

Mining Data to Find Adept Teachers in Dealing with Students

Umesh Kumar Pandey

Dept. of Computer Science,
PSRIET, Chibila, Pratapgarh (UP) India
Pandeyu2003@yahoo.com

Saurabh Pal

Head, Dept of MCA,
VBS Purvanchal University, Jaunpur, (UP) India
drsaurabhpal@yahoo.co.in

Abstract—Higher education faculty staffs lack behind any prior training program of teaching. Mostly staffs teach students in his/her ways. They are unaware of the qualities of a teacher which they must possess as how to tackle the problems arising in teaching, what key points must be remembered while teaching etc. This may cause a teacher to be unsuccessful in classroom. So the problem is the amount of knowledge a staff has of a teaching process. Educationist finds few qualities of a good teacher. But their method is qualitative. In this paper a quantitative approach i.e. data mining is used to measure the quality of a teacher and suggest them what qualities they have.

Index Terms—Educational Data mining, Knowledge Discovery, Psychometric test.

I. INTRODUCTION

Data mining is a new method of modern technology for information analysis. Data mining is a new type of exploratory and predictive data analysis whose purpose is to delineate systematic relations between variables when there are no (or incomplete) a priori expectations as to the nature of those relations [1].

Rubening said, “Data mining is a logical evolution in database technology”. [2]

Paper repositories of larger data are very complex. Making conclusion from paper repository is very cumbersome and time taking process. Advent of computer gives a path for machine-led collection and calculation of data.

Data mining, which is the science of filtering databases for information and knowledge retrieval, has recently developed new album of applications and engendered an emerging discipline, called Educational Data Mining or EDM. EDM carries out tasks such as prediction (classification, regression), clustering, relationship mining (association, correlation, sequential mining, and causal data mining), distillation of data for human judgment, and discovery with models [3]. Moreover, EDM can solve many problems based on educational domain. Data mining is non-trivial extraction of implicit, previously unknown and potentially useful information from large amounts of

data. It is used to predict the future trends from the knowledge pattern. Remarkable amount of EDM endeavors have been conducted and published in many journals and conference proceedings related to, but not limited to, Artificial Intelligence, Learning Systems, Education, and others.

A tag of war still continues among educationists on poles of education. John Dewey said that education is bipolar process [4].

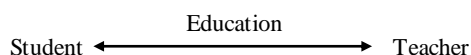


Fig 1: Bipolar education system

Another concept is proposed by Raybern. He said that it is the tri-polar process. These three poles are student, teacher and syllabus. Each poles affects to each other. Following figure shows tri-polar education system.

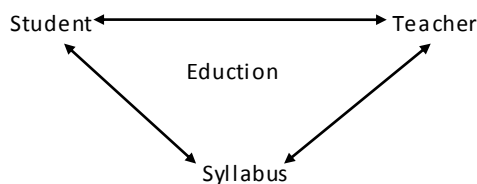


Fig 2: Tripolar education system

In both aspects students and teachers are constantly available. The education flows from teachers to students. In this paper we are focusing on the one pole of education system i.e. teacher. It is tried to establish a model to evaluate the teacher's teacher ship on the basis of student feedback.

The rest of this paper is organized as follows: Section 2 presents background and history in educational data mining. Section 3 describes the Psychometric test. Section 4 describes the methodology used in our experiments about applying data mining techniques on the educational data. Section 5 illustrates the results obtained. Finally we conclude this paper with a summary and an outlook for future work in Section 6.

II. BACKGROUND AND HISTORY

From ancient to modern era teacher’s role always praised for carrying lamp of education from one generation to another. Alexander the great said, “I owe my birth to my father, but life to my teacher.”

Former president of India and education laureate Late Dr. S. Radhakrishnan said about the role of teacher, “The teacher’s place in society is of vital importance. S/he acts as the pivot for the transmission of intellectual traditions and technical skills from generation to generation and helps to keep the lamp of civilization burning.

