

A Machine Learning Approach to Determine the Motivating and Demotivating Factors in Online Learning Management Systems

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Abstract

Learning is the secret to success for career-oriented people who want to grow in both their personal and professional life and may pursue it for the rest of their lives. Sadly, the bulk of us are having trouble fitting new hobbies into our demanding and strict schedules. This research is mainly based on finding the factors that motivate or demotivate the students or the teachers for using online learning management systems such as Zoom, Moodle, Microsoft Teams etc. To forecast the influencing elements of online learning management systems, this study assessed and contrasted several supervised machine learning algorithms such as Gaussian Naive Bayes, Multinomial Naive Bayes, K-Nearest Neighbors, Support Vector Machines, Decision Tree Classifier and Random Forest Classifier. All these algorithms are included in the proposed model. With a focus on how students and teachers perceive online learning management systems, the survey includes information gathered from 102 students and 20 teachers at an engineering university in Bangladesh (LMS). A set of significant factors to the development of online learning systems are revealed by an analysis of the data that was collected. The findings recommend enhancing positive experiences and reducing demotivating elements in the online learning environment.

Keywords

Machine Learning Algorithms, Learning Management System and Online Learning.

1. Introduction

According to the minutes of an internal meeting of China's National Health Commission, as many as 248 million people, or nearly 18% of the population, probably caught the virus in the first 20 days of December. According to estimates from the government's main health authority, around 37 million people in China may have contracted Covid-19 on a single day this week, making the country's outbreak by far the greatest in the world. If true, the infection rate would far exceed the previous daily high of 4 million, which was achieved in January 2022. Under these conditions, the closure of educational institutions might be expected, much as the last pandemic attack. Online learning is essential in these situations. The rising usage of online learning resources is the new norm in education. The COVID-19 epidemic has inspired innovative approaches to education. Educational institutions all around the world are looking to online learning platforms to carry on the process of educating pupils. The paradigm of education has changed, and the foundation of this change is online learning. This is the new normal. Today, digital learning has become a vital tool for students and educational institutions all around the world. This is a brand-new approach to education that many educational institutions have been forced to adopt. Online education is increasingly available for learning about more than simply academic subjects. Higher education is becoming a more dynamic and adaptable idea as online courses become more common. Numerous academic institutions across the globe have developed a variety of online courses that are offered to their students in the last two decades. Learning motivation is relatively important in most environments with a lot of interaction. The demand for online education has greatly increased recently and will likely continue to do so in the future. Online learning, like any educational modality, offers advantages and disadvantages of its own. Deciphering and comprehending these advantages and disadvantages can assist institutions in formulating plans for more effectively delivering the lectures, assuring a continuous learning experience for students.

1.1 Objectives

The primary goal of this study is to identify the elements that either encourage or discourage students or teachers from adopting online learning management systems like Zoom, Moodle, Microsoft Teams, etc. Predicting the likelihood that online learning management systems would be accepted from the perspectives of teachers and students is another driving force behind this study. Here, comparisons between the accuracy levels of various machine learning methods are also conducted.

