

Original Article

Analysing Student's Academic Performance in Relation to Psychosocial Aspects Using AI

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Abstract - During the pandemic and after the reopening of colleges, we all are witnessing a new normal situation, and teachers and students are trying to cope with it to stay strongly connected with the roots of the education system. Given today's uncertainties, it is vital to understand the psychosocial aspects that have a strong influence on the academic performance of a student. The academic performance of any student depends on a complex interplay of various factors, such as mental health, emotional health, physical health, social and spiritual health. This paper, therefore, examines the importance of these factors on students' academic performance during the shift from offline teaching to online teaching and hybrid mode in the current situation. The data was collected through a self-designed comprehensive questionnaire, which consisted of statements from 214 undergraduate students studying in various streams of the University of Delhi. The data collected was analysed using techniques like Feature Selection, Regression, Neural Networks, Naïve Bayes machine learning algorithm, and multi-dimensional analysis was used to analyse as well as predict a student's academic performance based on psychosocial parameters. Statistical tools, SPSS and programming languages like R and Python were used to implement codes to dig into data and predict results.

Keywords - Academic Performance, Psychosocial aspects, Mental Health, Social-Media, Spiritual health.

1. Introduction

COVID-19 has caused a significant shift in the educational system not only in India but throughout the world. Universities in India and around the world had to shift from physical classrooms to virtual classes. Online education in India is still in its early stages. While most private universities in India have experienced a combination of pros and negatives because of this transformation, government colleges and universities are still adjusting. While technology makes things more accessible and easier, it may also be restricted, particularly in India, where many students lack access to the internet.

Analysing and predicting the academic performance of students is a challenging task as it depends on a complex interaction of several factors, including socioeconomic, psychological, and environmental factors. As per the Indian government's AISHE report, enrolment of students in Higher Education (HE) has increased significantly.

Many new public, private and autonomous colleges have come in the last decade with the prime objective of delivering high-quality education to produce well-educated and skilled students who can be an asset not just for India but for the entire world. To contribute to this goal, the authors have conducted research to investigate non-academic factors that affect the student's performance. A survey was conducted to collect information and responses from students regarding factors affecting their performance.

Once these factors are identified, appropriate action can be taken to minimise the factors that hinder performance and maximise those that boost performance. Discovering these factors and taking steps to handle them will facilitate the students to make informed decisions regarding their daily routines, everyday habits, place of stay and connection with friends/ family.

The study was conducted from November 2022 to February 2023. For this study, the authors formed a questionnaire that dealt with various factors that could impact the academic performance of college students. The questionnaire was divided into various major dimensions: socio-demographic, Online Teaching-Learning Process, Cognitive component, Physical Health, Mental Health, Social Health and vocational dimension. Under these dimensions, the questionnaire consisted of a few demographic questions like age, gender, socioeconomic status, place of residence, staying with family/hostel / PG, and the course stream students were pursuing. The other questions dealt with various aspects that are related to the student's academic performance and well-being. These questions were related to student's habits, number of close friends, optimism, level of satisfaction, emotional quotient, state of mind, consuming hukkah/ alcohol, smoking habits, shopping patterns, time spent on social media, being a consistent learner, mood swings affect the academic



performance of the student, online teaching, teacher & student interaction & role of technology in learning.

The results of the study will be disseminated to higher education stakeholders such as the DoE, AICTE, UGC and universities. The study presented in this paper is very useful and calls for intensified efforts at supporting and develop students.

In India, the students are supposed to appear in an entrance exam to get admission in to a college or course of their choice. In such a competitive environment, there is a stringent need to analyse the factors that affect a student’s performance both negatively as well as positively.

2. Literature Review

All research reviews support the hypothesis that student performance depends on different socioeconomic, psychological and environmental factors. Other factors like race, gender, and sex also affect student’s performance. [5]. In their paper, researchers explain the connection between students’ achievements, economic circumstances, and the risk of becoming a dropout.

B.A Chansarkar and A. Mishaeloudis [1] highlighted the effects of age, qualification, distance from learning place, etc., on students’ academic performance. They stated that students’ performance is not affected by age and sex but is associated with qualification in quantitative subjects. Moreover, students who live near the university perform better than those who live far away. Yvonne Beaumont Walters, kola soyibo [8] identified that the performance of a student also depends on socioeconomic back ground. Kirby and Winston [4] highlighted that impatience influences students’ academic performance. Goethe found that weak students perform better when grouped with other weak students. However, the results of Zimmerman [9] were somewhat contradictory to Goethe’s. His study proved that weak peers might reduce the grades of middling or strong students. Burnout, which refers to emotional exhaustion, usually coexists with feelings of frustration and tension. It leads to a lack of energy, insensitivity towards classmates, reduced accomplishment, higher absenteeism, lower

motivation to do required coursework, and higher dropout rates [11].

The author showed that students whom their peers rejected had lower academic achievement scores than more popular students. Students with higher stressors would show negative emotions and low work performance.

Parental involvement, teacher attitudes, course load, and peer relationships are also important factors affecting students’ academic performance [7]. Keeping in view all these factors, we have focussed our study on various variables that impact students’ academic performance. Our study has specifically been conducted to reduce factors like stress, anxiety, and indulgence in consuming alcohol or other seductive substances so that students can become academically stronger and successful.