Hu mayun Kabir said, “The efficiency of a system of education rests on the quality of teacher. Without good teacher even the best of the system is bound to fail. With good teachers even the defects of the system can be largely overcome.

On challenges face by a teacher in future, Dr. Ballard said, “The teacher of the future will be less concerned with impressing his personality on his pupils than with gaining as much insight as he can into the personalities of his pupils and trying to find in each of them the lamp that illuminates and the spring that motivates.”

In this sequence, around the world a debate started on the quality of the teacher. Educationist tried to establish the measurement criteria for a good teacher, which proves the teachership of a person. In 1913, Dr. F.L. Clapp of United States of America organized a study and established ten measurement criteria for a good teacher [4].

TABLE 1: DR F.L. CLAPP MEASUREMENT CRITERIA

Sr. No.	Parameter
1	Address
2	Personal Appearance
3	Optimism
4	Reserve
5	Enthusiasm
6	Fairness of mind
7	Sincerity
8	Sympathy
9	Vitality
10	Scholarship

Bagley and Keith of U.S.A. organized another study in which they proposed three new parameters and added into the Dr. F. L. Clapp’s list i.e. Tact, Capacity of leadership and good voice.

Department of education in New York proposed two parameter list of qualities of a teacher [4].

TABLE 2: NEW YORK DEPT OF EDUCATION FIRST MEASUREMENT CRITERIA

Sr. No.	Parameter
G	Gregariousness
O	Open-mind ness
O	Originality
D	Discernment
T	Tidiness
E	Enthusiasm
A	Adaptability
C	Cooperativeness
H	Health
E	Efficiency
R	resourcefulness

TABLE 3: NEW YORK DEP’T OF EDUCATION SECOND MEASUREMENT CRITERIA

Sr. No.	Parameter
1	Thoughtfulness
2	Reliability
3	Leadership ability
4	Integrity
5	Tact
6	Sense of Humor
7	Objectivity
8	Fluency
9	Ability to do creditable college work

Several studies used data mining for extracting rules and predicting certain behaviors in several areas of science, information technology, human resources, education, biology and medicine.

For example, Bray [5], in his study on private tutoring and its implications, observed that the percentage of students receiving private tutoring in India was relatively higher than in Malaysia, Singapore, Japan, China and Sri Lanka. It was also observed that there was an enhancement of academic performance with the intensity of private tutoring and this variation of intensity of private tutoring depends on the collective factor namely socio-economic conditions.

Bharadwaj and Pal [6], applied the classification as data mining technique to evaluate student’ performance, they used decision tree method for classification. The goal of their study is to extract knowledge that describes students’ performance in end semester examination. They used students’ data from the student’ previous database including Attendance, Class test, Seminar and Assignment marks. This study helps earlier in identifying the dropouts and students who

need special attention and allow the teacher to provide appropriate advising.

Yadav, Bharadwaj and Pal [7] obtained the university students data like attendance, class test, seminar and assignment marks from the students' database, to predict the performance at the end of the semester using three algorithms ID3, C4.5 and CART and shows that CART is the best algorithm for classification of data.

Researchers like Chein and Chen [8] have worked on the improvement of employee selection, by building a model, using data mining techniques, to predict the performance of newly applicants. Depending on attributes selected from their CVs, job applications and interviews. Their performance could be predicted to be a base for decision makers to take their decisions about either employing these applicants or not.

III. PSYCHOMETRIC TEST

Psychometric assessment explores potential in terms of ability, aptitude, personality, intelligence, interest and value systems [9].

A psychological test is an instrument designed to measure unobserved constructs, also known as latent variables. Psychological tests are typically, but not necessarily, a series of tasks or problems that the respondent has to solve [10]. Psychological assessment is similar to psychological testing but usually involves a more comprehensive assessment of the individual. Psychological assessment is a process that involves the integration of information from multiple sources, such as tests of normal and abnormal personality, tests of ability or intelligence, tests of interests or attitudes. Latent variables (as opposed to observable variables), are variables that are not directly observed but are rather inferred (through a mathematical model) from other variables that are observed (directly measured) [11].

