Data Acquisition, ii) Data Processing, and iii) Knowledge representation. Data acquisition delas with finding data source and gathering data. The acquired data may contain unwanted values which needs to be cleaned for correct interpretation and it requires cleaning. The cleaned data is used for analysis. The data analysis is performed using IBM Cognos Analytics tool over the cloud deployment. The data is also analyzed using python programming for studying relation between satisfaction level and identified factors.

The analysis is presented using different visualizations or charts as detailed in the results section. The visualizations are created as story and integrated in the web using flask integration with the website. The user can use various available filters to check the validity of the proposed solution.

2.2 Hardware/Software Designing

This project needs no specific hardware. To implement and study this project, the cloud-based IBM Cognos tool is used. To use this tool, an authorized account login on IBM Cognos system is required. The account has been created on IBM Cognos system and is activated to use the tool for analysis and presenting the results in the present report. To facilitate this tool, a seamless internet connectivity is required to conduct the implementation and the analysis. Alternatively, Python programming language is used to perform data analysis.

3. EXPERIMENTAL INVESTIGATIONS

3.1 Data Acquisition

To conduct the study, dataset relating to online education system is extracted from various sources. A standardized data set is used in the present report and is provided to conduct the study. **Collect the dataset:** The data set [4] is collected from the provided link to conduct study. Acquired data is to import for analysis in IBM Cognos. A valid account is required to use this tool for analysis.

Connect data with IBM Cognos:

The following steps are followed:

- Login to IBM Cognos account using the username and password used during the activation of the Cognos service.
- Click on IBM Cognos Analytics. The following screen opens (shown in Fig 2):

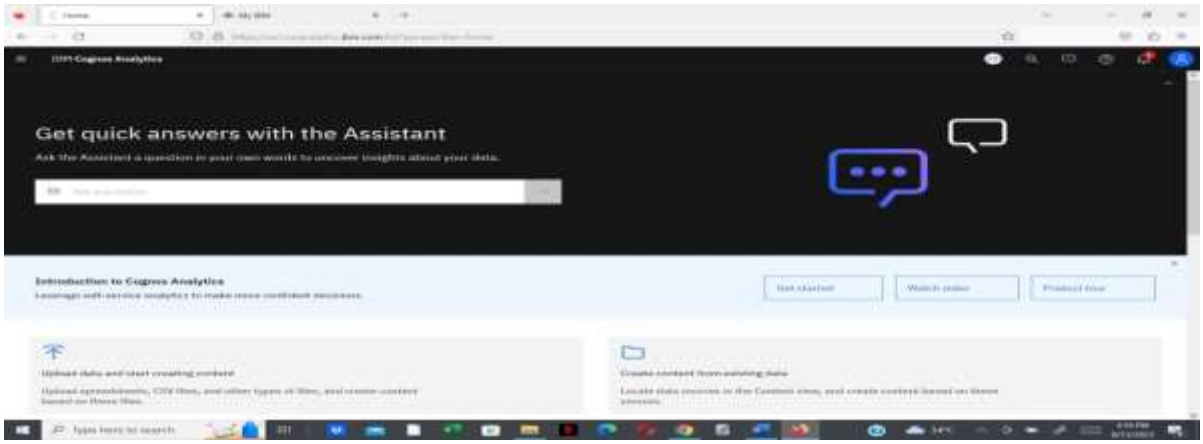

Figure 2: IBM Cognos Analytics interface

- From hamburger icon, click Upload Data. Browse the dataset downloaded and click Open. Now the dataset “ONLINE EDUCATION SYSTEM REVIEW.CSV” is available to work. See the following screen: (as shown in Fig 3)