2. Literature Review

Even though COVID-19 had a significant part in the development of online learning, other factors, such as nation disparities, gender, and COVID-19 also had a significant impact on online learning access (McIntyre, 2022). Depending on the platform they used, the preferences and behaviors of the students alter. Quantitative analysis is performed on behaviors such as benefits, drawbacks, engagement, learning effort, and the desire to remain online or not (Gherheş et al. 2021). Lack of data always limits the effectiveness of a prediction model when employing a short dataset, as is the case in many situations. With a quasi-experiment conducted among 62 college students, a deep learning-based learning performance prediction approach (PT-GRU) was presented and demonstrated to have a high level of accuracy. Since acquiring data takes time, this opens up a new direction for machine learning (Wang et al. 2022). Data from the students' experiences with online learning during the COVID-19 circumstance were collected and analyzed using the Random Forest algorithm to understand more about the students' viewpoint. The findings demonstrate that student happiness is significantly influenced by relationships between teachers and students. When a teacher is approachable, even when teaching online, students feel comfortable and at ease. Technology and instructional materials have an impact on student satisfaction as well. Online-friendly learning resources are necessary for students to maintain their focus for extended periods of time. Another problem is that access to technology for online platforms is limited in developing nations, which leads to learning disparities that impede integrated growth (Suparwito et al. 2021). The motivational variables can be altered in an online context since learning occurs in a different environment than it does offline. Online learning has a significant impact on areas that require group projects and teacher-student dialogue. Obtaining good marks, comprehending the course material, and managing views about learning through boosting self-efficacy are the main determinants, according to a quantitative analysis based on the poll of 89 respondents (Che Soh et al. 2022). An investigation of the motivating and demotivating characteristics of online learning was conducted because online courses are given by numerous colleges throughout the world. The study was conducted among professors and students using Moodle as the exclusive online learning platform. The findings demonstrated that some tasks, such as managing materials and automating test checking, have become simpler, which is encouraging for online learning systems. The ease with which students can communicate with their teachers online and the availability of mobile and laptop access are motivating aspects for students. However, there are also some demotivating elements, such as a lack of openness, a lack of interaction between students and teachers, a lack of student plagiarism checks, and a lack of network (Aikina&Bolsunovskaya 2020).

3. Methodology

This part gives a quick review of the main machine learning techniques and demonstrates the necessity to implement them in a range of circumstances, such as predicting the probability of usage of online learning platforms. Machine learning algorithms can often be divided into supervised and unsupervised methods. For predicting the object class from pre-labeled objects, supervised algorithms are trained. The unsupervised algorithm, however, identifies the logical grouping of the items provided as unlabeled data. In this paper, the supervised learning methods listed below are of interest.

1) Gaussian Naive Bayes:

Continuous valued features are supported by Gaussian Naive Bayes, which also models each as following a Gaussian (normal) distribution. Assuming that the data is characterized by a Gaussian distribution with no covariance (independent dimensions) between dimensions is one method for building a straightforward model. Finding the mean and standard deviation of the points within each label, which is all that is required to establish such a distribution, will allow this model to be fit.

2) Multinomial Naive Bayes:

A specific form of naive bayes called multimodal naive bayes, sometimes known as multinomial naive bayes, is created to handle text data utilizing word counts as its fundamental technique of calculating probability. It's crucial to comprehend the fundamentals before delving into multinomial naive bayes.

3) K-Nearest Neighbors:

The k-nearest neighbors algorithm, sometimes referred to as KNN or k-NN, is a supervised learning classifier that employs proximity to produce classifications or predictions about the grouping of a single data point. Although it can be applied to classification or regression issues, it is commonly employed as a classification algorithm because it relies on the idea that comparable points can be discovered close to one another.

4) Support Vector Machine:

Support Vector Machine (SVM) is a supervised machine learning technique used for both regression and classification. Although we also refer to regression concerns, categorization is the most appropriate term. Finding a hyper plane in an N-dimensional space that clearly classifies the data points is the goal of the SVM method. The number of features determines the hyperplane's size. The hyperplane is essentially a line if there are just two input features. The hyperplane turns into a 2-D plane if there are three input features. Imagining something with more than three features gets challenging.

5) Decision Tree Classifier:

The decision tree algorithm belongs to the supervised learning subset. They can be applied to both classification and regression issues. Each leaf node of the decision tree corresponds to a class label, and the interior nodes of the tree are used to represent the attributes to answer the problem. The decision tree can be used to represent any Boolean function on discrete attributes.

6) Random Forest Classifier:

A random forest is a machine learning method for tackling classification and regression issues. It makes use of ensemble learning, a method for solving complicated issues by combining several classifiers. The decision trees used in this approach are numerous. The random forest algorithm creates a "forest" that is trained via bagging or bootstrap aggregation. The accuracy of machine learning algorithms is increased by bagging, an ensemble meta-algorithm. Based on the predictions of the decision trees, the (random forest) algorithm determines the result. It makes predictions by averaging or averaging out the results from different trees. The accuracy of the result grows as the number of trees increases.

The algorithms indicated above were utilized to create the model we suggested. The key factors that can motivate or demotivate people to use different online learning platforms are then determined using this approach.