IV. METHODOLOGY

Normally no specific evaluation method is available to evaluate teachers' performance. Rather than using only central value of different group we are using also dispersion method. Because central value gives single value that represents the entire data but did not explain distribution of the central value. In two or more distribution the central value may be the same but still there can be wide disparities in the formation of distribution. Basic purpose of variation is, to determine the reliability of an average, to serve as a basis for the control of the variability, to compare two or more series with regard to their variability. In this paper we used average method for central value tendency and standard deviation to find the distribution of the data. The standard deviation measures the absolute dispersion. A small standard deviation means a high degree of uniformity and a large standard deviation has means just opposite. In our case highest value of

average and lowest value of standard deviation will give highest final score [1].

A. Data collection

Students are best evaluator of a teacher. At first meeting with the teacher students observe the teacher completely and make picture of his/her quality in his/her mind. Every student have independent picture of teacher's quality. This is just because of different temperament of student and other factors affecting human relationship. But if we consider their opinion collectively they will give some interesting fact about a teacher. We use student opinion to identify the qualities of teacher. It is toughest work, because students directly do not give correct data about a teacher. In this case a psychometric assessment will organize.

This psychometric test contains a series of question related with the quality of teacher. Educationist proposed a number of qualities which is earlier discussed. Here we prepare different group of qualities which are close to each of them.

TABLE 4: MEASUREMENT CRITERIA IN FORM OF GROUP

Group	Teacher quality
Gr1	Gregariousness, cooperativeness
Gr2	Open-mindedness, discernment, thoughtfulness
Gr3	Originality, reliability
Gr4	Tidiness, efficiency
Gr5	Enthusiasm, ability to leadership
Gr6	Adaptability, tact, sense of humor
Gr7	Health, good voice, optimistic, personal appearance
Gr8	Resourcefulness, fluency

Every group has two or more characteristic. So meaning and their correlation among characteristic is given below:

- **Group 1:** According to oxford dictionary meaning of gregariousness is "Linking to be other people, sociable or living in groups" and cooperativeness is "involving, doing something together or working with others towards a shared aim; helpful by doing what you are asked to do; owned and run by the people involved with the profits shared by them". A person who wishes to live in group knows very well the value of cooperativeness. Because cooperativeness is characteristic of a group where people help to each other to do better performance.
- **Group 2:** This group contains three characteristics: open-mindedness, discernment and thoughtfulness. According to oxford dictionary open-mindedness is "willing to listen to, think about or accept different ideas", discernment is "the ability to know, recognize or understand something; the ability to show good judgment about the quality of

somebody.” And thoughtfulness is “the ability show that you think about and care for other people. Students prepare their own concept on each topic taught by a teacher. In this process students also has some thought and/or solution on that topic. So a teacher must listen it, judge it and care of their thought to correct them or recognize as a good point.

- **Group 3:** This group contains characteristics originality and reliability. According to oxford dictionary originality means “ the quality off being new and interesting in a way that is different from anything that has existed before” and reliability means “ that can be trusted to do something well; that you can rely on or that is likely to be correct or true”. Nobody is ready to listen to others. Students are also example of this fact. In this case a teacher must present their thoughts in a new way so that students are bind with the class and ready to listen him. But a teacher must be causes at this time because originality does not over rule the characteristic of reliability. Because if a fact is original but unreliable does not have any worth.
- **Group 4:** This group contains characteristic tidiness and efficiency. Oxford dictionary defines tidiness as “the ability to arrange neatly with everything in order or keeping things neatly” and tidiness as “the quality of doing something well with no waste”. Tidiness and efficiency are complements of each other. A teacher must produce every matter neatly but sometime in this process teacher wastes a lot of time and materials. So it is valuable if tidiness is along with efficiency.
- **Group 5:** This group contains enthusiasm and ability to leadership characteristic. Oxford dictionary defines enthusiasm as “a strong feeling of excitement and interest in something and a desire to become involved in it; something that you are very interested in and spend a lot of time doing” and ability to leadership as “ability of a person or thing in first place in race”. In the classroom and outside of the classroom students of the class students follow teachers. In this way the teacher is leader of his/her pupil. So it is necessary that he has a strong feeling and desire to be ahead of the pupil. So, enthusiasm motivates a teacher to lead his pupil.
- **Group 6:** This group has three characteristic adaptability, tact and sense of humor. Oxford dictionary defines adaptability as “able to change or be changed in order to deal successfully with new situation”, tact as “the ability to deal with difficult or embracing situation carefully and without doing or saying anything that will annoy or upset other people”