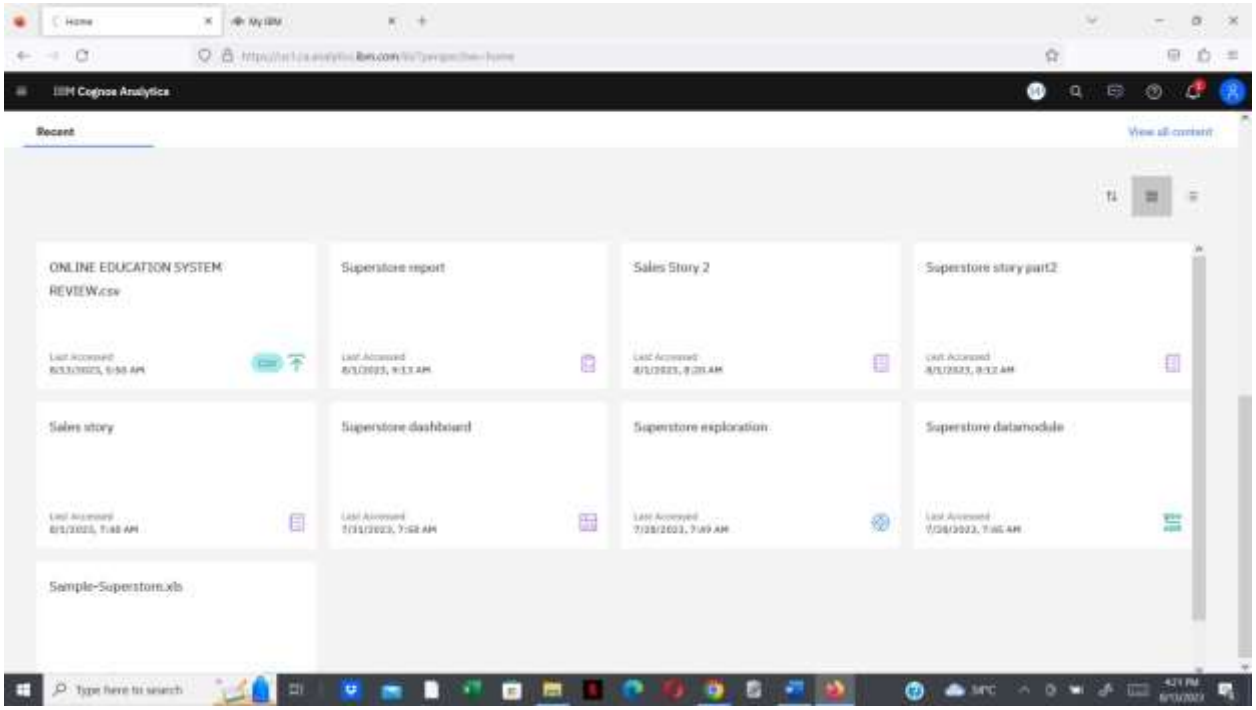

Figure 3: Dataset on IBM Cognos analytics login

- Now click on New item from hamburger icon and select Data Module. Select the dataset from my content and click Ok. Preview of data is available. The data module is saved as Online Education System Review:

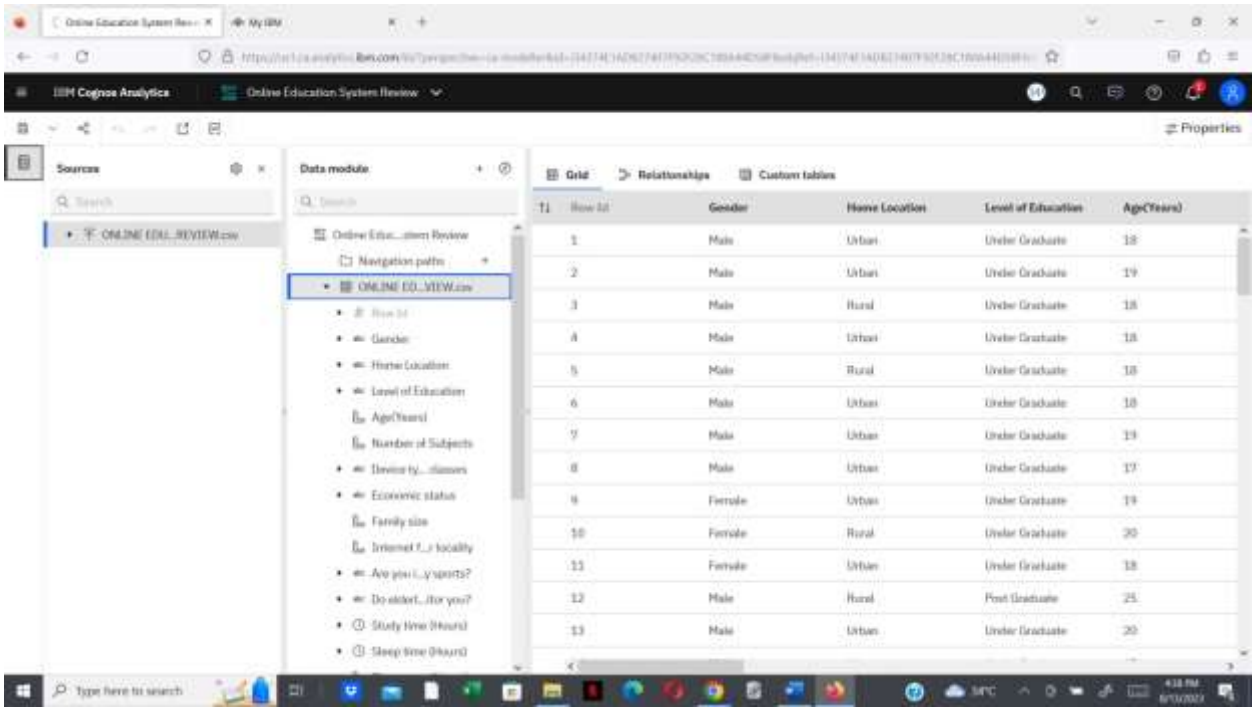

Figure 4: Module data exploration

- The data is now available to work. Dataset has 1034 rows with 23 columns. (As shown in Fig 4)

Data Preparation

Data preparation is the process of preparing raw data so that it is suitable for further processing and analysis. The data is checked for any false data or wrong entry. It is observed that there is no false or irrelevant data. Thus, cleaning is not required in the chosen dataset.

Data Visualization

The data visualization is to represent the relationship among data items to explore meaningful insights. To create a visualization, the following steps are followed:

- Click on New from menu, then select Exploration.
- It will open a new window where we need to click +Create link. Here select Single Visualization. Then select the relevant chart/graph for visualization.

The visualizations are created to analyze the questions drafted after literature survey.

4. FLOWCHART

The modules and the flow of data and information is displayed in the Fig. 5 below. The flow starts from Data Acquisition to Data Analysis and then visualization.

