Prashant G Tandale
Assistant Professor, Bharati
Vidyapeeth University,
Institute of Management,
Kolhapur, Maharashtra, India

Dr. Anil T Gaikwad
Associate Professor, Bharati
Vidyapeeth University,
Institute of Management,
Kolhapur, Maharashtra, India

Holistic model for customized pedagogical strategies using data mining techniques

Prashant G Tandale and Dr. Anil T Gaikwad

Abstract
Educational data mining is an emerging discipline that focuses on applying data mining tools and techniques to educationally related data. The data mining technology can discover the hidden patterns, associations, and anomalies from educational data. This knowledge can improve the decision making processes in higher educational systems. Data mining is considered as the most suited technology appropriate in giving additional insight into the lecturer, student, alumni, manager, and other educational staff behavior and acting as an active automated assistant in helping them for making better decisions on their educational activities. This paper tries to take review of work done so far in this area of educational data mining and one of the applications of data mining called "Prediction"

Keywords: Educational Data Mining (EDM), KDD, Classification, Clustering, Prediction

1. Introduction
Education is an essential element for the betterment and progress of a country. It enables the people of a country civilized and well mannered. Today the important challenge that higher education faces, is reaching a stage to facilitate the universities in having more efficient, effective and accurate educational processes. To date, higher educational organizations are placed in a very high competitive environment and are aiming to get more competitive advantages over the other competitors. To remain competitiveness among educational field, these organizations need deep and enough knowledge for a better assessment, evaluation, planning, and decision-making. The required knowledge cannot be gained from the tailor made software used now a days. Data mining incorporates a multitude of techniques from a variety of fields including databases, statistics, data visualization, machine learning and others. Educational data mining (EDM) is an emerging discipline that focuses on applying data mining tools and techniques to educationally related data. The discipline focuses on analyzing educational data to develop models for improving learning experiences and improving institutional effectiveness.

The data mining technology can discover the hidden patterns, associations, and anomalies from educational data. This knowledge can improve the decision making processes in higher educational systems. Data mining is considered as the most suited technology appropriate in giving additional insight into the lecturer, student, alumni, manager, and other educational staff behaviour and acting as an active automated assistant in helping them for making better decisions on their educational activities. The data mining techniques can help the institutes in extracting patterns like students having similar characteristics, Association of students' attitude with performance, what factors will attract meritorious students and so on. The past several decades have witnessed a rapid growth in the use of data and knowledge mining as a means by which academic institutions extract useful hidden information in the student result repositories in order to improve students' learning processes.

2. Review of literature
A literature review on educational data mining topics such as student retention and attrition, personal recommender systems within education, and how data mining can be used to analyze course management system data. Gaps in the current literature and opportunities for further research are presented.

Correspondence
Prashant G Tandale
Assistant Professor, Bharati
Vidyapeeth University,
Institute of Management,
Kolhapur, Maharashtra, India

1. According to Paulraj and Ponniah (2001) [6] the main benefits of data mining to educational institutes are – It provides an integrated and total view of an institute. It makes the institute's current and historical information easily available for the decision making. It provides the facility to students to get their different subject notes from a web enabled database. It provides the information about student's attendance. Students can get theirs results easily and very quickly. It helps to provide information about faculty like how many members are there in all the different departments etc.

2. Proposed an approach to classify students in order to predict their final year grade based on the features extracted from logged data in an educational web based system was reported. Data mining classification process was used in conjunction with genetic algorithm to improve the prediction accuracy.

3. C. Romero and S. Ventura (2010) [9] survey the relevant studies carried out in the field of education. They have described the types of users, types of educational environments and the data they provide. Also they have explained in their work the common tasks in the educational environment that have been resolved through data mining techniques.

4. Have used data mining techniques for understanding student enrolment data. They have done comparative study of three predictive data mining techniques namely Neural Network, Logistic regression and Decision tree. The results obtained can be used by the planners to formulate proper plan for the university.

5. Shaeela Ayesha *et al*. (2010) [11] discusses data mining technique named k-means clustering is applied to analyze student's learning behavior. Here K-means clustering method is used to discover knowledge that come from educational environment.

6. Have identified the association between different attributes of educational environment i.e. the location of the college, type of college, different social groups, different courses etc. and thereby extract strong association rules. They used data mining technique of association rule mining to extract strong rules in educational environment that identifies students' success patterns in different colleges in different social groups. Further they have processed the available data to find the pattern of support for these rules from time to time.

