Data Analytics in Educational Management System

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Data Analytics in Educational Management System

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ABSTRACT
Educational data analytics is used to study the data available in the educational field and bring out the hidden knowledge from it. Analytics is a process of discovering, analyzing, and interpreting meaningful patterns from large amounts of data. Data analytics reliesonthe techniques of data mining such as, classification, association, correlation, categorization, prediction, estimation, clustering, trend analysis and visualization. Predictive analytics can help in improving the quality of education by providing right information for decision makers to take better decisions. This paper focuses on the need for implementing the data analytics in educational system, suggests some strategies to use these needs. While implementing any system, the understanding of different components and their functions is necessary. In Educational management system, there are different components like technology, content, services, e-learner etc. This paper also discusses the key issues related with these components and their functions within the system such as services to be provided, content design criteria. The educational data analytics has potential to discover, analyze and predict meaningful knowledge from educational data which will help to education management system for flexible planning, execution and prediction for future.

Keywords
Data Analytics, Predictive Model, Educational Management System, Decision Making

1. INTRODUCTION
Information plays key role in management, planning and evaluation of an education system. The education management system (EMS) should inform to the different its pedagogical and institutional operation, its performance, efficiency, shortcomings and needs. An education management information system is a repository for data collection, processing, analyzing and reporting of educational information including institute, students, teachers and staff. An information system should not only aim to collect, store data and process information but also help in the formulation of education policies, their management and their evaluation. There has been greater interest in highly specific indicators concerned such as attendance rates, retention rates, students' achievement level and discipline problems.

Currently the huge amount of data is stored in educational databases. These databases contain the useful information to predict students' performance. Educational data analytics is used to study the data available in the educational field and bring out the hidden knowledge from it. Analytics is a process of discovering, analyzing, and interpreting meaningful patterns from large amounts of data.

Data analytics isnecessary withgreat potential to help institutions tofocus onthe most important informationintheirdatawarehouses,prospectiveanalysesofferedb ydatamining tools ofdecisionsupportsystems. Software tools and methodologies have been developed in the field of statistics and data analytics to process data and to let these data more informative to users who need them for decision making.

Data analytics reliesonthe techniques of data mining such as, classification, association, correlation, categorization, prediction, estimation, clustering, trend analysis and visualization. Higher education institutions can useclassification, foranalysis of student performance, or use estimationto predict theprobabilityofavariety ofoutcomes,suchas result, persistence,retention, and course success. Data analytics enables educational institutions to better allocate resources and staff, proactively manage student outcomes and improve the effectiveness of education management system.

Predictive analytics in educational management system consists of four main steps.

Data Collection
Data need to be collected regarding courses offered, students enrolled, and their results etc. Data need to be preprocessed and need to be converted in proper format to store.

Build the predictive model
The predictive model will be built as shown in figure considering few of the stakeholders such as administrators, educationists, principals, HODs, faculty members, industry experts, faculty members, students and parents.

Model Validation
The predictive model will be validated on testing data. Few test data sets will be considered to validate it.

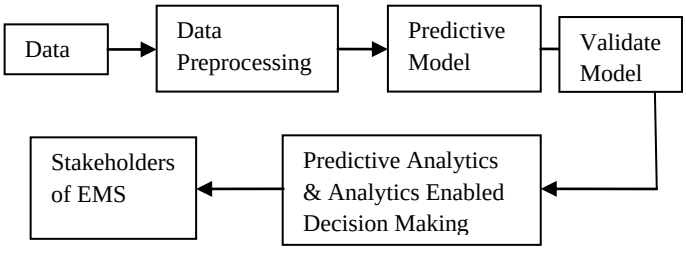

Fig 1: Steps for predictive analytics in Educational Management Analysis

Analytics enabled decision making
People at top level management as well as middle level management will be able to take better decision by analyzing the data. The model will be helpful for them in decision making.

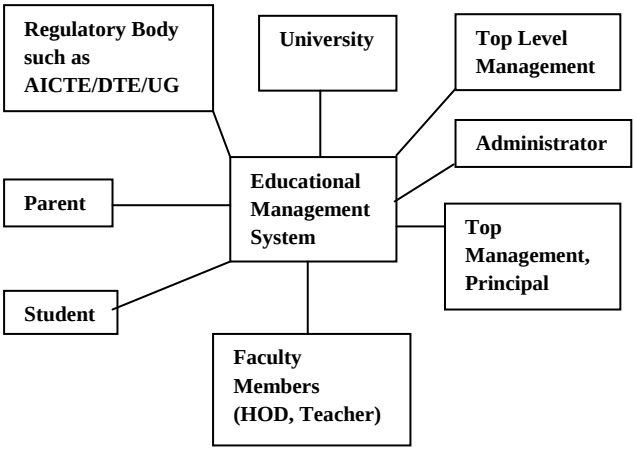

Fig 2: Stakeholders of Educational Management System

2. INTERNATIONAL STATUS OF EDUCATIONAL DATA ANALYTICS

Data analyticsis a powerful toolforacademicintervention.Through dataanalytics,institution couldpredictwithmorethan80percent accuracy which students will complete the course or will not.The institution could usethisinformationto concentrate academicassistance onthose studentsmost risk offailure in particular subjects.