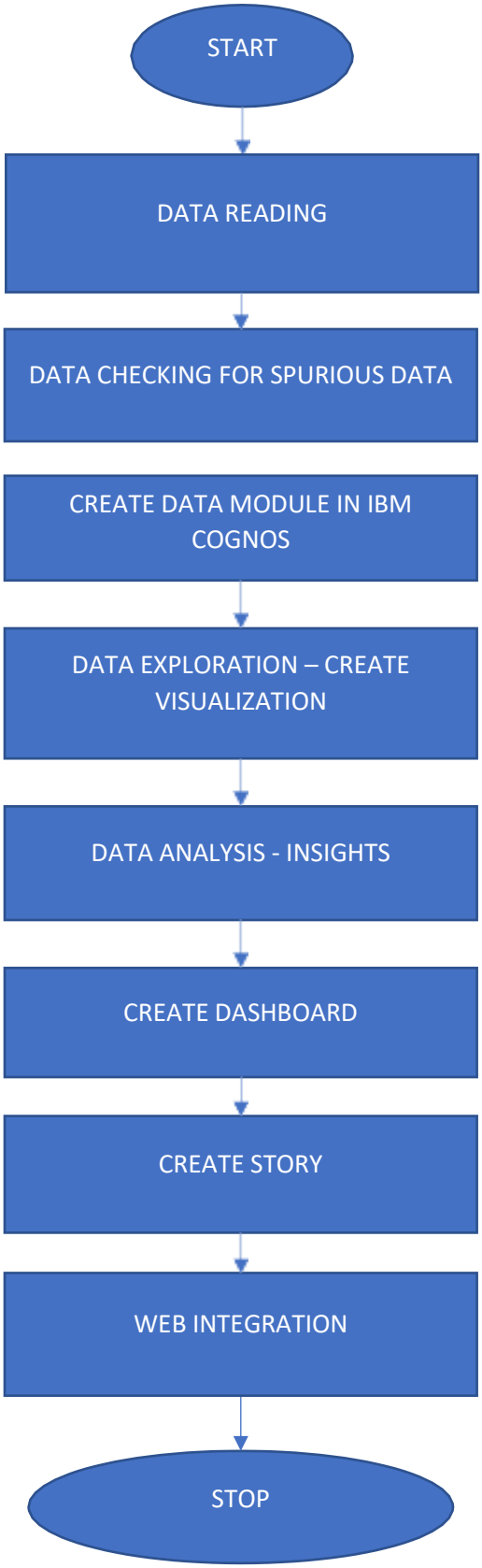

Figure 5: Flowchart of the education data analysis process

5. RESULT

The entire data is analyzed using IBM Cognos Analytics tool to answer the research questions identified and the results is discussed below in the coming sections. Various graphs/visualizations are used during analysis and are created using Data Exploration module of IBM Cognos Analytics.

Q1: Level of education of students taking online education.

- To analyze the level of education of students, pie chart (as shown in Fig 6) is created by selecting "Level of Education"as Segments and Size.

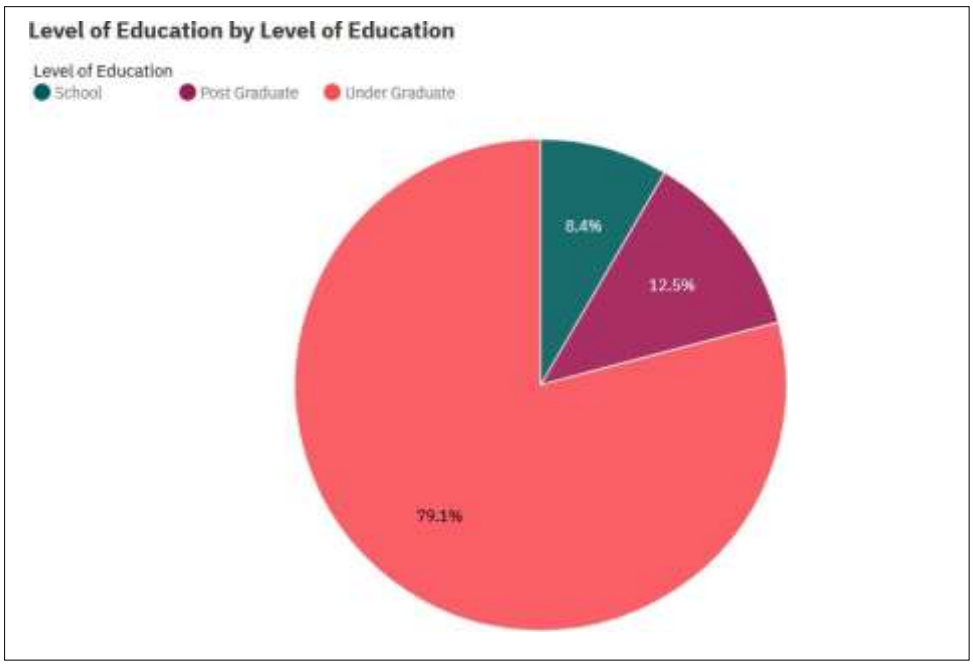

Figure 6: Participation in online learning system by education level

This is analyzed from Fig. 6 that a total of 817 (79.1%) undergraduate students participated in the online education system. Further, the gender-based analysis is performed on theses 817 students to observe the education level and it is observed that 483(46.8%) undergraduate students using online education system are male and 334 (32.3%) are female students, as shown in the Fig. 7 below:

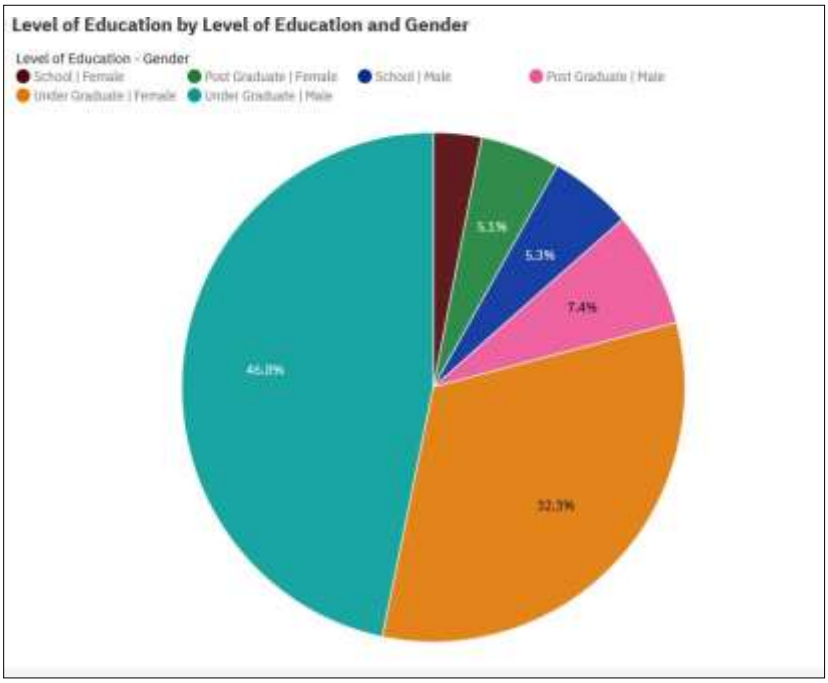

Figure 7: Detailed participation in online education by students - gender-based

Q2: Level of Satisfaction with Online education platform.

To visualize the level of satisfaction with online education platform another pie chart visualization is created. The satisfaction is categorized into three classes: Good, Average, and Bad as per the response collected. The target is to study the satisfaction level from online education system. Based on the data received from the users, the generated pie chart is as shown below in Fig. 8:

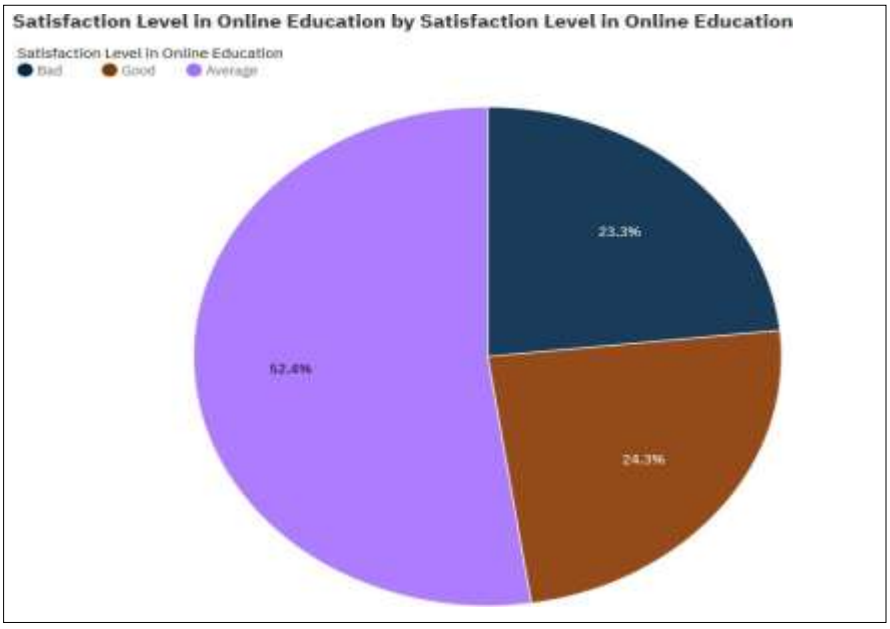

Figure 8: Satisfaction level of students in online education system

It is observed from the above chart that only 24.3% the students are satisfied from the online education system. There is a major part 52.4% showed the average satisfaction from the online education users. It has also presented during the literature review that the satisfaction level of students using online education system is also affected by the time spent on studying online. The accessibility is affected by the location of the student. It is studied that based on internet facility satisfaction level is affected. When the availability of the internet facility is high with average value of 3.75, the satisfaction level is Good, see Fig. 9:

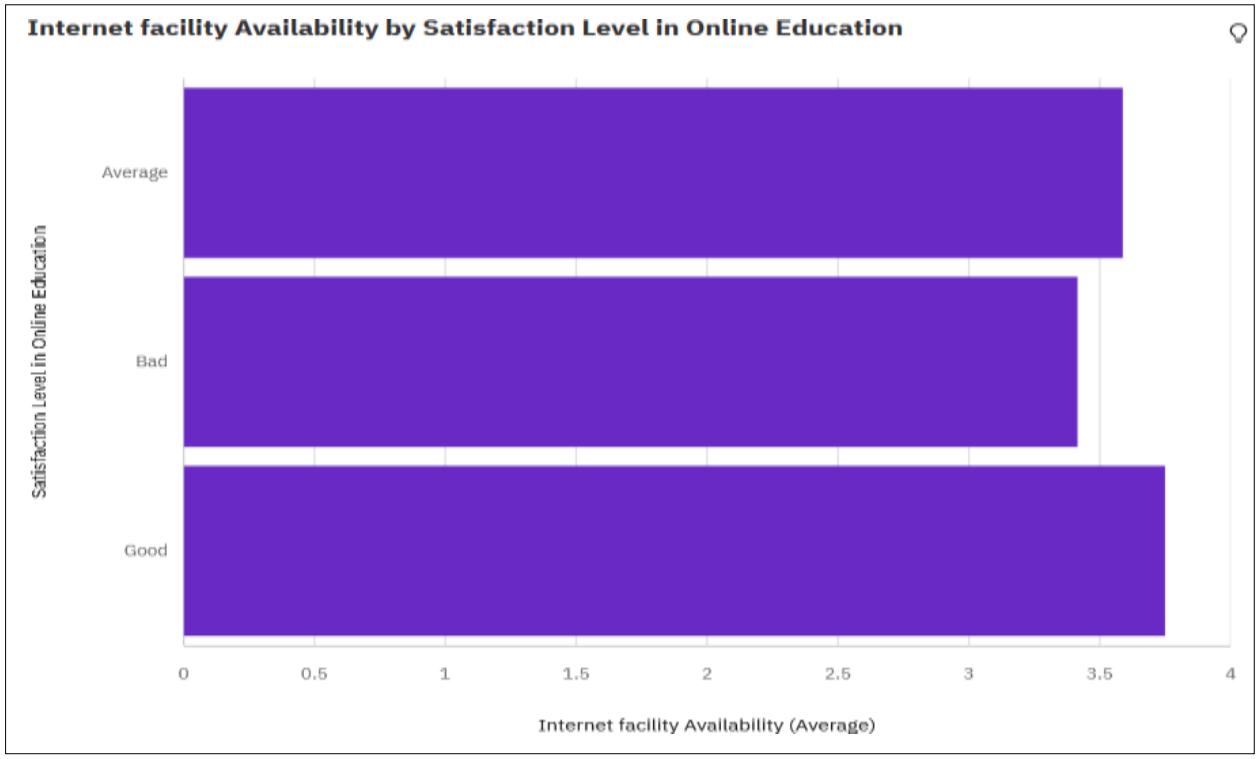

Figure 9: Effect of Internet facility on satisfaction level

Education level is analyzed to study the satisfaction level. Fig. 10 shows the graph with applied filter on Gender. It is studied that the female students perform better than male students. Undergraduate students perform best with average performance score of 6.99. Further, it is analyzed how the time spent on social media segmented by location. To illustrate this, the following chart as shown in Fig. 11 is created:

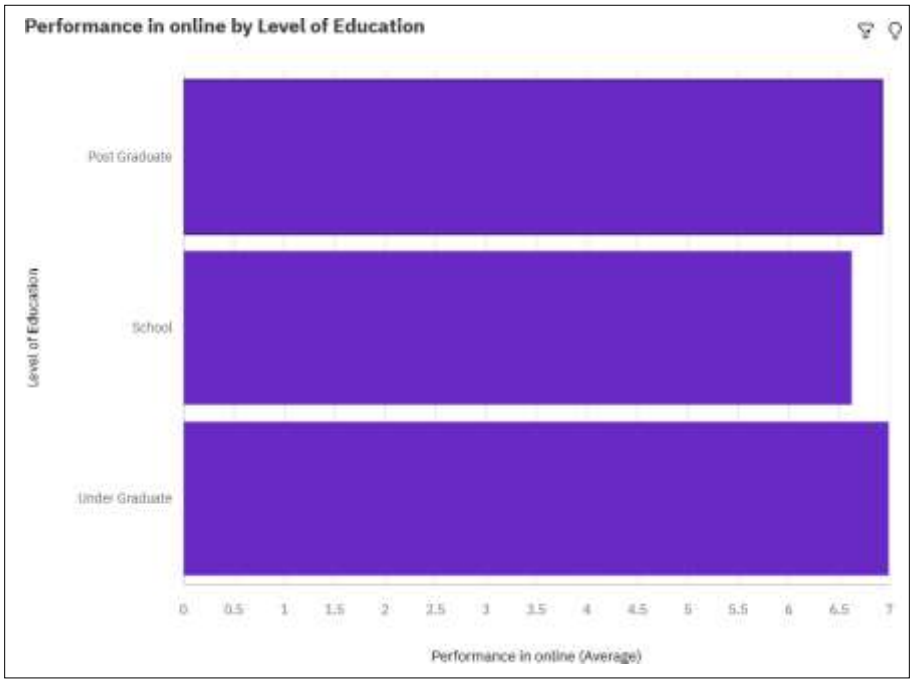

Figure 10: Level of education and performance in online.

