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

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Problem Understanding

The domain of education has been remarkably transformed with the emergence of online education and e-learning platforms. This transfiguration came up with new avenues for learning and dissemination of knowledge. The growth of adoption of online education platforms has rapidly increased due to accessibility of the internet and other digital advancements. Unveiling the Virtual Classroom: An In-Depth Analysis of the Online Education System project aims at addressing the Challenges of Virtual Classrooms: Exploring Effective Strategies for Enhancing Engagement, Interaction, and Learning Outcomes in Online Education system. The problem definition is classified into four parts as: Business problem, Business requirements, Literature survey, and Social or business impacts.

Business Problems:

The major business project we have tried to cover through this project are as follows:

- **Technical Challenges:**
  - Connectivity Issues: Ensuring that both instructors and students have reliable internet access to participate in virtual classes without disruptions.
  - Hardware Compatibility: Addressing problems related to different devices, operating systems, and browsers that users may use for virtual classes.
  - Software Reliability: Ensuring the virtual classroom software functions smoothly, providing features like video conferencing, screen sharing, and interactive whiteboards without glitches.
- **Engagement and Interaction:**
  - Lack of Face-to-Face Interaction: Mitigating the loss of in-person engagement, which can lead to reduced student-teacher and student-student interactions.
  - Engagement Tools: Finding effective tools and strategies to keep students engaged during virtual classes, such as interactive quizzes, polls, breakout rooms, and discussions.
  - Overcoming Distractions: Dealing with potential distractions at home or in remote environments that can affect student focus and participation.
- **Assessment and Evaluation:**
  - Cheating and Plagiarism: Preventing and detecting academic dishonesty during online exams and assignments.
  - Assessment Security: Ensuring the security and integrity of online assessment tools to maintain the credibility of certifications and degrees earned.
- **Digital Equity:**
  - Access Disparities: Addressing the digital divide by ensuring that all students, regardless of socioeconomic background, have access to the necessary technology and resources for virtual learning.

    - Accessibility: Ensuring that virtual classrooms are accessible to individuals with disabilities, meeting legal requirements and ethical considerations.
- **Teacher Training and Preparedness:**
    - Effective Online Teaching: Providing teachers with training and resources to effectively use virtual classroom tools, create engaging content, and manage online classes.
    - Technology Proficiency: Helping educators become proficient in using various virtual classroom technologies and troubleshooting common technical issues.
- **Data Privacy and Security**:
    - Protecting Student Data: Implementing robust data security measures to safeguard student information and privacy in compliance with regulations like GDPR or FERPA.
    - Cybersecurity: Protecting virtual classroom platforms from cyber threats and hacking attempts that could compromise the integrity of online classes.
- **Time Zone Challenges:**
    - Global Participation: Managing scheduling conflicts due to students and instructors being located in different time zones, which can affect attendance and participation.
- **Content Delivery**:
    - Effective Content Presentation: Ensuring that course content is effectively delivered in a virtual format, including lectures, presentations, and multimedia materials.
    - Content Access: Ensuring that students can access and download course materials easily, even with slow internet connections.
- **Feedback and Communication**:
    - Feedback Mechanisms: Establishing efficient feedback mechanisms for students to ask questions, seek clarification, and provide input to instructors.
    - Communication Channels: Managing communication overload by using appropriate channels for announcements, discussions, and one-on-one interactions.
- **Cost and Resource Allocation:**
    - Infrastructure Costs: Managing the cost of maintaining virtual classroom platforms, including software licenses, servers, and technical support.
    - Resource Allocation: Efficiently allocating resources for technical support, server capacity, and software updates to meet increasing demand.
- **Pedagogical Adaptation**:
    - Adapting Teaching Methods: Adapting traditional teaching methods to suit the virtual environment and making the best use of available technology for effective learning.

Business Requirements

To address the business problems discussed in previous section, the project requires the following resources:

- Access to a diverse set of online education platforms, courses, and providers to analyze and compare their features, methodologies, and effectiveness.
- Collection of relevant data from students, educators, administrators, and industry experts to gain insights into their experiences, preferences, and expectations from online education.

- Expertise in research methodologies and data analysis to conduct a robust examination of the online education system, considering factors like student engagement, learning outcomes, course quality, and pedagogical approaches.
- Knowledge of emerging technologies and their potential impact on online education to explore innovative ways of enhancing the virtual classroom experience.
- Awareness of the regulatory landscape and legal considerations to ensure compliance with relevant laws and guidelines related to online education.