and sense of humor as “the ability of find things funny or make people laugh”. All students have their own behavior which depends on the environment he comes. In that situation in the classroom students’ behavior is not as per discipline of the classroom. In this changed situation a teacher has to find some funny method which controls the students without annoying or upsetting anyone.

- **Group 7:** This group has four characteristic Health, good voice, optimistic and personal appearance. Oxford dictionary defines health as “the condition of a person’s mind and body”; good voice as “the sounds produced through the mouth by a person speaking or singing”; optimistic as “expecting good things to happen or something to be successful” and personal appearance is the way that somebody looks on outside. Teacher is a motivator of students. The teacher with his optimistic approach towards any problem motivates students continuously to indulge them o solve it. Good voice communicates instruction clearly all students. Physical and mental healthiness always associated with good voice and optimistic. Lastly personal appearance combines all of the three.
- **Group 8:** This group has resourcefulness and fluency as a characteristic. Oxford dictionary define resourcefulness as “good at finding ways of doing things and solving problems etc.” and fluency as “the quality of doing something in a smooth and skillful way”. Now-a-days a lot of teaching aids are available which can increase the learning power of students. There is two problem associated with it firstly a teacher must know to use all these resources. Secondly to judge when and in which situation appropriate tool can be used to teach a student. It completely depends on teacher how fluently s/he uses these resources.

B. Data tables

Above discussed groups have minimum 10 psychometric questions in each group. These questions answered in either 0 or 1. 0 represents disagree whereas 1 represents agree. This test conducted among the students who have been taught by the teacher. How many points each student has given in each group is stored as shown in table 5.

TABLE 5: TEACHER SCORE IN EACH GROUP GIVEN BY N NUMBER OF STUDENT

Group	S1	S2	S _n
Gr1			
Gr2			
Gr3			
Gr4			
Gr5			
Gr6			
Gr7			
Gr8			

In table 5, Gr1, Gr2... Gr8 shows different groups. S1, S2 ...Sn that there is n number of students participated in this test.

In this test if, there are 10 questions in each group then a teacher can score maximum 10 marks in each group. Now another table (table 6) is prepared which will store the number of occurrences of score in the table

In table 6 score column contains score could obtained by a teacher. If there is M number of question then a teacher can score maximum M marks. In the case of 10 questions value of M is 10. Frequency column have eight sub columns, which are Gr1 to Gr 8. In these sub columns number of occurrences of scores is recorded.

TABLE 6: FREQUENCY TABLE OF A TEACHER AT EACH SCORE

Score	Frequency			
	Gr1	Gr8	
1
.
.
.
.
.
.
M

With the help of table 6 a new table is generated table 7. This table contains four columns i.e. group, average standard deviation and final score. Group column contains all group of teacher quality i.e. Gr1, Gr2.....Gr8. average column contains average score in each group. Standard deviation column contains deviation of student scoring for teachers. Final core is calculated as

$$Final_score = Average - Standard_deviation$$

TABLE 7: FINAL SCORE TABLE

Group	Average	Standard deviation	Final score (Average - standard deviation)
Gr1			
Gr2			
Gr3			
Gr4			
Gr5			
Gr6			
Gr7			
Gr8			

With the help of table 7 final score is calculated for each teacher. In final score analysis standard deviation is subtracted from the average. Because it is possible, that the two distribution have same mean with different dispersion. Similarly, two distributions have same dispersion but with unequal means. High value of standard deviation express that respondents do not have one opinion and they did not think that actually have this quality. In the case of low value of standard deviation indicates that student strongly express that that the teacher has this quality. If any, organization has P number of teaching faculty then organization can collect scores of each teacher store as per table 8. This table has three columns i.e. Teacher, group and Max (TP). Find out the maximum scoring group of a single teacher in row and in columns to find out maximum scoring teacher among the teachers in each group.