7. Robertas (2009) [8] analyzed student academic results for informatics course improvement, rank course topics following their importance for final course marks based on the strength of the association rules and proposed which course specific course topic should be improved to achieve higher student learning effectiveness and progress.

8. W.M.R. Tissera *et al*. (2006) [13] presents a real-world experiment conducted in an ICT educational institute in Sri Lanka. A series of data mining tasks are applied to find relationships between subjects in the undergraduate syllabi. This knowledge provides many insights into the syllabi of different educational programmes and results in knowledge critical in decision making that directly affects he quality of the educational programmes.

9. Monika Goyal (2012) [2] used different types of rule – based systems and have been applied to predict student's performance (mark prediction) in an e learning environment (using fuzzy association rules). Several regression techniques are used to predict student's marks like linear regression for predicting student's academic performance, stepwise linear regression for predicting time to be spent on a learning page, multiple linear regression for identifying variables that could predict success in courses and for predicting exam results in distance education courses

3. Research methodology

The present study will be completed using Field Survey, interviews. While carrying the survey the researcher would approach directly to the different management institutes and through viewing office records, web sites of the institutes and relevant data will be solicited. For this purpose, questionnaires will be designed. Empirical data will be collected from the samples of Bharati Vidyapeeth Deemed University in Maharashtra state.

a. **Primary Data Collection**- The primary data will be collected from selected students and all teachers from each management institute which is constituent unit of Bharati Vidyapeeth Deemed University. Face to face interviews with management and administrators of the institutes will also be conducted.

b. **Secondary Data Collection** - Secondary data will be collected by literature survey and visits to various libraries and websites of the management institutes. Data can also be collected from Activity Log of LMS (Learning Management System), Server Log, Public Data.

4. Knowledge discovery process

Data mining is also known as Knowledge Discovery from Databases (KDD). Data mining techniques are used to operate on large volumes of data to discover hidden patterns and relationships helpful in decision making. At the level of a university, administrative information systems collect information about students, their enrolment in particular programs and courses, and performance like examination grades. In addition, the information about the lectures, instructors, study programs, courses and prerequisites, are typically available as well. The following figure shows the Holistic model for customized pedagogical strategies using data mining techniques.
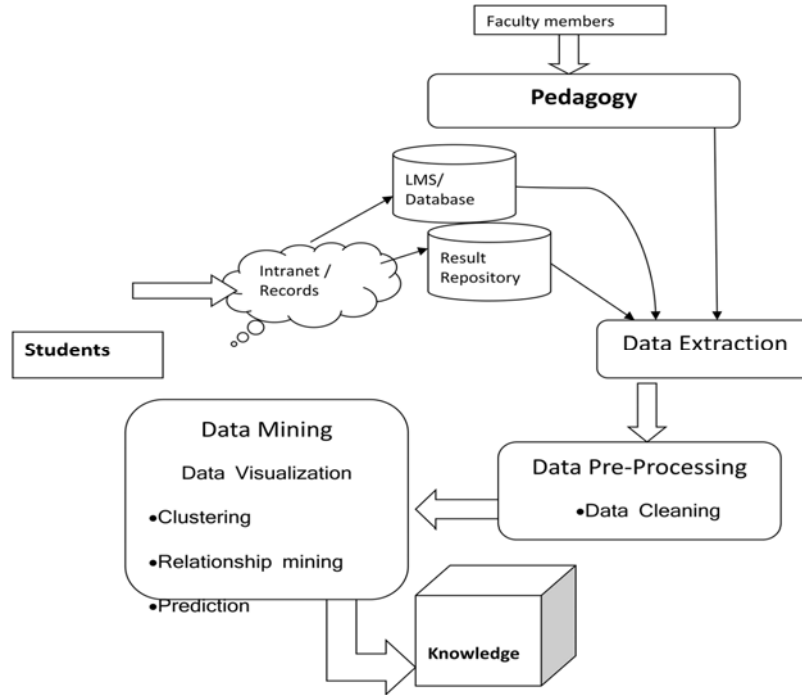
Fig 1: The Holistic Model (Proposed Educational Data Mining Framework)

5. Data analysis & interpretation

Data is collected and analysis using SPSS. In this study we tried to find out the effectiveness of the different pedagogical strategies. So that the teachers will decide the perfect strategy while teaching to a particular class. The teacher may also customize the strategy according to the need. Feedback from 340 students regarding effectiveness of pedagogical strategy is collected in the form of 5 point likert scale. Feedback remark 1 indicate unsatisfactory, 2 – Satisfactory, 3- Neutral, 4- Good & 5- Very Good. The following table shows the effectiveness of different pedagogical strategies applied.