In [20], the authors studied the components of psychological health and concluded that one of the important indicators of students’ psychological health is a decrease in the level of emotional distress and emotional instability (neuroticism, nervousness). A positive change in students’ internal state leads to an increase in students’ satisfaction with their educational environment.

3. Methodology

Data Visualisation and statistical techniques, including regression analysis and Machine Learning algorithms, were used to analyse data and make predictions. The code to implement these techniques was written in R and Python. Questionnaire was prepared under the guidance of professors from the Computer Science, Education and Psychology Department. 214 undergraduate students studying in the 2nd and 3rd year were randomly selected from different disciplines to fill out the Google Form. The questionnaire had questions related to student’s habits, friends, optimism, level of satisfaction, emotional quotient, state of mind, consuming addictive items like hukkah/ alcohol, smoking habits, shopping patterns, time spent on social media, state of mind, mood swings and academic score obtained in the past, etc. The summary sheet of questions asked and answers obtained is given below in Table 1.

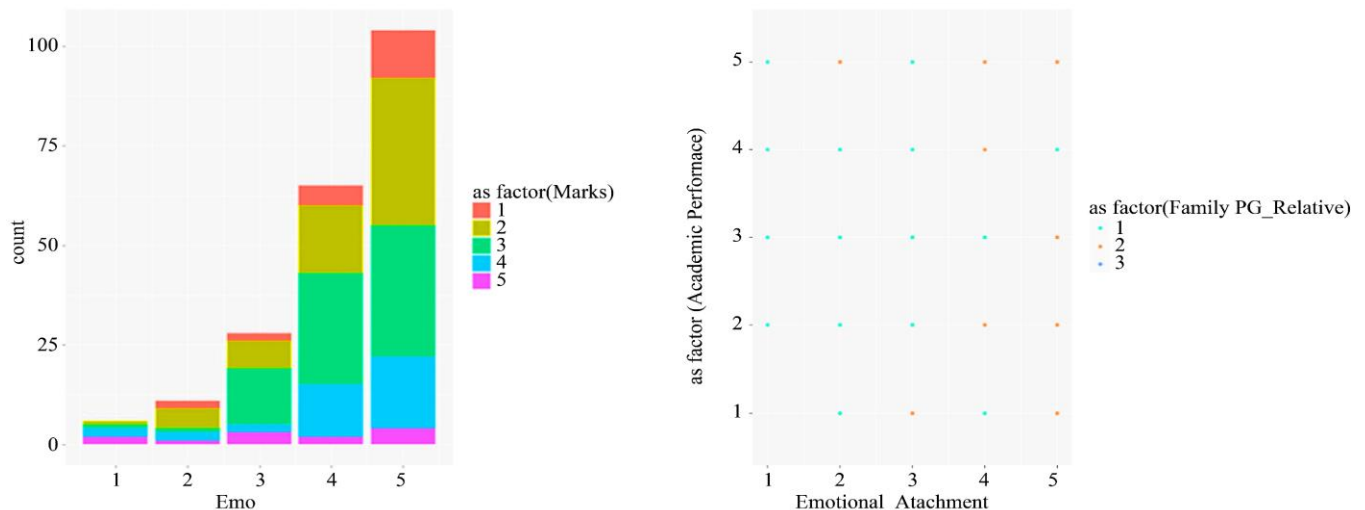


Fig. 1 (a) Emotional attachment vs Academic performance (b) Analysing effect of emotional attachment, place of stay on academic performance

Table 1. Summary of response

Query	Response
Where do you stay?	73.4% stayed at home 21.5% of PG 3.7% with Friends/ Relatives Rest in Hostel
If you smoke or consume seductive items (e-cigarettes/ hookah / alcohol), then what is the frequency?	8.9% consume very rarely 1.9% very frequently 2.3% monthly 0.9% Weekly 0.5% Daily Rest do not consume
How strongly are you emotionally connected to your family?	48.6% rates 5 30.4% rates 4 13.1% rates 3 5.1% rates 2 Rest rates 1 Where 1 means lowest and 5 means very strongly connected
When you listen to a spiritual leader / motivational speaker, what are your topics of interest?	36.4% for Handling Relationships 66.3% for Enhancing Concentration 57.3% for overcoming anxiety 72.4% for staying motivated 12% do not listen to any spiritual leader
How many hours do you spend on social media per day?	16.8% spend less than 1 hour daily 36.9% spend 1 to 2 hours daily 29% spend 2 to 3 hours daily 12.6% spend 3 to 4 hours daily 4.7% study for more than 4 hours daily
How many close friends do you have?	11.7% have no close friend 65.4% have 1 to 3 close friends 15.9% have 4 to 5 close friends 7% have more than 5 close friends
How frequently do you meet your friends in a week?	8.4% meet once a week 5.1% meet twice a week 6.1% meet thrice in a week 26.2% meet more than three times 54.2% meet them occasionally
Do you discuss your personal issues with your close friends?	50.5% say certain issues, not all 35% feel free to discuss 14.5% do not share
How satisfied are you in your life?	39.5% are moderately satisfied 28.5% are fairly satisfied 11.2% are satisfied 14.5% not satisfied 6.1% are highly dissatisfied
How frequently do you have mood swings?	36.4% experience mood swings multiple times in a day 15.4% once in a day 13.6% once in a week 28.5% once every fortnight Rest occasionally
What is the state of your mind in general?	43.3% vary frequently 24.3% calm 16.8% happy 14.9% highly frustrated and disappointed