Literature Survey

On 11th March 2020, the World Health Organization categorized Coronavirus as a pandemic (Anon 2020c). Who would have thought that this virus had the power to stop the functioning of the world? COVID-19 affected people despite their background, class, community, gender, or nationality. People from the marginalized community were the worst hit by COVID-19. It increased the gap between the haves and have nots.

The screeching halt that COVID has put in has severely disturbed the education system. The closure of schools, universities, and other educational institutions has affected 990 million (UNESCO, 2020) students worldwide and over 320 million in India. Primary class students have been the most severely afflicted in India, with over 143 million (UNESCO, 2020). It has significantly troubled the lives of children from marginalized and vulnerable backgrounds, especially children with special needs and low-income families. The lockdown has deprived these children of physical learning opportunities and social and emotional support available at school (Bonal & Gonzalez, 2020). The current COVID situation has revealed many underlying vulnerabilities and inequalities in the education system.

India's situation is way more challenging to handle than countries worldwide because of the sheer number of population. During the country-wide lockdown, the Indian government had to resort to online classes for education. Teachers in India have been using the chalk-talk method for a long time, but this situation has compelled them to shift to the online mode for education (Ledrman, 2020). Online teaching is victor ludorum amidst this chaos; it is no more an option but a necessity (Dhawan, 2020). As a result, there has been a boom in the e-learning sector. Apps like Zoom, Webex, Google teams are becoming a norm for the students, teachers, and parents. With that comes the need to have a smart device and reliable internet connection, which is not always guaranteed in India (Menon & Unni, 2020). Many of the teachers are not even trained in teaching online. Teaching from home has its challenges. Teachers who have kids at home are finding it challenging to have a work-life balance. Beri & Sharma (2019) say that the teachers lack training and technical support in using ICT (Information and communication technologies) for teaching; in turn, there is an attached sense of anxiety to using ICT for teaching-learning purposes.

As more and more countries now begin to plan re-opening the schools, India continues with the online mode of education as the numbers of Coronavirus cases are drastically increasing. This leads us to question what learning is happening in our primary classes. Mohney (2020) says that teaching primary class students online involves significant challenges as it generally involves hours of screen time, which hampers child development and does not allow for hands-on learning. Moreover, a low attention span adds to the problems. The lack of human touch, the absence of opportunities for collaborative learning and the most important being the lack of support for hands-on learning for complex subjects like math and science are a big concern for achieving quality education (Chari, 2020).

Nevertheless, the pandemic has given us a chance to make a difference. It serves as an opportunity to rethink the current situation and make emergency education planning inclusive (Nhlapo, 2020).

It would come with challenges, but this is long-awaited to bring about a drastic change in our education system. Therefore, it must be looked at as an opportunity to devise a new paradigm shift in the way we look at education. A more holistic plan must be developed that focuses on the entirety of the child's life (UNESCO, 2015). Therefore, an exciting thing that has come from the lockdown is that we can incorporate online education and encourage open-ended, exploratory, and liberal education (Illich, 1971). The researchers are undertaking this research to understand and analyze a virtual classroom's functioning and how teachers are making their classes an inclusive space for primary class students in budget private schools in India. The paper engages with the questions; in what ways is online teaching different from face-to-face learning, what are the challenges and advantages of virtual classrooms, what is the teacher's understanding of Inclusive education and what are the different inclusive practices used in a virtual classroom in primary classes.

The landscape of education has been transformed by the emergence of online education systems, bringing forth the concept of the virtual classroom. This literature survey delves into the multifaceted dimensions of online education, investigating its strengths, weaknesses, opportunities, and challenges. The seminal work introduced by Siemens in 2005 given the notion of connectives, highlighting how digital tools foster new learning paradigms and how online environments promote knowledge sharing (George, 2005). Digital education leverages technology to facilitate learning and teaching, enabling flexible access to educational content and fostering interactive and personalized learning experiences. It encompasses online courses, virtual classrooms, and digital resources that enhance education's reach and effectiveness. Distance Education Enrollment Report 2017 given by Allen & Seaman (Allen & Seaman, 2017) provided insights into the growth and trends of online education enrollment, offering a comprehensive view of its expansion using online medium. An overview of research on online learning effectiveness, examining factors influencing student outcomes was done by Means et al., 2014. A report identifying emerging technologies impacting education, including adaptive learning and educational gaming was put forward by NMC horizon report 2016 (Duke et al., 2016).