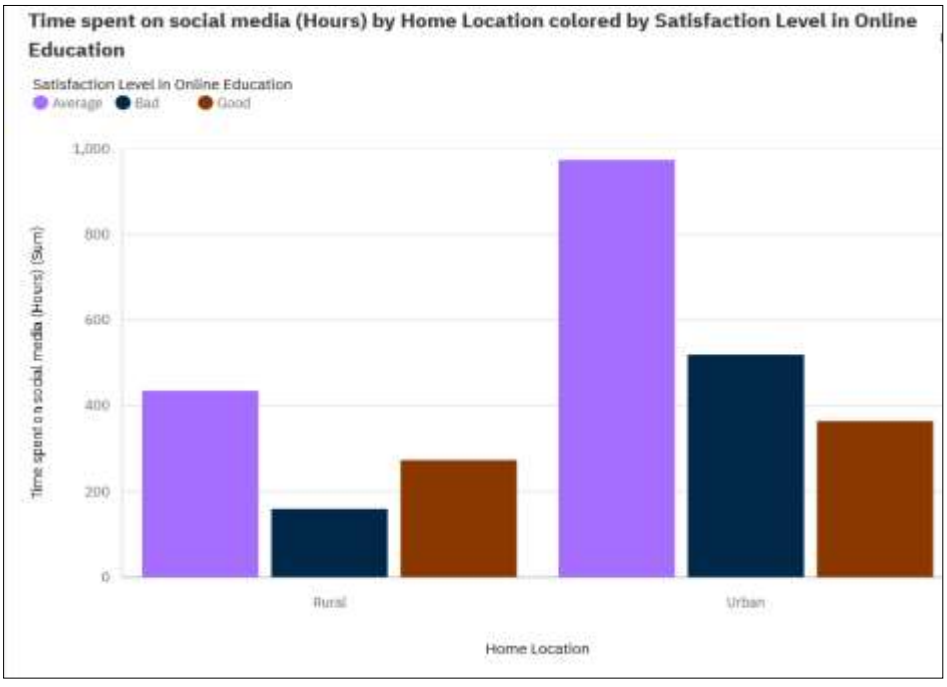

Figure 11: Relation between satisfaction level and time spent & location.

It is observed that student located in Urban area spent more time online and the satisfaction level is higher as compared to students located in the Rural area.

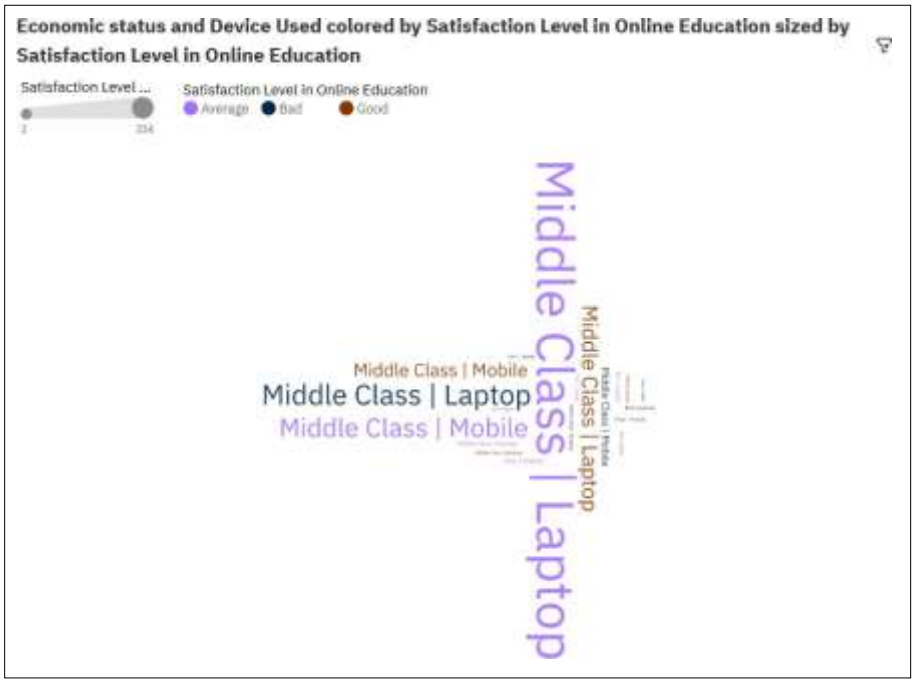

Figure 12: Effect of economic status, devices used on satisfaction level

It is observed that the student belonging to middle-class family used more devices and thus perform better in online education.

Q3: Relation across time spent online, average marks obtained and economic status of the students.