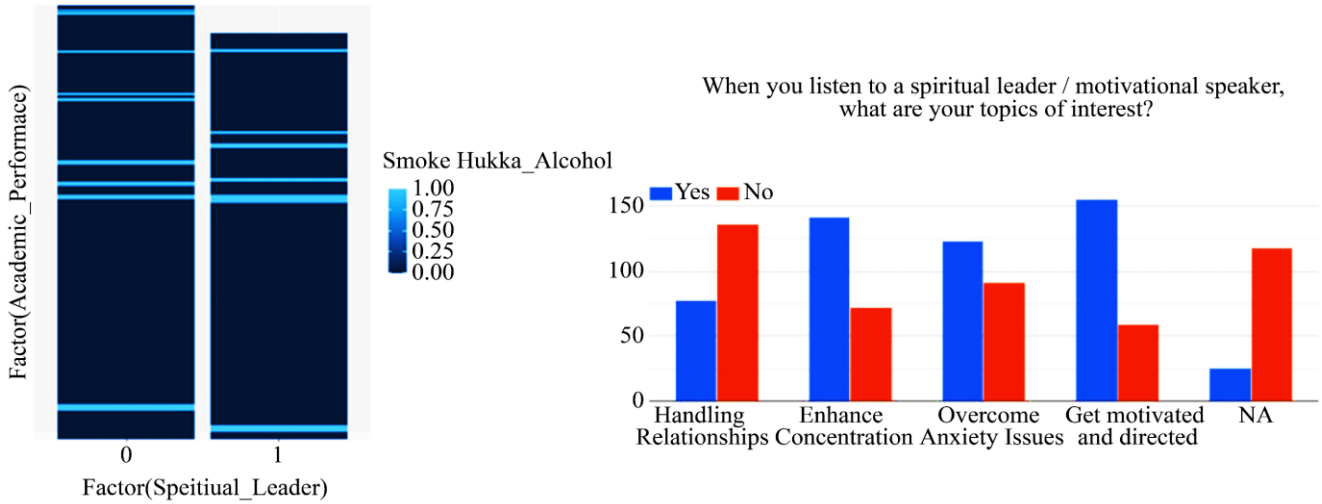


Fig. 2 (a) Analysing academic performance based on listening to a Spiritual/ Motivational speaker and substance abuse
 Fig. 2 (b) Topics of interest when listening to a Spiritual/ Motivational speaker

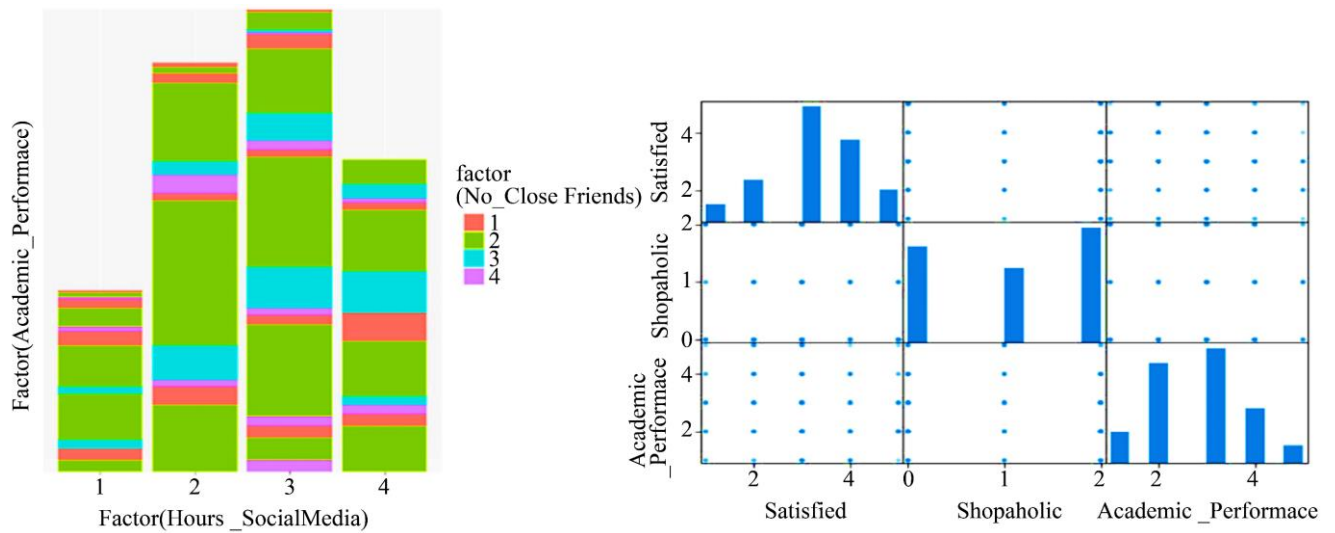


Fig. 3 (a) Analysing student's performance based on hours spent on social media and number of close friends
 Fig. 3 (b) Analysing student's performance based on being shopaholic and satisfied