The popularity of digital education encouraged the researchers to work on Blended learning. It combines traditional classroom instruction with online learning methods, seamlessly integrating in-person interactions with digital resources to enhance student engagement and learning outcomes in online education. Under the title ‘Blended learning: The new normal and emerging technologies’, the authors explored the blended learning, where virtual and physical classrooms intersect, showcasing how technology impacts pedagogical approaches (Dziuban et al., 2018). The trend of mobile technology in online education created a new trend for both the students and educators. In the same pace, a mobile technology-enhanced flipped classroom with effective home reading discussed the integration of mobile technologies and flipped learning to enhance online education (Hwang et al., 2015).

Furthermore, the application of gamification in e-learning enriches the educational journey by integrating game elements such as challenges and rewards, fostering active participation and motivation (Tsay et al., 2018: Kashive & Mohite, 2022). This approach transforms learning into an engaging and interactive experience, enhancing learner retention and overall comprehension. By infusing fun and competition, gamification elevates the effectiveness of e-learning platforms, making education an immersive adventure (Borba et al., 2018). .

To consider the challenges and mitigation strategies for an effective online education system, in 2015, Bates addressed challenges in online education, offering strategies for designing effective online courses and ensuring student engagement (Bates, 2015). The investigation of students' perceptions on security, integrity, etc. for online learning contexts and their impact on academic achievement have been studied by the researchers (Yavuzalp & Bahcivan, 2021). They found that students are more comfortable with online education than the traditional education system. Another report by NMC horizon in 2019 as a higher education edition outlined emerging technologies expected to impact education in the near future, such as AI-driven learning analytics (Becker et al., 2017). In fact, how the COVID-19 pandemic has accelerated the adoption of online education and potential post-pandemic scenarios excelled the research in the area of quality assurance of online education with respect to location, content available, customization. A thorough study of the impact of online learning during COVID-19 from the perspective of students' and teachers provided a remarkable contribution for analysis of the impact of the online education system (Nambiar, 2020).

The literature survey provides a comprehensive exploration of the online education landscape, encompassing pedagogical approaches, technological advancements, challenges, quality assurance, and future trends. It underscores the need for a holistic understanding of the virtual classroom's dynamics to shape effective and innovative online education systems.

Social and Business Impact

The nuanced analysis of the online education system will have significant social and business implications. Understanding the effectiveness of online education can positively impact learners by improving engagement, learning outcomes, and accessibility to education. It can also provide valuable insights to educational institutions and online platforms, enabling them to enhance their offerings, create more engaging learning experiences, and make informed decisions about resource allocation and course development. Additionally, by addressing challenges and capitalizing on opportunities, the project can contribute to the growth and sustainability of the online education industry, benefiting both providers and learners on a global scale.

Data Collection

The Dataset in the given problem consists of 23 columns and 1033 rows. The column Description for Online education system review:

- Gender: Gender of the student
- Home Location : Rural or Urban.
- Level of Education : UG, PG or school
- Age : age of the student
- Number of subjects :
- Device Type: device used to attend the online classes
- Economic status : economic status of the family
- Internet facility in your locality

- Are you involved on any sports
- Family Size
- Do elderly people monitor you ?.
- Study Time(hours)
- Sleep time (hours)
- Time spent on social media(hours)
- Interested in gaming ?
- Have a separate room for studying ?
- Engaged in group studies ?
- Average marks scored before pandemic in traditional classroom
- Your interaction in online mode
- Clearing doubts with faculties online ?
- Interested in ?
- Performance in online
- Your level of satisfaction in online education

Connection the Data with IBM Cognos

IBM Cognos is a powerful business intelligence and performance management tool that enables organizations to access, analyze, and visualize data from various sources. It offers advanced reporting, dashboarding, and data modeling capabilities, facilitating data-driven decision-making. Cognos seamlessly connects to diverse data repositories and provides insights through user-friendly interfaces, contributing to enhanced business performance and strategic planning.
Steps: Login to IBM Cognos —-> Launch IBM Cognos —-> Go to the prepare data section —-> click on upload option —->upload the csv file.

Data Preparation

Preparing the data for visualization involves cleaning the data to remove irrelevant or missing data, transforming the data into a format that can be easily visualized, exploring the data to identify patterns and trends, filtering the data to focus on specific subsets of data, preparing the data for visualization software, and ensuring the data is accurate and complete. This process helps to make the data easily understandable and ready for creating visualizations to gain insights into the performance and efficiency. Data preprocessing can be performed in many ways using many different steps depending on the data. Renaming the data columns and cleaning of rough data have been performed on collected dataset using IBM Cognos.

Data Visualization and Data Dashboard

The total 13 unique visualizations have been created from the given dataset. The types of visualizations include bar charts, line charts, heat maps, scatter plots, pie charts etc. These visualizations can be used to compare performance, track changes over time, show distribution, and relationships between variables, resource allocation, etc.

