

# ASSESSING TEACHERS NEEDS USING DATA MINING

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## ABSTRACT

*The aim of this research paper is to assess and prioritize the Teachers' needs using Data Mining. Working in incredibly challenging environments, Teachers are the backbone of the education system. Meeting their needs is crucial to the success of the educational institutions. In this study, a closed-ended questionnaire is used to collect data from teachers of higher education institutes. The paper focuses on the academic needs of the teachers and the responses generated help the educational institutes analyze the gaps in teachers needs and provide for a better and effective teaching experience. Sophisticated teaching abilities are required nowadays due to complex curriculums, diverse student needs and enhanced education standards. Keeping a tab on teachers needs is hence attaining importance. Further, it can help in increasing the teaching standards and planning for staff and instructors.*

**Keywords:** *Data Mining, Educational Data Mining (EDM), Faculty Needs.*

## I. INTRODUCTION

In the modern world, education has set new benchmarks. The educational institutes understand that every aspect of their reforms depends on highly skilled and motivated teachers for its success. Higher education institutes nowadays, are more diversified with increased emphasis on performance and quality of education. The plethora of programs and advanced education technologies require increase in wider participation by the faculty. This not only results in better student satisfaction, it also helps the faculty establish and achieve their own professional goals.

This growing diversity in higher education makes it imperative for these institutes to understand the faculty needs, which can help in building a more effective higher education system. "Need" is defined as the gap between current outcomes or outputs and desired (or required) outcomes or outputs [1]. It is important to understand, identify and address these gaps so as to enhance their skills, teaching methodologies and overall in-classroom teaching experience.

Data Mining (DM) is one technique, which can help in mining the educational data to get valuable information and improve the performance and quality of these institutes. Data Mining is the process of analysing data from different perspectives and summarizing it into useful information. DM is a powerful tool that can help one find patterns and relationships within the data. DM finds its use in many applications like Banking, Finance,

Marketing, Medicine, Insurance and many other sectors. But application of DM in the field of Education is still limited. DM can help educators in getting a focused understanding of students needs and improve upon the same. Data Mining tools predict behaviours and future trends, allowing businesses to make proactive, knowledge-driven decisions [2]. Educational Data Mining is an emerging field that focuses on applying Data Mining tools to Education related Data [3].

## II. RESEARCH BACKGROUND

Researches within Educational Data Mining field have focused on topics like finding set of Weak students, Student evaluation, Faculty Evaluation, Student dropout ratio, Understanding students enrollment data, impact of feedback on teachers and students behavior.

Recent literature on Educational Data Mining is presented below:

Romero and Ventura conducted survey on Educational Data Mining between Years 1995 to 2005 and concluded that Educational Data Mining is a promising area of research [4].

Alaa-El-Haleez gave a case study that used Educational Data Mining to analyze student-learning behavior [5].

B.K.Bhardwaj and Saurabh Pal used classification task on student database to predict the students division on the basis of previous database and reduce fail ratio [6].

Chong Ho Yu used Data Mining techniques to study the predictors affecting University student retention [7].

S.Anupama and Vijaylakshmi used Data Mining techniques to study behavior and performance of students [8].

Ajay Kumar Pal and Saurabh Pal used Data Mining techniques in EDM for predicting performance of students [9].

J.Ranjan and K.Malik used data-mining techniques for exploring the effects of probable changes in processes related to admissions, course delivery and recruitments [10].

Dr. Mohd Maqsood Ali, "Role of data mining in education sector", International Journal of Computer Science and Mobile Computing Vol. 2, Issue. 4, April 2013[11].

Agrewal, S., G. Pandey, and M. Tiwari. "Data mining in education: data classification and decision tree approach." International Journal of e-Education, e-Business, e-management and e-learning, 2 (2) (2012)[12].

In 2012, M. Sukanya, S. Biruntha, Dr. S. Karthik and T. Kalaikumaran analyzed and assisted the low academic achievers in higher education using Bayesian Classification Method of Data Mining [13].

Pandey, Umesh Kumar, and Saurabh Pal. "A Data mining view on class room teaching language". International Journal of Computer Science Issues (2011)[14].

Randa Kh. Hemaïd , and Alaa M. El-Halees, "Improving teacher performance using Data mining", International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 2, February 2015 [15].

Ahmadi,F.,and Abadi, S. "Data Mining in Teacher Evaluation System using WEKA", International Journal of Computer Applications (0975 – 8887), Vol 63 – No.10, February 2013[16].

Mardikyan, S. and Badur, B. "Analyzing Teaching Performance of Instructors Using Data Mining Techniques", Informatics in Education, Vol. 10, No. 2, 245–257, 2011, Vilnius University [17].