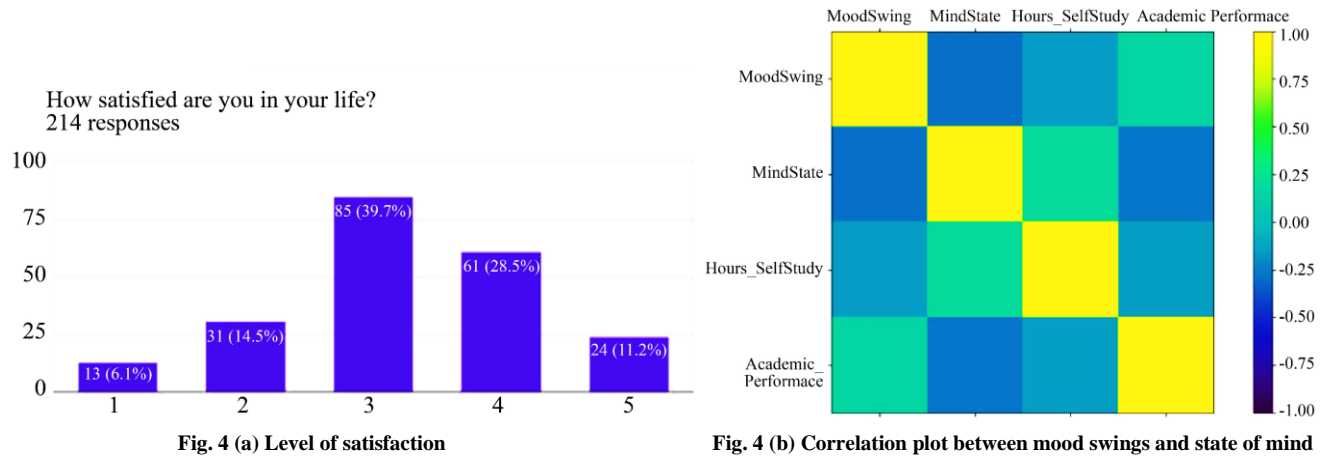


Fig. 4 (a) Level of satisfaction

Fig. 4 (b) Correlation plot between mood swings and state of mind

Figure 1 shows that the majority of the students are emotionally attached to their families, and the higher the attachment, the better the academic performance. Students staying in PG or hostel feel more attached to their families than those living with their families.

Figure 2 shows that students who listen to or follow a spiritual leader/ motivational speaker and stay away from consuming addictive items perform much better than their counterparts.

To concentrate on their daily work, 50% of the students preferred to hear them daily or weekly. They find these lectures very helpful as 60% of students try to implement their learnings in their daily routines.

The fact that 8% of the students who are academic achievers and follow a spiritual/motivational guru also have the urge to smoke or consume addictive items and this fact cannot be ignored. The educational institution must, therefore, conduct special lectures to create an awareness about ill-effects of these silent killers on our health, mind and relationships. The good news so far is that students who consumed such seductive items did it only once in a week or rare circumstances.

Students who usually follow a spiritual/motivational speaker are more interested in learning new and efficient ways to keep themselves motivated, enhance their concentration and handle their anxiety issues. The academic institution must, therefore, arrange such lectures at least once every semester.

Figure 3 illustrates that students spending 0 to 1 hour daily on social media exhibit better academic performance than those who spend more time on such platforms. We did not find a single student who used social media for less than an hour per day. Students who had at least one or less than four friends were academically stronger than those having no or more friends who did not, and having 1 to 3 close friends performed higher in academics.

They met their friends occasionally but were in touch with each other. Students, however, prefer not to discuss all their issues with their close friends. 26% of the students were not shopaholics. They spend money wisely. This may also be true because we conducted the research in a government college where students from lower-income and middle-income families are more than those from upper-income families.

Satisfaction is the key to success, but Figure 4 highlights that 85% of the students are moderately satisfied. So, measures must be taken to educate them that satisfaction is the greatest richness and they must be happy with whatever they have. A happy soul will help them to move mountains. The correlation plot shows that there is a positive relationship between mood swings, hours of self-study, state of mind and academic performance. However, the students have underestimated the impact of these factors on their performance.

There is an urgent need to counsel students to help them understand that self-study is the key to success. As of now, more than 55% of the students accepted that they have an agitated mindset and their mood varies frequently.

State of mind and mood swings are related to their mental health. But, the students are ignorant about the importance of having a calm mind and occasional/no mood swings. Techniques to maintain a good balance of mind in

every situation. This would ultimately boost their academic performance.

The above conclusion is very clear from the graph shown in Figure 5. Students who are not optimistic experience frequent mood swings. They feel agitated, and their state of mind is not stable. It varies very frequently. 52% of the students experience mood swings multiple times in a day.

All these factors, in turn distract them and hit their academic performance. Such students also find it difficult to learn new concepts. They also find it difficult to connect their learning with real-life scenarios and maintain a positive connection with their teachers.

Moreover, Consistent learners have better academic scores. They prefer watching educational videos and reading books or any other sort of reading material to gain concept clarity. Students who just rely on group studies with friends do not perform very well in academics.

Figure 6 demonstrates that consistent learners who also perform better academically usually have two close friends, spend 1 to 2 hours daily on social media, and rarely smoke or consume alcohol/ hukkah. We however, need to counsel them to refrain from such habits and further improve their performance.