4. Data Collection

The Bangladesh University of Engineering and Technology in Dhaka, Bangladesh, was the site of the current study. 20 lecturers and professors, along with 102 engineering undergraduate students, participated in the project. The study's objective was to investigate the elements that influence the motivation and de-motivation of educators and students when using the several online learning platforms. There were several questionnaires in the survey, and each contained multiple-choice, checkbox and open-ended questions. The participants' replies were based on their academic and extracurricular learning and teaching experiences using learning management systems (LMS) from the university, including Zoom, Google Meet, Microsoft Teams, Moodle, and others. The results highlight the respondents' opinions of e-learning as well as the challenges they encountered.

5. Results and Discussion

According to data gathered from students, 55 (56%) of them are giving their opinion about online learning platforms that are efficient enough to be used for education. On the other hand, 47 (46%) of them believe that appropriate educational delivery is ineffectual and unsuccessful online. But if we go deeper for analyzing, we will be able to learn about that perception about online learning platforms varies from different age ranges for students. A higher portion of students of the age range 21-25 find online learning effective and significant whereas students of age range 16-20 find them unsuccessful and fruitless.

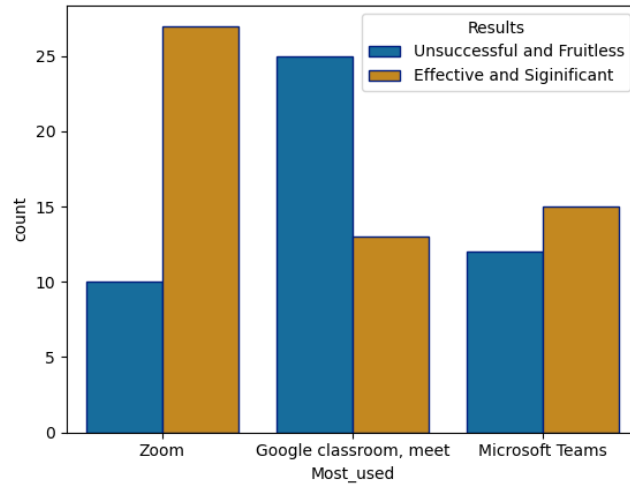


Figure 1 Final Result Counts

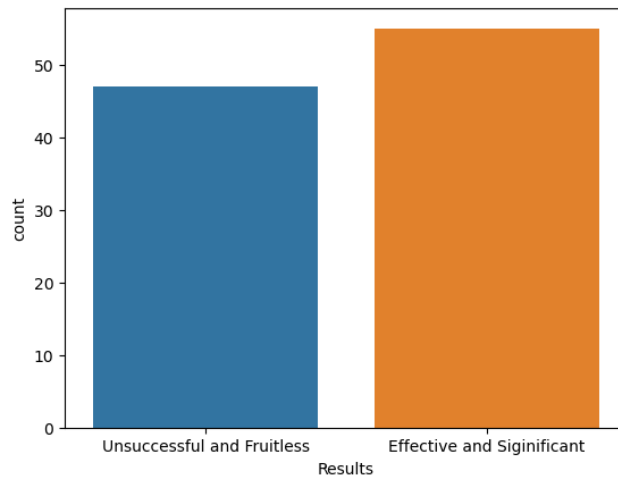


Figure 2 Final Result Counts Vs Age

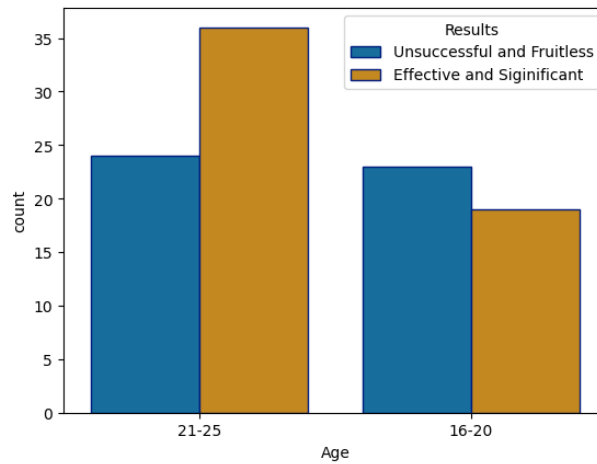


Figure 3 Satisfaction or Dissatisfaction According to Their Mostly Used Software

However, this perception again changes when the questions arise about which online platform was mostly used by the students. In that view, Zoom and Microsoft Teams got positive opinions from the students where google classroom/meet was represented as inefficient. Graphical representation of this case is like following,