1. The proposed work uses Data Mining to identify the needs of faculty and further enhances their skills to help them achieve their career goals.
2. Identify the needs and preferences of teachers towards appropriate course ware, teaching methodologies, faculty competency & approach and ways of assessment.
3. Prioritize the needs of the faculty and help them in developing new, focused and more effective teaching strategies and methodologies. Need patterns can be further studied to identify the focus areas that need to be developed in order to achieve improved learning outcome.

## IV. DATA MINING TECHNIQUES

Data Mining Techniques consist of various algorithms and techniques for finding out patterns from the data. These Techniques can be classified into two categories: Predictive and Descriptive.

*A. Predictive Data Mining:* It uses some variables or fields to predict unknown or future values of variables of that interest. It includes Classification, Regression and Prediction techniques.

*B. Descriptive Data Mining:* It focuses on finding patterns describing the data that can be interpreted by humans. It includes Clustering, Summarization and Association techniques.

## V. RESEARCH METHODOLOGIES

### A. Data Collection Strategy

The data for this study has been collected from faculty of undergraduate courses of different colleges. A sample size of 66 teachers has been used in the study. The closed-ended questionnaire comprised of various attributes pertaining to academic needs.

Participants on the scale of 1 to 5 responded to the Likert scale based questionnaire:

1. Very Important
2. Fairly Important
3. Neutral
4. Not Important
5. Not at all Important.

### B. Cleaning and preparing data

The collected data needs to be pre-processed and cleaned before Data Mining Techniques can be applied on the same to extract meaningful information. In this step only those fields were selected which were required for data mining. The pre-processing was done in terms of filling up missing values, rectifying inconsistent data and removing duplicate data. The Excel dataset collected from various sources has been collated into a single dataset for further analysis.

### C. Partial Data Set (raw data)

Table 1: The raw data for our study is presented in the Table1 below:

**TABLE 1. (Sample of 5 respondents)**

Above data set is for 23 questions and has been filled by 66 faculty members of undergraduate courses of different colleges.

Teacher No	1. Appropriate & Updated Course Material	2. Career Oriented Course Material	3. Practical approach towards Understanding of concepts	4. Availability of Books/Journals etc.	5. Number of lectures allocated to the course	6. Lectures	7. Usage of Technology (Smart classes / Electronic text books etc.)
1	1	2	3	2	1	2	3
2	1	1	1	2	1	2	2
3	1	1	1	2	1	2	2
4	2	2	1	2	2	2	2
5	1	1	2	2	3	2	2

**D. Reliability Test**

Cronbach’s alpha test is a measure of internal consistency that is, how closely related sets of items are as a group. It is a co-efficient of reliability (or consistency) [18].

**TABLE 2. Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.948	0.950	23

The Alpha co-efficient is 0.948 suggesting that the items have relatively high internal consistency.

**E. Data mining exploration**

A popular DM tool, IBM SPSS has been used for initial statistical analysis of the data. The Excel dataset is imported into SPSS.

Data has been explored using Statistical Measures (Median and Mode).

Refer Table 3 below:

**TABLE 3. (Sample)**

	1.Course Material	2. Career Oriented	Practical approach towards Understanding of concepts	4. Availability of Books/Journals etc.
N Valid	66	66	66	66
Missing	0	0	0	0
Median	1.00	1.00	1.00	1.50
Mode	1	1	1	1

The table shows Median and Mode of individual questions reflecting the central tendency.

Response to each question has been analyzed separately. The table 4 below shows the frequency and percentage of responses to individual questions.

Refer Table 4 and Bar chart 1 below:

TABLE 4. (Q1: Course Material)

	Frequency	Percent	Valid Percent	Cumulative Percent
Very Important	47	71.2	71.2	71.2
Fairly Important	14	21.2	21.2	92.4
Neutral	2	3.0	3.0	95.5
Not Important	2	3.0	3.0	98.5
Not At All Important	1	1.5	1.5	100.0
Total	66	100.0	100.0	