The above interpretation is verified using the graphs shown in Figure 7. Students who are consistent learners rarely smoke or consume hard drinks or hukkah. It is also observed that students who indulge in consuming hard drinks or other addictive items have 0 to 1 close friends. This may reflect other mental-health-related problems like depression, anxiety, loneliness, boredom, etc.

Since these factors make students vulnerable to being misguided by evil elements in society, the utmost care and compassion must be given to them, and they must be involved more in extra-curricular activities. The above chart also points to a major contradiction. Students who spend more than 4 to 5 hours on social media daily believe that they are consistent learners and are optimistic.

Students who are in a frustrated and agitated state of mind have accepted that they experience frequent mood swings. Those with calm or a happy mind rarely have mood swings and are satisfied with who they are and with whatever they have. However, less than 40% of respondents had a calm/ happy state of mind. Again, the above conclusion can be validated by the chart shown in Figure 8 (b), which illustrates that a satisfied person is more optimistic. But the chart also highlights one more concern.

85% of the students who believe that they are satisfied and optimistic state their mindset flickers fast between the two extremes. This is again a contradiction and calls for immediate action to have more mentorship programs, counselling sessions and happiness workshops to help them have a balanced mindset.

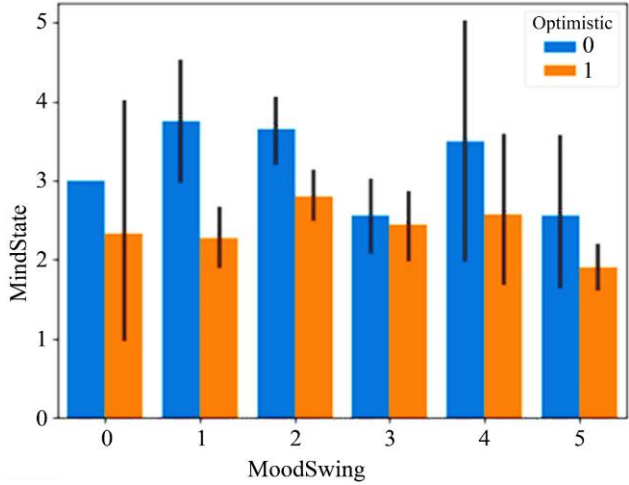


Fig. 5 a Stable mind vs Mood swings

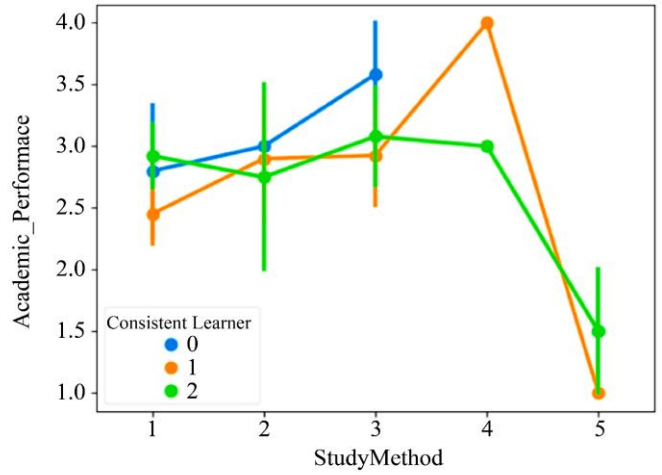


Fig. 5 b Method of study vs Academic performance

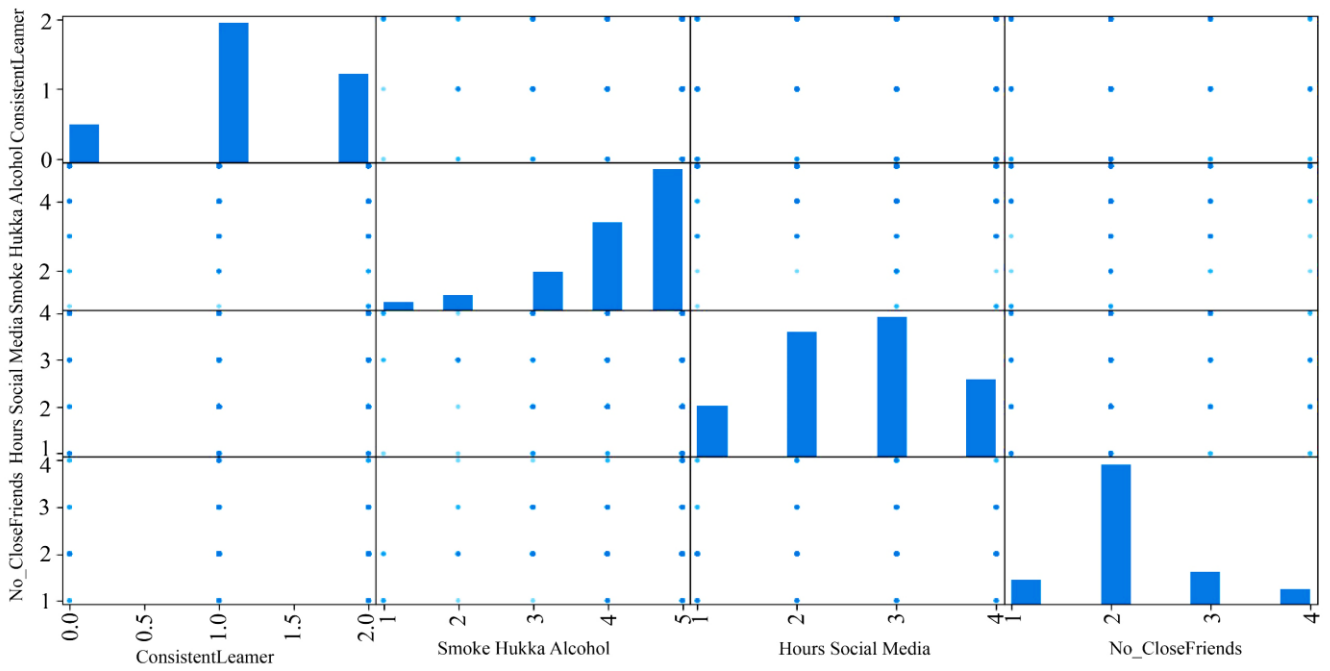


Fig. 6 Analysing characteristics of consistent learner

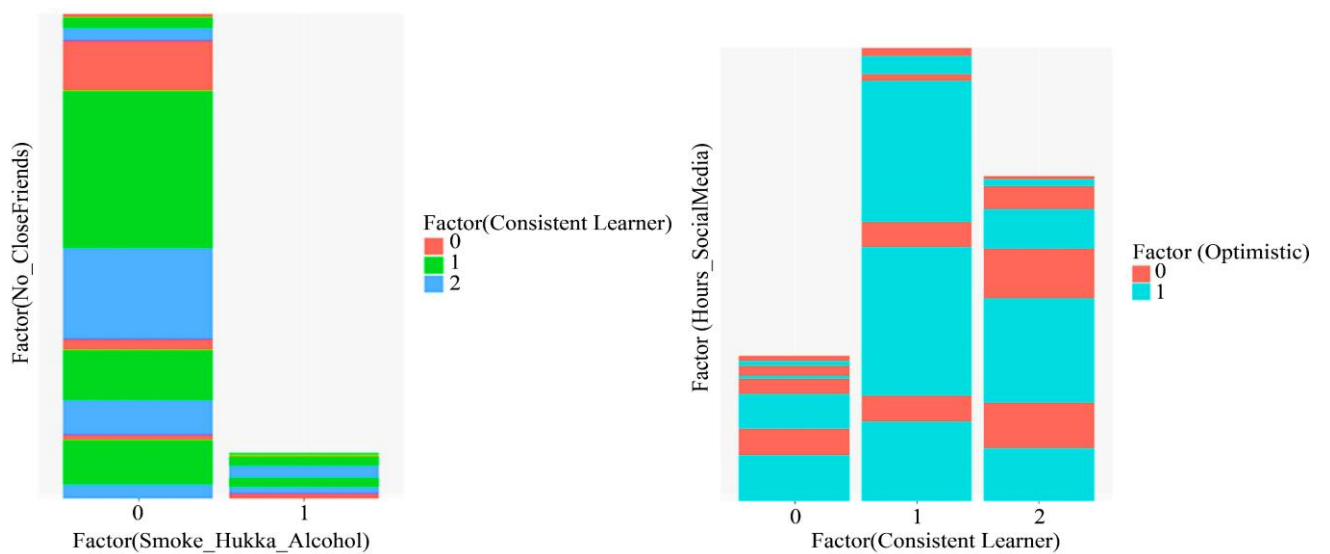


Fig. 7 Analysing characteristics of consistent learner (Graphically)

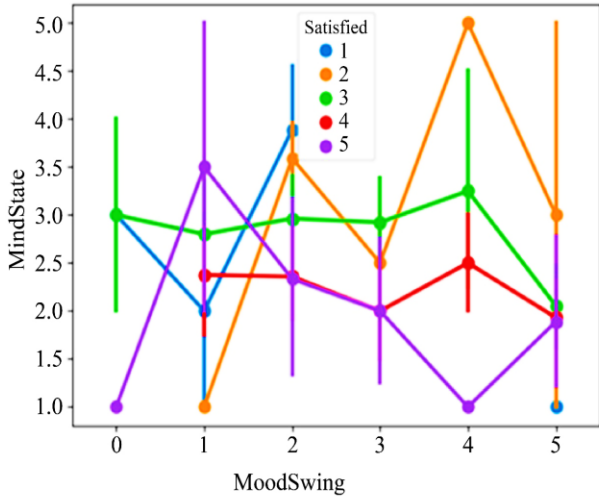
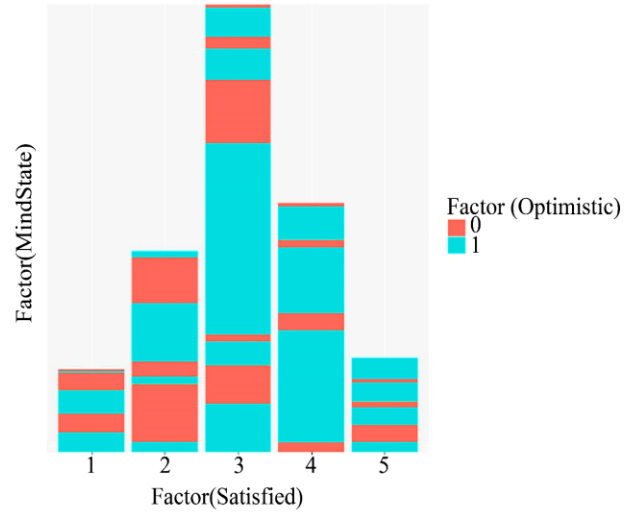