TABLE 8: ALL TEACHER GROUP SCORE TALLY TABLE

Teacher	Group			Max(Gr)
	Gr1	Gr2.....	Gr8	
T1
T2
.
.
.
.
TP
Max (TP)

V. ILLUSTRATION

In the table 9 final score of a teacher is shown. In this table final score is subtraction of average and standard deviation. A comparative study of group 2 and group 4 shows that values of standard deviation and average score of group 2 is less than group 4. Because of high standard deviation the final score of group 2 is higher than group 4. Another point is that standard deviation of group 8 is lowest among values. It indicates that maximum student is around the central

value and they strongly recommends that teacher has this group of quality. Similarly, group 4 has highest standard deviation. It indicates that respondents do not give response around the average. High value of standard deviation reduces the average heavily; on the other hand low value of standard deviation has low impact.

TABLE 9: FINAL SCORE TABLE OF INDIVIDUAL TEACHER

Group	Average	Standard deviation	Final Score
Gr1	4.75000	1.87639	2.87361
Gr2	5.31667	1.85734	3.45932
Gr3	5.08333	1.86070	3.22263
Gr4	5.36667	1.97203	3.39464
Gr5	6.61667	1.57445	5.04222
Gr6	4.45000	1.57445	2.87555
Gr7	7.08333	1.41382	5.66951
Gr8	7.41667	1.22429	6.19238

We represented group score tally of 8 teachers in table 10. This table is final table and prepared after calculating final score from subtraction of average and standard deviation of all teachers at individual level. T1, T2, T3.....T8 are 8 different teacher where as Gr1, Gr2.....Gr8 represent all 8 group of measurement criteria of good teacher. From this table we can say that T1 has Gr8 quality, T2 has Gr7 quality, T3 has Gr4 quality, T4 has Gr3 quality, T5 has Gr6 quality, T8 has Gr1 quality. While going to assign a job a administrator can see group score of individual teacher and then assign job to the teacher. This will help in organizing and managing student.

TABLE 10: EXAMPLE OF 8 TEACHER GROUP SCORE TALLY TABLE

Teacher	Group								Max(Gr)
	Gr1	Gr2	Gr3	Gr4	Gr5	Gr6	Gr7	Gr8	
T1	2.87361	3.45932	3.22263	3.39464	5.04222	2.87555	5.66951	6.19238	6.19238
T2	3.45932	4.56783	2.87555	4.56783	4.56783	3.39464	5.86271	5.04222	5.86271
T3	3.22263	6.21111	5.66951	6.87986	6.09875	5.04222	3.54356	5.53241	6.87986
T4	3.39464	5.53241	6.35671	5.53241	5.98784	5.67849	4.56783	5.90912	6.35671
T5	5.04222	4.93245	3.54356	5.04222	3.39464	5.98784	3.39464	5.98784	5.98784
T6	2.87555	4.68732	4.56783	2.87555	5.04222	3.54356	5.04222	4.89765	5.04222
T7	5.66951	5.53241	5.98733	5.66951	4.89765	4.56783	4.89765	4.67895	5.98733
T8	6.19238	4.98786	5.53241	6.19238	4.67895	5.53241	4.67895	3.39464	6.19238
Max(T)	6.19238	6.21111	6.35671	6.87986	6.09875	5.98784	5.86271	6.19238	

VI. CONCLUSION

Every teacher is not aware about teaching qualities. So s/he is unsuccessful in his/her teaching career. Similarly, administrators are biased towards their most favorite subordinate and the overall result becomes unsuccessful achievement. In this paper it is tried to find out that how could be found a teacher who is well in performing his duty. For this purpose a psychometric test is performed with the help of students who interact with the teacher. This psychometric test converts qualitative variables into quantitative. So that further calculation can be done.