Through the survey questions, students were asked about some determinants which may have certain levels of importance of taking decisions about these online learning platforms whether they are useful are not. These factors are given below in Table 1:

Table 1. Raw Attributes and Their Measurement Scale (For Students)

<u>Attributes</u>	<u>Measurement Scale</u>
1. Simplicity of Joining Online Classes (Simplicity)	Likert Scale of 1-5
2. If the Online Classes are Responsive or not (Responsiveness)	Likert Scale of 1-5
3. Simplicity of Storing Important Study Materials (Simplicity_Resources)	Likert Scale of 1-5
4. Likelihood of a Student Losing His/her Concentration During Online Classes (Concentration loss)	Likert Scale of 1-5
5. Joining Online Classes are Problematic or Not (Joining_problems)	Likert Scale of 1-5
6. Likelihood of a Student Copying from any Sources During any Online Examination or Assessment (Plagiarism)	Likert Scale of 1-5
7. Response Variable (Effective and Significant or Unsuccessful and Fruitless)	Binary (1 = Unsuccessful and Fruitless, 0 = Effective and Significant)

Graphical representation of correlations between these attributes and our response variables (if online learning is effective or not) are given below:

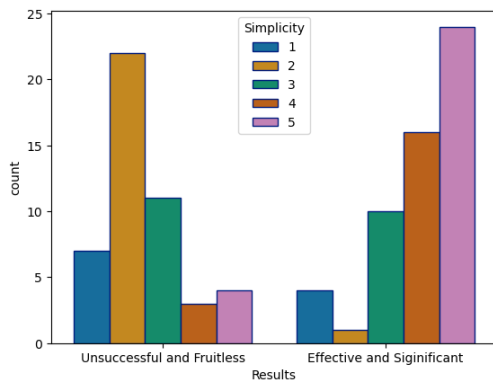


Figure 4. Simplicity Vs Response Variable

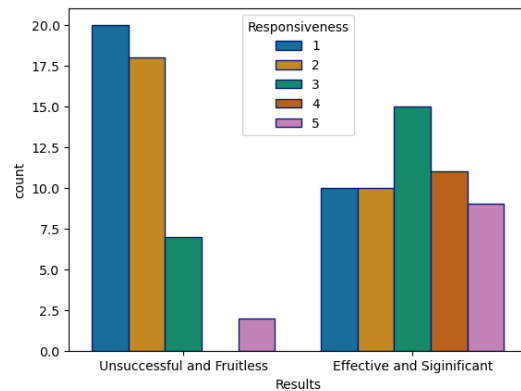


Figure 5. Responsiveness Vs Response Variable

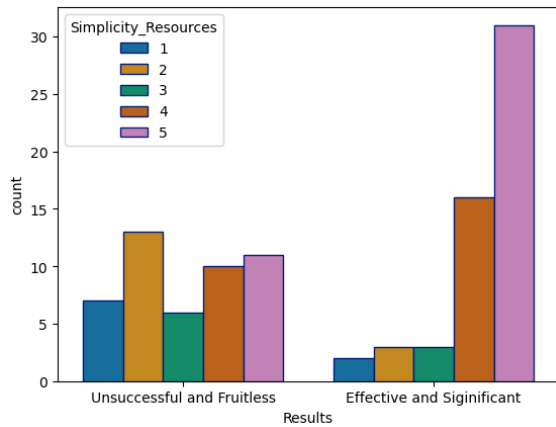


Figure 6. Simplicity Resources Vs Response Variable