Fig. 8(a) Effect of mood swings on stable mind and satisfaction



(b) Relation between satisfaction, optimism and stable mind

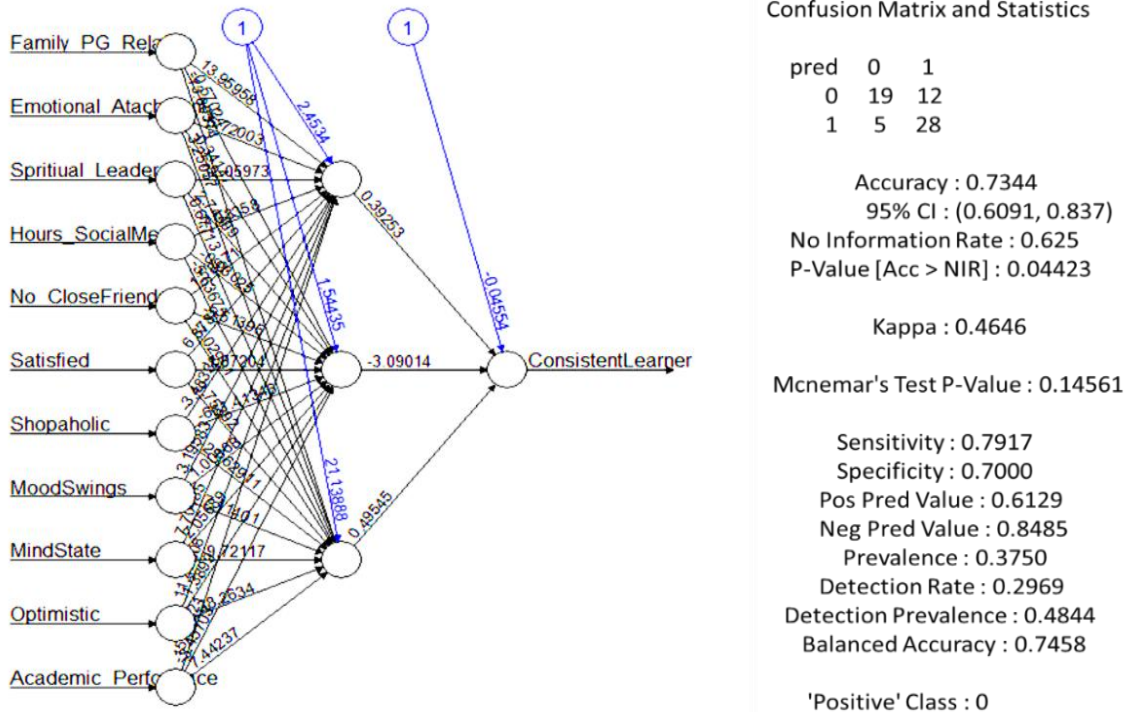


Fig. 9 Predicting whether a student will be a consistent learner or not

Table 2. Non-academic factors affecting the student's academic performance

Variable	Expected Relationship	Results of Study
Staying with Family	Positive	Negative
Listening to Spiritual/Motivational Speaker	Positive	Positive
Emotional Attachment with Family	Positive	Positive
Consuming/Hukka/Alcohol/Cigarette	Negative	Negative
Number of Close Friends > 3	Negative	Negative
Hours Spent on Social Media Platforms > 1 hr daily	Negative	Positive
Satisfaction	Positive	Not Clear
Shopaholic	Negative	Negative (Biased)
Stable Mind	Positive	Not Clear
Mood Swings	Negative	Not Clear
Optimistic	Positive	Negative

