Effect of Academic Interest and Emotional Happiness on Academic Performance in Learning Environment.

Amala Jayanthi,M, Lakshmana Kumar.R

Abstract: According to Bloom's Taxonomy, the motto of education is to groom the student's as a better personality in knowledge, skill set and emotions under the supervision of academicians. Development of information technology paves the way to analyse the data from the educational environment and make decisions which help to be in track to achieve the motto, i.e. Educational Data mining. Educational Data mining is one of the research domains of data mining which convert the data from the educational sector as insights for decision making. This paper is to analyse the effect of student's academic interest on emotional happiness and academic performance by applying supervised and unsupervised learning techniques. Students' Emotional Happiness and students' academic performance is evaluated by the Oxford Happiness Inventory and criterion reference model. Academic interest is received as yes or no responses from the students. Naive Bayes classification algorithm and K Means clustering algorithm is applied to categorise the student participants based on their happiness scale, academic interest and academic performance. The association between academic interest and performance is determined using predictive and descriptive mining. By this research, it is witnessed the positive association between academic interest, happiness and performance. The insights of this investigation will allow the teachers' to understand the students in a better way and do the needful to enhance academic efficiency.

Keywords: Education, Bloom's Taxonomy, Academic Interest, Happiness, K-Means clustering, Naive Bayes Classification, Apriori Association.

I. INTRODUCTION

Educational Data mining[12] is one of the emerging research fields of data mining that explore the data collected from the educational environment and helps the stakeholders in decision making by discovering insights using supervised and unsupervised techniques. These techniques help to establish a better understanding of students in the academic environment. Student's well-being is discovered using oxford happiness inventory. Criterion Reference Model is used to group the students' based on their academic performance. The continuous assessment scores of theory and programming are taken as performance. Based on Bloom's taxonomy and educational objectives, this research examines the effect of academic interest, emotional happiness on academic performance in academics.

K-Means clustering algorithm is utilised for discriminating the student participants under clusters happy and unhappy, yes and no, above average and below average according to their Happiness level, Academic Interest and performance into classes of similar students. Navies Bayes classification, a supervised learning technique is employed to classify the student's subcategory using the dataset. This technique identifies student subclasses based on the research criteria. Apriori algorithm is implied to discover the association rules based on the association between emotional happiness, academic interest and performance. The research aims to discover the relation between happiness, academic interest and performance using supervised and unsupervised learning process.

II. RELATED WORK

A. Bloom's Taxonomy:
Bloom's Taxonomy [3] explains the three domains of the learning process as Cognitive Domain (Intellectual), Affective Domain (Emotional), and Psychomotor (Skills). Benjamin Bloom framed Bloom's Taxonomy. According to Bloom, a student during is learning process grows cognitively, affectively and skillfully.

B. Oxford Happiness Inventory:
The Oxford Happiness Inventory is of 29 multiple choice questions [1]. Every question has four ordinal options constructed to reflect incremental steps as a low level of happiness and a high level of happiness. The student participants are requested to answer one choice for a question, which describes the way he/she has been over a week. The score is calculated accordingly to the student responses with which students are categorised as Happy and Un Happy.

C. Criterion –Reference Model
A criterion – reference model is a model to evaluate the student level of attaining the objective, of course. The evaluation is carried out with specific measures. The outcomes of the model are the relations that match the students' performance with the measures defined. The result is assigned based on the standard that the student has attained on the criteria [2]

D. K-Means Clustering Algorithm:
K-Means algorithm[9] is well known and most straightforward unsupervised learning to perform clustering for a given problem.
The procedure is as follows,
1. Define K centers one for each Cluster.
2. Take each point of data set and associate it to the
   nearby center. This is done by calculating the
distance between the data point and centers.
3. The data point, which is closed to the cluster
   center, is assigned to that Cluster whose distance is
close to the cluster center.
4. Repeat step 3, Recalculating the new cluster center
   until data points exist.

E. Naive Bayes Classification Algorithm:
The Naive Bayes algorithm [4] is a simple probability
classification algorithm which counts the occurrence and
combinations to calculate the set of the probability of a
given data set. It is a supervised learning technique. The
algorithm makes use of Bayes's theorem, that assumes all
variables to be independent and as a class variable. Bayes
conditional probability is given below,

\[ P(A|B) = \frac{P(B|A)P(A)}{P(B)} \]

Figure 1 Bayes Theorem

Where,
- \( P(A|B) \), the conditional probability of A when B occurs
- \( P(A) \), probability of A
- \( P(B|A) \), the conditional probability of B when A occurs
- \( P(B) \), probability of B.

Apriori Algorithm:

Apriori algorithm is a traditional algorithm in data mining to
mine frequent itemsets and association rules.

The main concept in the Apriori algorithm is the anti-
monotonicity of the support measure.

According to the concept,
1. All subsets of a frequent itemset must be frequent
2. Similarly, for any infrequent itemset, all its
   supersets must be infrequent too.

General steps of the algorithm,

Step 1: Apply minimum support to find all the frequent sets
   with k items in a database. (Pruning)
Step 2: Use the self-join rule to find the frequent sets with
   k+1 items with the help of frequent k-itemsets. Repeat this
   process from k=1 to the point until the possibility to apply
   the self-join rule (Joining)

Two General steps to discover association rules,
Step 1: Find all the frequent itemsets whose support is
   higher than the threshold support.
Step 2: Generate rules from each frequent itemset using the
   binary partition and check for the rules with high
certainty.