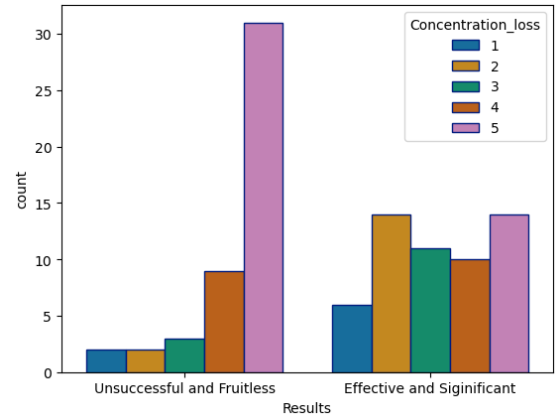


Figure 7. Concentration loss Vs Response Variable

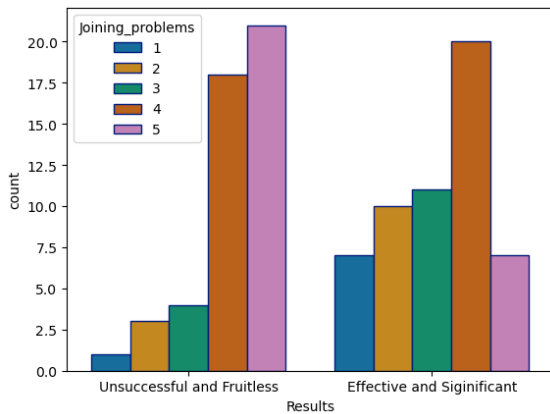


Figure 8. Joining problems Vs Response Variable

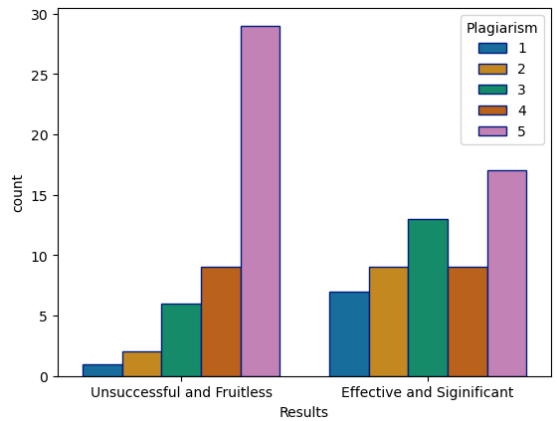


Figure 9. Plagiarism Vs Response Variable

By going through the surveys, we came to learn that Simplicity in joining online classes and storing study materials have played the most vital factor in choosing online learning platforms as effective and useful for students. Lack of responsiveness has been the most significant reason for taking online learning as ineffective. Similarly, for students who find online learning management systems ineffective, loss of concentration, joining problems and plagiarism are the main factors behind it.

Similar study has been performed based on those responses of 20 professors and lecturers of BUET.

According to data gathered from teachers, 13 (65%) of them are giving their opinion about online learning platforms that are efficient enough to be used for teaching purposes. On the other hand, 7 (35%) of them believe that appropriate educational delivery is ineffectual and unsuccessful online. But if we go deeper for analyzing, we will be able to learn about that perception about online learning platforms varies from different age ranges for teachers also. A higher portion of teachers of the age range 25-40 find online learning effective and significant whereas teachers of the higher age range 40-60 find them mostly unsuccessful and fruitless.