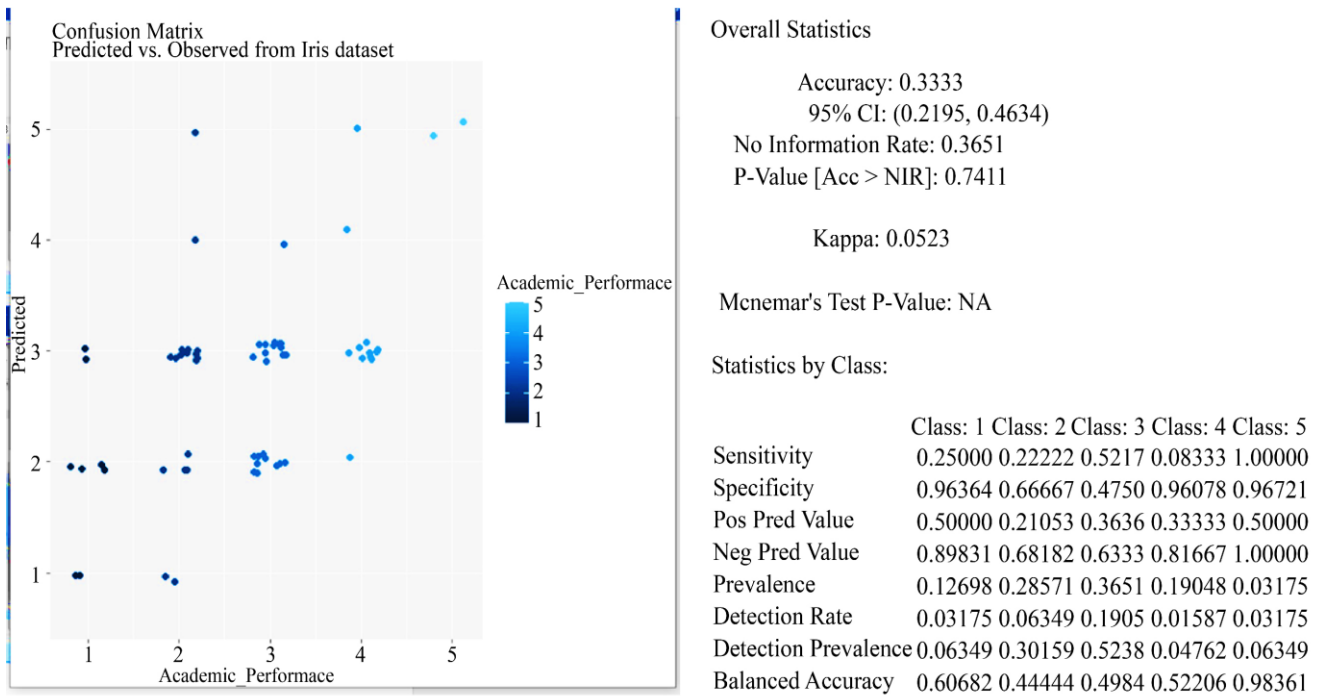


Fig. 10 Predicting academic performance using Naive Bayes

Table 2 summarises the non-academic factors that affect students' academic performance. With our data, we have confirmed the relationship between all these parameters and performance except four. A more intense study after the implementation of our recommendations would be conducted to understand the improvement in the results. Going one step ahead of data visualisation, we have created a Neural Network Model to predict the academic performance of a student based on the non-academic parameters listed in Table 1.

We know that a consistent learner is strong in academics. So have created a machine learning model to know whether a new student taking admission in the first year would be a consistent learner or not. This would help us to estimate his academic performance and direct him/her in a way that boosts academic performance.

We chose neural networks to teach computers to process data like the human brain. It has interconnected nodes or neurons in a layered structure resembling the human brain. The model automatically learns from its mistakes to improve continuously. They are, therefore, used to solve complicated problems with limited human assistance and greater accuracy. But, the accuracy of our model was just 73.44%. Though this accuracy is a good figure, it is not acceptable because no information is better than wrong information. Our model will predict only 73.44% of cases correctly. The reason behind this under performance is clearly the relationship between variables that are either not clear or are contradictory.

We have also used the Naive Bayes machine learning algorithm to classify a new student in one of the five classes. These classes are based on academic performance- 90-100 percent, 80-90 percent, etc. The algorithm is based on the

Bayes Theorem. It is a simple yet powerful algorithm that is frequently used in multi-class classification problems. Figure 10 shows that our Naive Bayes model had a low accuracy level. This is indeed a good sign for us because Bayes' Theorem assumes that all predictors are independent. However, a low accuracy indicates that all the predictor variables are dependent on each other, thus supporting our hypotheses. We need to mentor and counsel our students to accept this fact, as they are unaware about the relationship that exists between their habits, state of mind and success.

4. Conclusion and Future Scope

The paper had identified several non-academic parameters that affect a student's performance. Data was collected from 214 students of a government college studying various disciplines. Several data visualisation techniques were used to plot a variety of charts to understand how parameters like Staying with Family, Listening to Spiritual/Motivational Speaker, Emotional Attachment with Family, Consuming/ Hukkah/ Alcohol/ Cigarette, Number of Close Friends > 3, Hours Spent on Social Media Platforms > 1 hr daily, Level of Satisfaction, Being Shopaholic, Having Stable Mind, Experiencing, Mood Swings and Being Optimistic have a positive or negative correlation with a student's performance. Machine Learning algorithms like Naive Bayes and Neural Network algorithms were used to predict the performance of a new student based on the value of the non-academic parameters listed above. However, the accuracy of the models was not acceptable. Low accuracy strongly indicates that all these variables are not independent.

One variable is related to another. In post-pandemic times, students are in a state of confusion and aggression. They are becoming pessimistic, experiencing frequent mood

swings, not having a stable mind, spending more time on social media platforms, having either no friends or having more than 3 close friends, indulging in consuming hukkah/alcohol/smoking though not very frequently.

In such a challenging situation, it is the responsibility of the academic institutions to arrange proper counselling sessions by medical practitioners, psychologists and motivational speakers once every semester to help the students remain focused and have a stable and calm mind, which would, in turn, help them perform better in

academics. In future, we would do the same study on at least 1000 students from government as well as private institutions.

This would help us to get a better clarity. We would also statistically analyse the performance of students studying in colleges that give due importance to mental health and physical health with those in whose college these factors are ignored. We shall also analyse this data on the socioeconomic background and gender of the students.

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