Education laureates spell various teaching qualities. These qualities are divided into eight groups. If a teacher scores lowest number in any group it indicates that s/he does not possess qualities of that group and high score means just opposite. So a teacher must try to achieve the higher score by changing his attitude and behavior towards the student. If there are more than one teacher, a comparative table must be prepared which will help the administrator to choose adept teacher to perform the given duty.

REFERENCES

- [1] Luan J, "Data Mining and its Application in Higher education", SPSS Executive Report, 2002.
- [2] Rubenking "Hidden Messages", PC Magazine, May 22, 2001.
- [3] Romero C and Ventura S, "Educational Data Mining: A survey from 1995 to 2005" expert system with Application 33, pp.135-146, 2007.
- [4] Sukhia S.P. "Educational Administration, Organization and Health Education" Agrawal Publishers, Agra, India, 2005.
- [5] M. Bray, The shadow education system: private tutoring and its implications for planners, (2nd ed.), UNESCO, PARIS, France, 2007.
- [6] B.K. Bharadwaj and S. Pal. "Mining Educational Data to Analyze Students' Performance", International Journal of Advance Computer Science and Applications (IJACSA), Vol. 2, No. 6, pp. 63-69, 2011.
- [7] S. K. Yadav, B.K. Bharadwaj and S. Pal, "Data Mining Applications: A comparative study for Predicting Student's Performance", International Journal of Innovative Technology and Creative Engineering (IJITCE), Vol. 1, No. 12, pp. 13-19, 2011.
- [8] Chein, C., Chen, L. "Data mining to improve personnel selection and enhance human capital: A case study in high technology industry", Expert Systems with Applications, In Press, 2006.
- [9] <http://www.assessmind.com/>
- [10] http://en.wikipedia.org/wiki/Psychological_testing
- [11] http://en.wikipedia.org/wiki/Latent_variables.
- [12] Gupta S.P., "Statistical Methods", S. Chand & Sons Educational Publishers New Delhi, 2007.



Umesh Kumar Pandey is Assistant Professor in the Department of Computer Applications, P S R I E T, Pratapgarh, UP India. He obtained his M.C.A degree from IGNOU (2004) and M.Phil. in Computer Science from PRIST University, Tamilnadu. He is currently doing research in Data Mining and Knowledge Discovery from Singhania University, Rajasthan. Umesh Kumar Pandey published two papers in international Journals i.e. IJCSI &

IJCSIT and one paper in national journal i.e. LBSIMDS. He participated in one national conference in LBSIMDS. He is member of two international associations i.e. IAENG and IACSIT.



Saurabh Pal received his M.Sc. (Computer Science) from Allahabad University, UP, India (1996) and obtained his Ph.D. degree from the Dr. R. M. L. Awadh University, Faizabad (2002). He then joined the Dept. of Computer Applications, VBS Purvanchal University, Jaunpur as Lecturer. At present, he is working as Head and Sr. Lecturer at Department of Computer Applications.

Saurabh Pal has authored a commendable number of research papers in international/national Conference/journals and also guides research scholars in Computer Science/Applications. He is an active member of CSI, Society of Statistics and Computer Applications and working as reviewer and member of editorial board for more than 15 international journals. His research interests include Image Processing, Data Mining, Grid Computing and Artificial Intelligence.

How to cite this paper: Umesh Kumar Pandey, Saurabh Pal, "Mining Data to Find Adept Teachers in Dealing with Students", International Journal of Intelligent Systems and Applications (IJISA), vol.4, no.3, pp.27-33, 2012. DOI: 10.5815/ijisa.2012.03.04