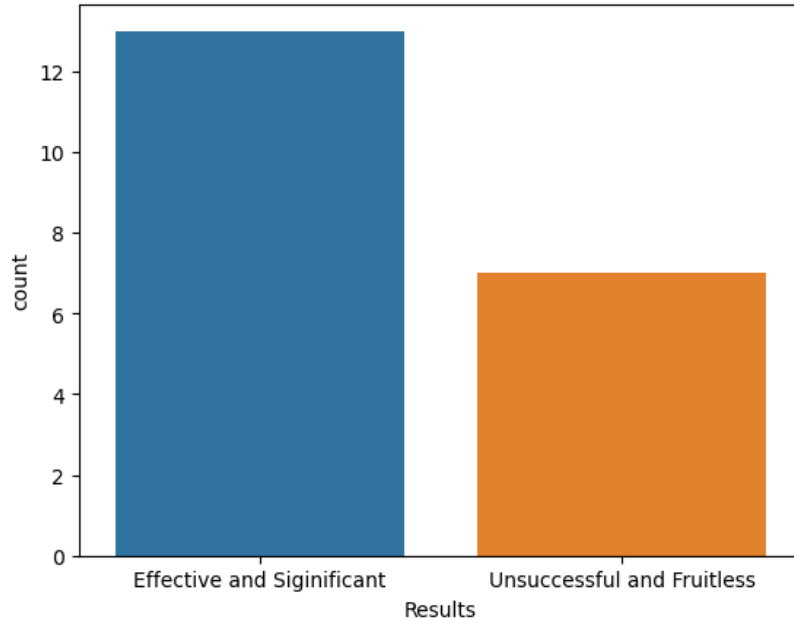


Figure 60. Final Result Counts for Teachers

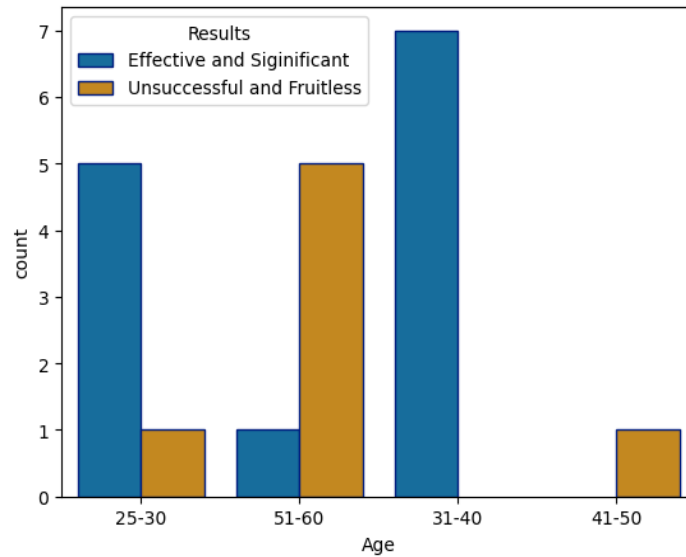


Figure 11 Final Result Counts Vs Age

However, this perception again changes when the questions arise about which online platform was mostly used by the teachers. In that view, Zoom and Microsoft Teams got positive opinions from the teachers where google classroom/meet was represented as inefficient and no one chose these platforms. Graphical representation of this case is like following,

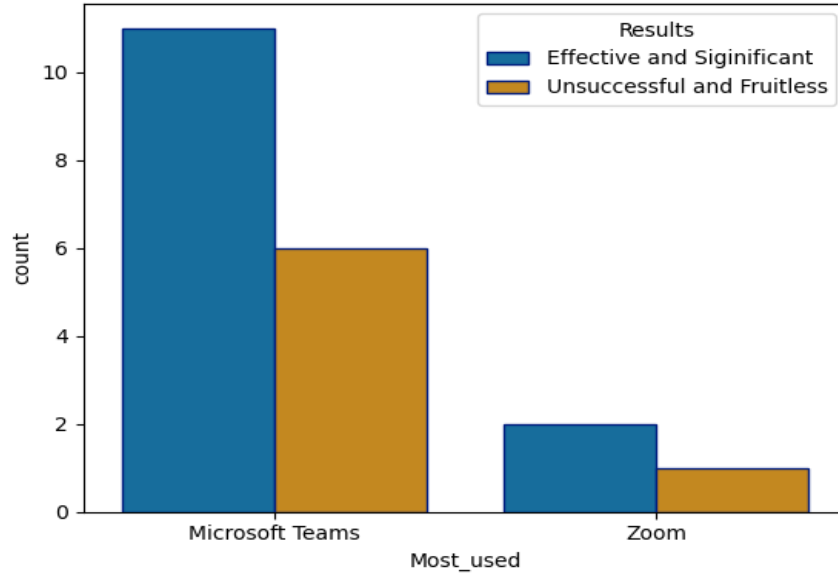


Figure 12. Satisfaction or Dissatisfaction According to Their Mostly Used Software

Through the survey questions, teachers were asked about some determinants which may have certain levels of importance of taking decisions about these online learning platforms whether they are useful are not. These factors are given below in Table 2:

Table 2 Raw Attributes and Their Measurement Scale (For Teachers)