Table 1: Effectiveness of different Pedagogical Strategies applied.

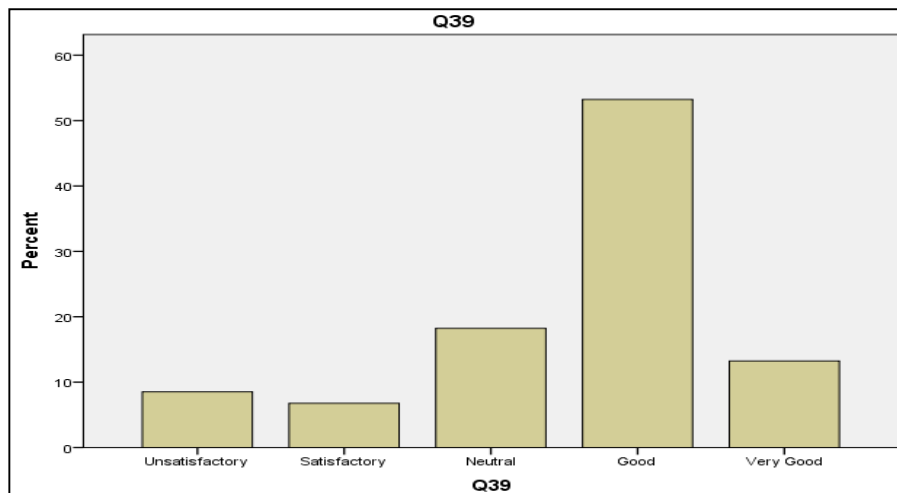| Pedagogical Strategies	Mean	Std. Dev
Chalk & Talk Method(Lecture)	3.77.	0.890
Experimental / Empirical	3.19	1.174
Collaborative (Group Discussion / Group Projects)	3.26	1.272
Demonstration	3.31	1.123
Problem Solving	3.90	0.808
Presentations	3.76	0.941
Use of ICT tools	3.56	1.078
Case Studies	3.64	0.839
Use of Social Media for Teaching- Learning	3.78	1.011

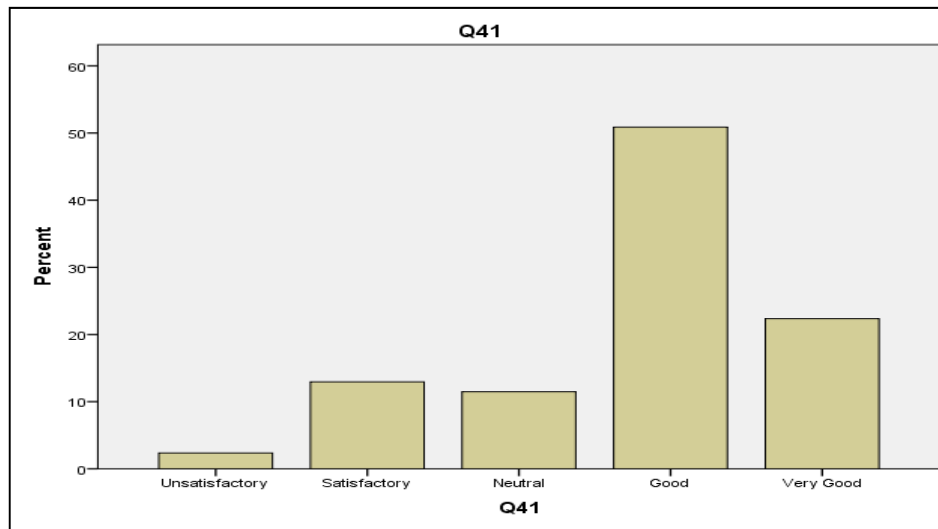
Fig 2: Roesponces for ICT enabled Teaching

Fig 3: Roesponces for use of Social Media for Teaching - Learning

6. Findings & conclusion

By observing the facts and figures of Table 1 we could interpret the following findings

1. Different pedagogical strategies and their effectiveness is studied. It is found that Presentations, Case study, ICT enabled teaching, social media are the most effective pedagogical strategies
2. 73% students like to use social media for learning.
3. 66% students like the use of different ICT tools in teaching and learning process.
4. There is poor response for Experimental teaching. The reason may be the education they pertaining is management education.

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