The responsiveness and design of a dashboard for online education review data is crucial to ensure that the information is easily understandable and actionable. Key considerations for designing a responsive and effective dashboard include user-centered design, clear and concise information, interactivity, data-driven approach, accessibility, customization, and security. Here, the goal is to create a dashboard that is user-friendly, interactive, and data-driven. Four tabs has been included in the dashboard from the pinned visualization in IBM Cognos. Refer Figure 1- Figure 4 for dashboard.

Figure 1: Visualization 1

Figure 2: Visualization 2

Story

A Story provides an insight for the entire project. A story depends on the complexity of the analysis and the specific insights that are trying to be conveyed. It is a visual representation of the data analysis process and it breaks down the analysis into a series of steps or scenes. The number of scenes in a storyboard for a data visualization will analyze the performance and efficiency of online education. The story scenes given in Figure 3 describes the analysis of online education system based on given data.

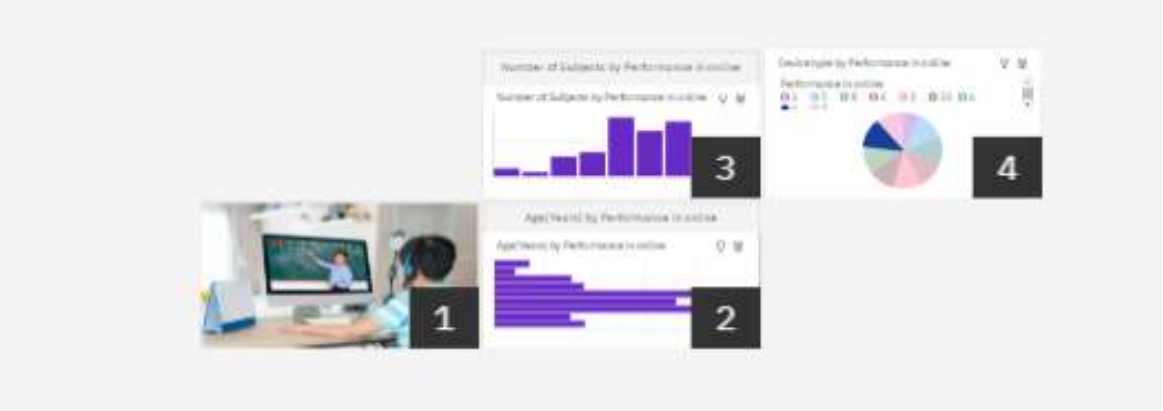

Figure 3: Scenes of Story

Report

In IBM Cognos, a report is a structured presentation of data insights using visual elements like tables, charts, and graphs. It is essential for data analytics as it translates raw data into understandable formats, enabling effective data-driven decision-making. Reports in IBM Cognos facilitate data exploration, visualization, and communication of key insights, forming a cornerstone of robust data analysis processes. Figure 6 and Figure 7 depicts the report generated for the analysis of the virtual classroom in online education system.

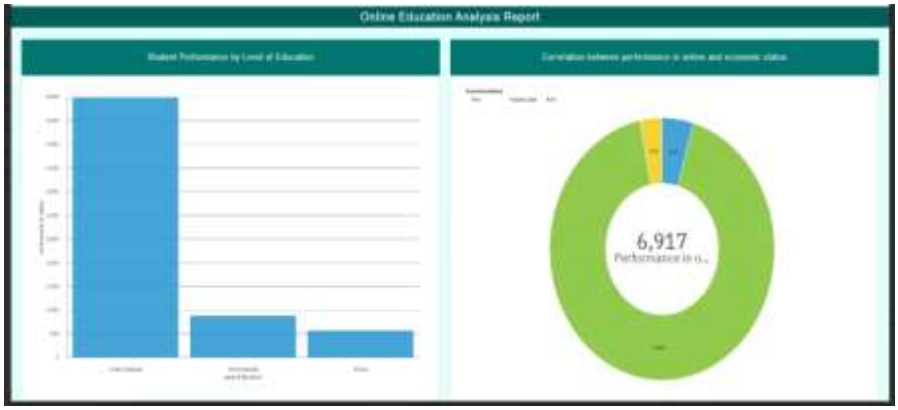

Figure 4: Report Part-1

Figure 5: Report Part-2

Web Integration

Web publishing helps us to track and monitor key performance metrics, to communicate results and progress. Helps a publisher stay informed, make better decisions, and communicate their performance to others.

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