<u>Attributes</u>	<u>Measurement Scale</u>
1. Simplicity of Joining Online Classes (Simplicity)	Likert Scale of 1-5
2. If the Online Classes are Responsive or not (Responsiveness)	Likert Scale of 1-5
3. Simplicity of Storing Important Study Materials (Simplicity_Resources)	Likert Scale of 1-5
4. Likelihood of a Student Losing His/her Concentration During Online Classes (Concentration_loss)	Likert Scale of 1-5
5. Likelihood of a Student Copying from any Sources During any Online Examination or Assessment (Plagiarism)	Likert Scale of 1-5
6. Response Variable (Effective and Significant or Unsuccessful and Fruitless)	Binary (1 = Unsuccessful and Fruitless, 0 = Effective and Significant)

Graphical representation of correlations between these attributes and our response variables (if online learning is effective or not) are given below:

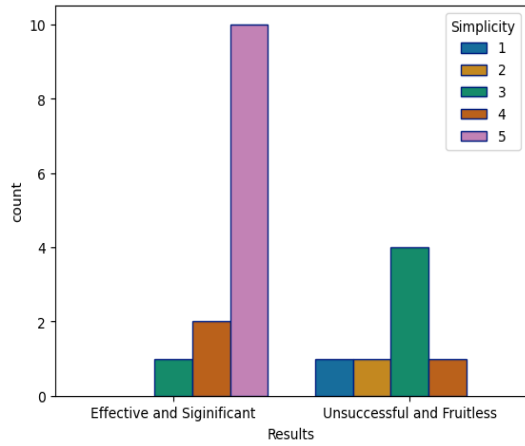


Figure 13. Simplicity Vs Response Variable

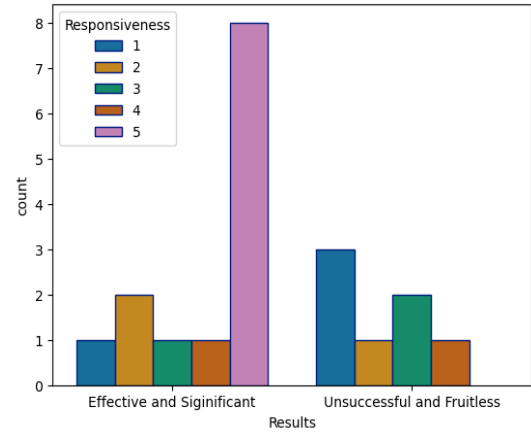


Figure 14. Responsiveness Vs Response Variable

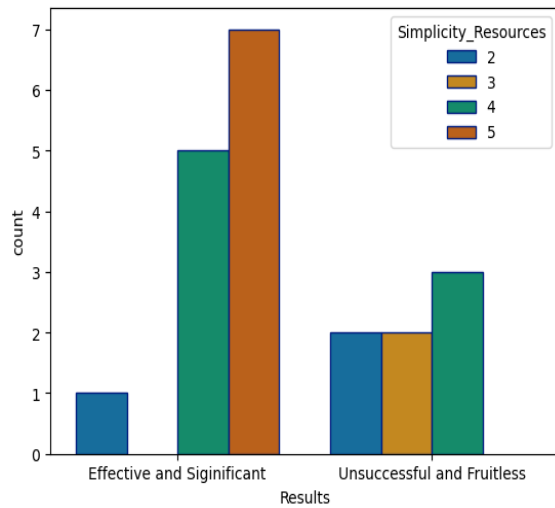


Figure 15. Simplicity Resources Vs Response Variable

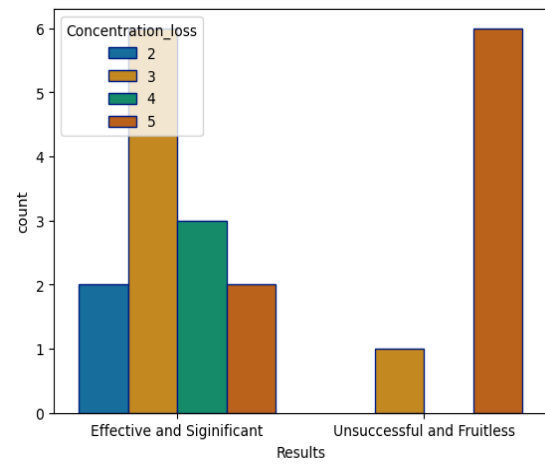


Figure 16. Concentration loss Vs Response Variable

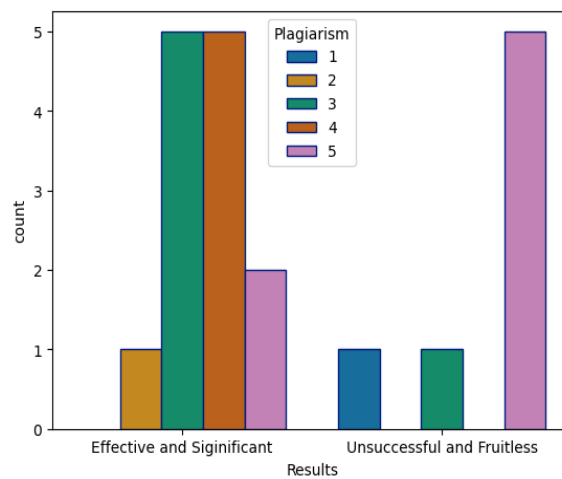


Figure 17. Plagiarism Vs Response Variable

By going through the surveys, we came to learn that Simplicity in joining online classes and storing study materials have played the most vital factor in choosing online learning platforms as effective and useful for teachers which is like the results from students. Teachers find no unsuccessfulness has occurred due to lack of responsiveness. Similarly, for teachers who find online learning management systems ineffective, loss of concentration and plagiarism are the main factors behind it.

5.1 Numerical Results

To forecast how students will respond to various online learning platforms in the near future, we performed six machine learning algorithms. Prior to that, we calculated the correlations between the several attributes we employed in this Table 3.

Table 3. Correlation Among Variables

	Simplicity	Responsiveness	Simplicity_Resources	Concentration_loss	Joining_problems	Plagiarism	Response variable (1 = Unsuccessful and Fruitless, 0 = Effective and Significant)