To analyze the impact of economic status on average marks obtained in offline classes and time spent online, the column chart is created. The data column for bars is Average marks Score before Pandemic in Offline classroom, bar length is denoted by Time spent on social media, and economic status is selected to represent the colors in column. The generated chart is visualized below as Fig. 13:

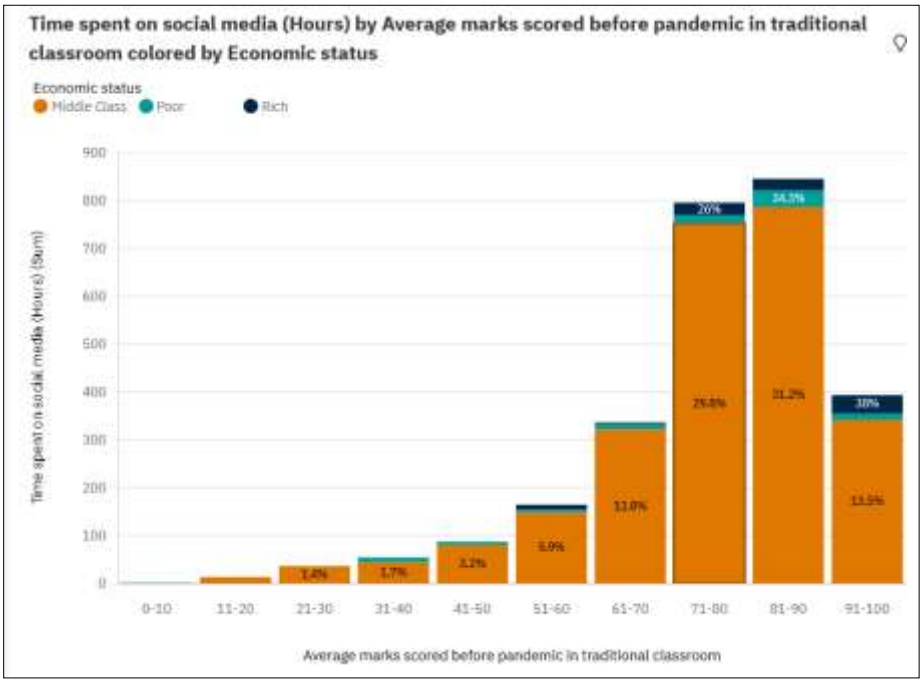

Figure 13: Time spent, and marks obtained by students belonging to different economic status

It is observed that Time spent on social media (Hours) is unusually high when Economic status is Middle Class. Similarly, it is observed that Time spent on social media (Hours) is unusually high when the combinations of Average marks scored before pandemic in traditional classroom and Economic status are 81-90 and Middle Class and 71-80 and Middle Class. It concludes that the students belonging to the Middle Class spent more time on social media.

Q4: Analyzing the relationship among gender, clearing doubts with faculty and their impact on satisfaction level.

During online education platform review, the gender-based satisfaction is analyzed. The satisfaction level is associated with the doubt clearance of a student during the session. In online mode of education delivery, the doubt clearance by faculty is analyzed and is visualized as stacked column chart. It is created by selecting single visualization, then column chart. Gender column is chosen to represent bars, length of bars is clearing doubts with teachers in online education, the satisfaction level is used to color the column. The following visualization is created and is shown in Fig. 14:

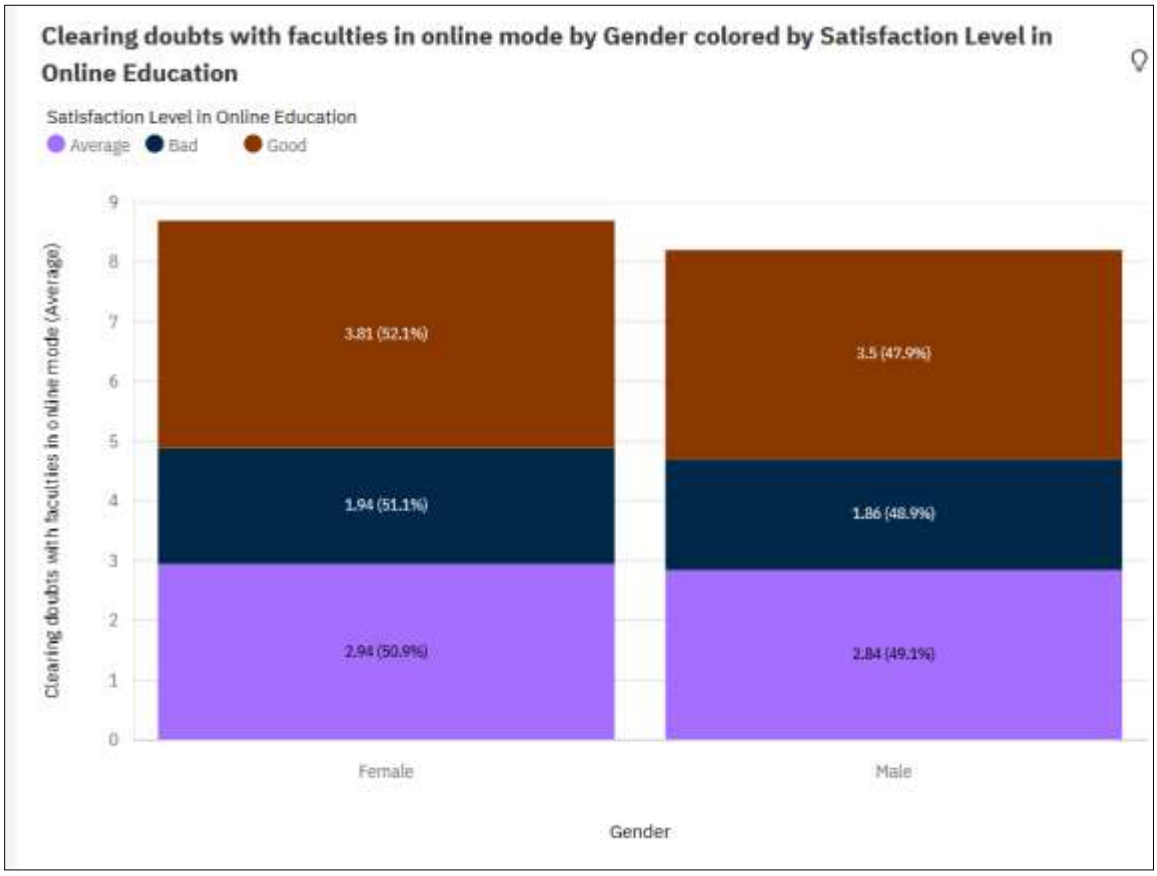

Figure 14: Relationship between satisfaction level and doubts clearance by male and female students.

It is observed that Satisfaction level is good when the clearing doubts online is high (3.81). Clearing doubts with faculties in online mode is high among Female students and accordingly the satisfaction level is Good. In contrast to this, Male students have low tendency to clear doubts with faculties in online mode and respectively the satisfaction level is low as compared against the Female students.

Q5: Visualization to relate economic status with availability of internet facility, devices used and time spent online.

The literature reflected that the economic status of family is major factor in facility availability to the users. The facility includes the devices, internet facility in the locality of the student. The availability of facility directly impacts the time spent online for education and impacts the level of satisfaction amongst the students. The analysis is carried out to relate the economic status with the facility available and time spent online using IBM Cognos analysis and exploration tool. The Fig. 15 is used to represent the analysis in tabular format with average facts presented.

Internet facility Availability, Economic status, Device Used and Time spent on social media (Hours)

Economic status ▲	Time spent on social media (...	Internet facility Availability	Device Used
Middle Class	2.57	3.75	Laptop
	2.63	3.52	Desktop
	2.81	3.25	Mobile
Summary	2.64	3.59	
Poor	1.87	2.81	Mobile
	2.44	3.17	Laptop
Summary	2.08	2.94	
Rich	2	4.5	Mobile
	3.43	4.64	Laptop
Summary	3.33	4.63	
Summary	2.64	3.59	

Figure 15: Analysis of device usage, time spent, and internet facility availability based on economic status of family.

Economic status, Home Location and Performance in online

Economic status	Home Location	Performance in online
Middle Class	Rural	6.72
	Urban	6.68
Summary		6.69
Poor	Rural	6.49
	Urban	6.07
Summary		6.37
Rich	Rural	9
	Urban	7.11
Summary		7.3
Summary		6.7

Figure 16: Economic status, location, and performance in online

It is observed from the Fig. 15 and Fig. 16 that the students belonging to the middle-class family spent more time online and they access online education system using all categories of devices like Laptop, Desktop, and Mobile. It concludes that the middle-class students have better accessibility to the devices. Students belonging to Rich class status family perform better with average performance of 7.3 in both areas rural and urban. This is because these students have better accessibility to devices and internet.

6. ADVANTAGES & DISADVANTAGES

The advantages of online education system review are manifold from the stakeholder's aspect. The main stakeholders to be benefited are students, teachers, and education institutions. Major advantages highlighted are:

- The education institutions can use this application to determine the factors affecting student performance in online education and accordingly may plan to deliver better. It will help to increase the interaction and interest of the students in online education to achieve better grades/marks.
- It concludes that many students use mobile for online education system. Thus, the content must be optimized to be effective on mobile devices.
- Teacher can analyze the student's performance based on demographic factors and accordingly design a tailor-made lecture delivery plan.

The system has the following disadvantages:

- Present study focuses on some identified factors, more socio-demographic factors can be identified and will not be analyzed in the present study. It will be taken as future work by the author.
- The dataset may belong to a particular region, thus restrict the application to be used in other regions. The application can be used by bringing in more data to the analysis system. Then, it will be more general and helpful to many regions.

7. APPLICATIONS

The proposed system in this report can be used by teachers, institutions to analyze the effect of factors on the student's performance in online education system. Institutions accordingly guide the teachers to make the online education delivery more effective with innovative ideas to increase interactivity among the students. The proposed system is also useful for the education delivery platforms to improve their products to incorporate more interactivity, personalization, and availability of the recorded sessions. Keeping all these measures, the product will become more useful for the students and teachers. Researchers can use this project to analyze the impact of identified factors on student's performance during online education system.

8. CONCLUSION

The analysis concluded that during online education system the female candidates show more participation as compared to the male students. The satisfaction level is higher among female students. It is concluded that student belonging to rural area has limited accessibility to the internet facility and thus unable to perform better in the online education system which in result lower the satisfaction level. Urban students perform better due to better availability of the internet facility. The students who spent more time in sleeping than study was able to spend more time online, but their performance level is lower. Middle class student used more type of devices during online education system and the performance is above average. The education level of the students is an important factor to determine the satisfaction level. The undergraduate and postgraduate students perform better in online education.

9. FUTURE SCOPE

The system has capacity to study some factors and some other factors can be identified and incorporated in the study. More data in dataset will improve the system performance and the system will be more beneficial to wider regions of the society. The system can be enhanced by incorporating artificial intelligence algorithms for better study. It will help to predict more student problems affecting the student's performance in the online education system.

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