III. METHODOLOGY

Phase 1: Pretesting of the Questionaire:
In phase 1, the Oxford Happiness inventory is pretested.
Then analyse test for Happiness Level was conducted to
students undergoing post-graduation degree in computer
applications. Based on the responses to the inventory, the
student participants are characterised as students of
Happiness and Unhappiness. The academic interest of the
students is collected manually from the students.
Accordingly, students are categorised under yes and no. The
continuous assessment scores of students are considered as a
performance factor[8]. Based on the Criterion Reference
Model, the scores are grouped under Above Average (Marks
>=60), and Below Average(Marks<60). Now the dataset
comprises of the responses of analyse test of Oxford
Happiness Inventory, academic interest and their academic
performance.

Phase 2: K-Means Clustering:
K-Means Clustering Algorithm is applied to identify the
clusters among the students based on the academic interest,
Happiness Level and performance. Accordingly, cluster
groups are assigned as yes and No for academic interest,
happy and unhappy for happiness level and above average
and below average based on performance.

Phase 3: Navies Bayes Classification:
The Navies Bayes classification algorithm is utilised to
analyse by classifying the student data set based on
academic interest as yes and low, happiness level as happy
and unhappy, and Similarly, performance as above average
and below average.

Phase 4: Apriori Association Rule Mining Algorithm
The relationship between the academic interest, happiness level and the performance of the student participants are determined using the Apriori algorithm.

IV. RESULT AND DISCUSSION

The association between emotional happiness, academic interest and academic performance of the learners are analysed with the data set containing information collected from 300 students.

Table 1: Emotional Happiness Level and Cluster Assignments

| C0 | C1   | Happiness    |
|----|------|--------------|
| 180| 0    | Happy        |
| 0  | 120  | Unhappy      |

Table 2: Academic Interest and Cluster Assignments

| C0 | C1   | Performance  |
|----|------|--------------|
| 180| 0    | Above Average|
| 0  | 120  | Below Average|

Table 3: Academic Performance and Cluster Assignments

| C0 | C1   | Performance  |
|----|------|--------------|
| 180| 0    | Above Average|
| 0  | 120  | Below Average|

Table 4: Confusion Matrix for Emotional Happiness

| Cross Validation | Predicted |
|------------------|-----------|
| Actual           | a  b      |
| Happiness        | 180 0     |
| Unhappy          | 0 120     |

Table 5: Confusion Matrix for Academic Interest

| Cross Validation | Predicted |
|------------------|-----------|
| Actual           | a  b      |
| Interest         | 180 0     |
| No               | 0 120     |

Table 6: Confusion Matrix for Academic Performance

| Cross Validation | Predicted |
|------------------|-----------|
| Actual           | a  b      |
| Performance      | 180 0     |
| Above Average    | 0 120     |

Table 7: Confusion Matrix for Academic Performance

| Cross Validation | Predicted |
|------------------|-----------|
| Actual           | a  b      |
| Performance      | 180 0     |
| Above Average    | 0 120     |

Table 1, Table 2 and Table 3 depicts the cluster assignments obtained by employing the K-Means clustering algorithm of Emotional happiness, Academic Interest and performance, respectively. The happy level is assigned to C0, and Unhappy Level is assigned to C1. Academic interest, Yes is assigned to C0, and No is assigned to C1. Academic performance, Above Average, is assigned to C0, and Below Average is assigned to C1.

Table 7 shows the strong association between Academic Interest, Emotional Happiness and Academic performance with confidence 1. It depicts that students with academic interest no, are unhappy in the academic environment and their academic performance is below average. Similarly, the students with academic interest yes, are happy and good at their academic performance.

V. CONCLUSION

K-Means Clustering, Navies Bayes Classification and criterion reference model, are applied to discover classes based on happiness, academic interest and performance. From the association rules, mined by apriori algorithm, it is observed that Students whose academic interest to pursue the course are emotionally happy, and their academics proficiency is above average. This research reveals to concentrate on students having no interest in the course for Psychological transformation and better transformation.
The Correlation discloses the strong association between academic interest, happiness and performance.

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AUTHOR PROFILE

M.Amala Jayanthi is working as assistant professor in the Department of Computer Applications, Kumaraguru College of Technology, Coimbatore. She has 7 years of experience as academician. She received her Master of philosophy in Department of Computer Science, St. Joseph's College (Autonomous), Bharathiyar University, Tiruchirappalli, Tamil Nadu, India. She received her MCA degree from Kalasalingam University. Her current area of research is Data mining. She has published 11 research papers in various reputed journals.

Dr. R. Lakshmana Kumar is working as an Assistant professor & technical lead in Hindusthan College of Engineering and Technology, Coimbatore. Tamil Nadu. He is a global chapter Lead for MLCS [Machine Learning for Cyber Security] for the Coimbatore chapter. He has a passion for software development and holds the International certification on SCJP (Sun Certificated Java Programer) and SCJWCD (Sun Certificate Java Web Component Developer. He also holds the Data Science certification from John Hopkins University and also the Amazon Cloud Architect certification from Amazon Web Services. His keen interest is to write special issues for publishers like Elsevier,Inderscience, Springer and IGI-global and he holds publications in good IF journals.