Simplicity	1.000000	0.685729	0.489485	-0.40548	-0.317497	-0.215100	-0.560701
Responsiveness	0.685729	1.000000	0.364169	-0.45031	-0.293886	-0.314985	-0.432360
Simplicity_Resources	0.489485	0.364169	1.000000	-0.08128	-0.149124	-0.064604	-0.433328
Concentration_loss	-0.40548	-0.45031	-0.08128	1.00000	0.621978	0.651871	0.426674
Joining_problems	-0.31749	-0.29388	-0.1491	0.621978	1.000000	0.551873	0.401509
Plagiarism	-0.21510	-0.31498	-0.06460	0.651871	0.551873	1.000000	0.369130
Response variable (1 = Unsuccessful and Fruitless, 0 = Effective and Significant)	-0.56070	-0.43236	-0.43332	0.426674	0.401509	0.369130	1.000000

The scores of used machine learning algorithms are also given Table 4:

Table 4. Algorithms with Their Accuracy Levels

<u>Machine Learning Algorithms</u>	<u>Score</u>
RandomForestClassifier	0.5625
DecisionTreeClassifier	0.6875
Multinomial Naïve Bayes	0.8023
Gaussian Naïve Bayes	0.8140
KNeighborsClassifier	0.8023
Support Vector Classifier	0.8023

It gives us the crystal-clear view that Gaussian Naïve Bayes algorithm gives us the highest level of accuracy in predicting the acceptance probabilities of online learning platforms by students in further future.

6. Conclusion

One of the worst periods for humanity to have ever lived through was reflected by the unsettling quiet that pervaded the streets. Everyone's expression shows the wave of uncertainty that recently occurred. People were told not to leave their homes due to a terrible sickness that was spreading. The four walls contained the students. Online education can assist in winning any barrier created by any uncertain event. However, there are a few important factors that must be understood before employing any online learning management systems. According to this research, the ease of joining for online classes was the main factor in encouraging people to use these platforms for learning. The demotivating feature of concentration loss, on the other hand, can be an obstacle to the adoption of online education in countries like Bangladesh.

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Biographies

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