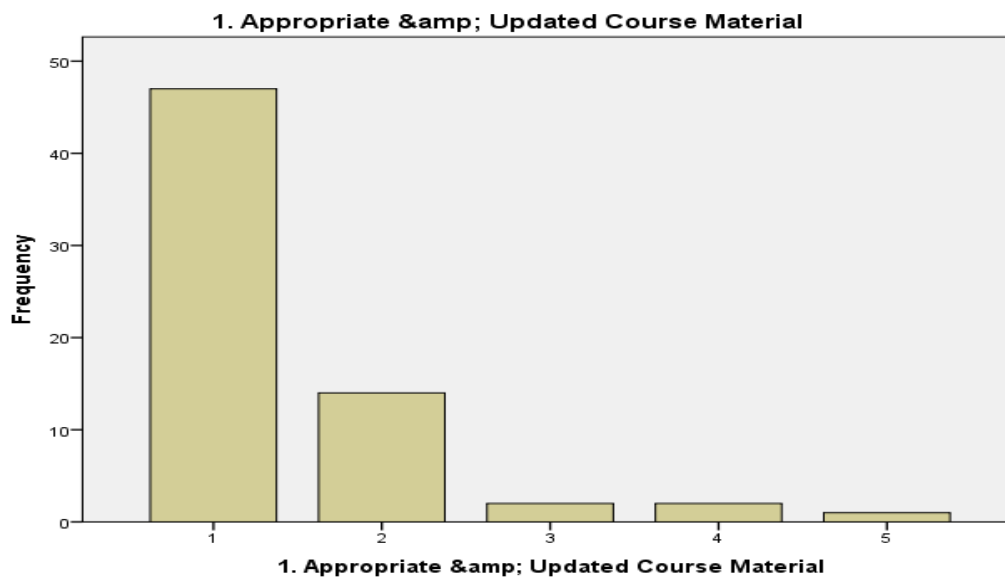


Fig. 1. Bar chart 1 (for Q1: Course Material)

After analyzing individual questions and applying various statistical techniques a priority list of the needs was generated which showed that ‘Appropriate and Updated Course material’ ranked the highest.

Table 5 below displays the percentages of responses in the (Very Imp + Fairly Imp) category, Neutral category and (Not Imp + Not at all Imp) category with respect to total responses. These responses have been further filtered from highest to lowest and the TOP 3 attributes are as follows:

1. Appropriate and Updated Course material
2. Educational Competency
3. Good Motivational skills

The complete Priority list is available below in Table 5.

*Prioritized list:* Refer Table 5 below:

**TABLE 5. (Highest to lowest on Percentage of Importance)**

<b>Attributes (descending order)</b>	<b>Percentage of Very Imp / Fairly Important</b>	<b>Percentage of Neutral</b>	<b>Percentage of Not Important / Not at all Important</b>	<b>Highest Percentage</b>
1. Appropriate & Updated Course Material	61.0	2.0	3.0	92%
19. Educational Competency	61	2	3	92%
23. Good Motivational skills	60	2	4	91%
7. Usage of Technology (Smart classes / Electronic text books etc.)	60	4	2	91%
21. Practical Approach	59	3	4	89%
3. Practical approach towards Understanding of concepts	59	5	2	89%
2. Career Oriented Course Material	58	5	3	88%
4. Availability of Books/Journals etc.	58	4	4	88%
11. Teaching support facilities (Labs / Workshops etc.)	56	9	1	85%
17. Industry based practicals / case studies	56	8	2	85%
5. Number of lectures allocated to the course	56	7	3	85%
6. Lectures	56	6	4	85%
22. Discussion Oriented	55	9	2	83%
8. Group based discussions (Knowledge sharing)	55	10	1	83%
13. Continuous Assessment (weekly / Monthly)	52	11	3	79%
9. Projects & Assignments	52	13	1	79%
10. Student to Teacher ratio (Class size)	50	12	4	76%
14. Yearly or Semester based assessment	50	12	4	76%
18. Exam scheduling / time table	49	16	1	74%
15. Multiple choice type or	46	15	5	70%



Essay type assessment				
20. Industry background	42	20	4	64%
16. Feedback on Assessment from Teachers	40	14	12	61%
12. Notes based teaching system	35	21	10	53%

The needs are categorized under different Groups as follows:

1. Courseware: Q1 to Q5
2. Assessment techniques: Q6 to Q12
3. Teaching Methodologies: Q13 to Q18
4. Teachers’ competencies: Q19 to Q23

**T-test**

T-test has been conducted to compare the needs of the above groups.

**TABLE 6. T-test**

**One-Sample Statistics**

	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error Mean</b>
<b>Course_Material</b>	66	1.5667	.72966	.08982
<b>Teaching_Method</b>	66	1.8312	.68301	.08407
<b>Assessment</b>	66	2.0631	.63768	.07849
<b>Teachers</b>	66	1.6970	.67959	.08365

The T-test indicates that there is significant difference in the Means of various Groups. Refer Table 6 above: Assessment group followed by Teaching methodologies rank the most important as per the T-test conducted.

**VI. CONCLUSION**

The priority list of the ‘Faculty Needs’ has been established and the study clearly shows the inclination of the teachers towards ‘Appropriate and Updated Course material’ and ‘Educational competency’. Teachers firmly believe in the importance of ‘Motivational skills’ and ‘Usage of Technology’ in the education system.

**VII. FUTURE SCOPE**

This research work focuses itself specifically on the Academic needs of the faculty members of Undergraduate courses. These results are clear indication to the faculty needs and may be used by Educational institutions to enhance the overall faculty performance. The future scope of the study can include a broader bandwidth including factors such as demographical needs, needs based on Age group, Gender, Socio-economic backgrounds, Ethnicity, factors like Career growth, College environment etc. More research work also needs to

be done in case of faculty members of schools or postgraduate courses, technical institutions, management courses etc. to judge their priority needs.



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