Educational data analytics techniques can reveal useful information to educators to help them design or modify the structure of courses. Students can also facilitate their studies using the discovered knowledge. Nowadays, the researchers utilize educational data analytics techniques mostly to guide student learning efforts, develop or refine student models, measure effects of individual interventions, improve teaching support or predict student performance and behavior [1].

Learning analytics focuses on collecting and analyzing data from different sources to provide information related to teaching and learning. This helps educational institutions to improve their quality of learning [2].

The university of Wisconsin- Madison is developing a data driven "early warning" system that can be used by faculty members to support student academic success. The system aims to identify at risk, improve students' academic success and identify campus retention and performance [3].

Santa Monica College's Glass classroom initiative aims to enhance students and teachers performance by collecting and analyzing large amounts of data [4].

Predictive analytics can help in improving the quality of education by providing right information for decision makers to take better decisions. Organizations adopt predictive analytics for key reasons such as competition, growth, enforcement, improvement, satisfaction, learning and action based on better information. Education and research play key role in nation's overall development. Quality education will be success oriented and fulfill better industry needs [5].

Immediate feedback can be provided by data mining software to students and teachers about academic performance. Different patterns can be used for the prediction of student performance related outcomes. This approach will be more effective with particular students based on different parameters[6].

Sheila MacNeilletl in their article presented an overview of analytics within the domain of education, highlighting potential areas of development and the challenges faced by the education sector. At the institutional level, senior management people are increasingly are in need of integrating analytic approaches with current business intelligence methodologies. This would enable them to gain actionable insights that will allow them to make effective decisions in terms of operating within new economic models, while addressing strategic priorities such as student retention and achievement [7].

The benefits of analytics will be in student performance, student recruitment and retention, student assessment, student satisfaction, resource optimization, quality enhancement, improvement of curriculum quality. Enrollment management, finance and budgeting and student progress were the areas used by most of the institutions to use data at a level that meets the definition of data analytics. There is potential of analytics to address various institutional challenges such as understanding students' demographics and behavior, helping students learn more effectively, recruiting students, improving administrative services, lowering cost of education, improving faculty performance, reducing administrative costs etc. [8].

In the article it is discussed that educational institutions must begin to consider using analytics to improve returns. It is more critical is finding ways to improve student retention, grades and services to students. To do this efficiently and effectively, educators and administrators need deeper insights into what impacts student completion rates, learning outcomes, and yet fulfills the goals of the institution bringing increased returns. Analytics once again could provide these answers. It could provide them the edge they need to remain profitable. But they must remember to ensure a careful balance. Automation and analytical tools and human coordination let them compliment and add value to each other. Educational institutes are also collecting huge amounts of data every day. Generated by students, faculty and administration, this data can be analyzed to discover meaningful patterns, and then used to make important operational decisions. Analytics can help Education institutions [9].

Schools in sixteen states used data mining techniques to identify at-risk students. Using prediction models based on truancy, disciplinary problems, changes in course performance, and overall grades, analysts have discovered that they have a reasonable probability of identifying students who drop out. (The school district in Charlotte-Mecklenburg County, North Carolina found their "risk-factor scorecard" showed who was at-risk and in need of special assistance) [10].

IMPACT software is used by Chicago Public Schools. It works based o four different areas such as student information management; curriculum and instructional management; student services management; and a gradebook for parents and students. The software can be used by different users such as students, parents, teachers, administrators, and support staff. There are different facilities provided by the software to the registered users such as results, assessment, different resources & discussion forums etc. [11].

3. NATIONAL STATUS OF EDUCATIONAL DATA ANALYTICS

Bharadwaj and Pal [12] conducted study on the student performance based by selecting 300 students from 5 different degree college conducting BCA (Bachelor of Computer Application) course of Dr. R. M. L. Awadh University, Faizabad, India. By means of Bayesian classification method on 17 attributes, it was found that the factors like students' grade in senior secondary exam, living location, medium of teaching, mother's qualification, students other habit, family

annual income and student's family status were highly correlated with the student academic performance.

Bharadwaj and Pal [13] obtained the university students data like attendance, class test, seminar and assignment marks from the students' previous database, to predict the performance at the end of the semester.

Yadav, Bharadwaj and Pal [14] obtained the university students data like attendance, class test, seminar and assignment marks from the students' previous database, to predict the performance at the end of the semester with the help of three decision trees. It was observed that C4.5 is the best algorithm.

Samrat Singh and Dr. Vikesh Kumar [15] concluded in their research that the data can be collected form historical and operational data reside in the databases of educational institutes. The student data can be personal or academic. The discovered knowledge can be used to better understand students' behavior, to assist instructors, to improve teaching, to evaluate and improve learning systems, to improve curriculums and many other benefits.

4. A SURVEY OF WORK DONE IN THE RESEARCH AREA AND THE NEED FOR MORE RESEARCH

It is important for educational institutes to maintain a high quality educational programme which will improve the student's learning process and will help the institute to optimize the use of resources. Exploration of subjects and their relationships can directly assist in better organization of syllabi and provide insights to existing curricula of educational programmes. It is necessary to identify related subjects in syllabi of educational programmes in a large educational institute. It is necessary to find the strongly related subjects in a course offered by the institute, identify the possible related subjects, determine the strength of their relationships and determine strongly related subjects.

There are many opportunities to advance learning through data mining, data analytics, and web dashboards and visual displays. Technology enables the use of new approaches to formative and predictive assessment. Educational administrators, students and teachers can get systematic feedback in real-time and use that material to improve academic performance.

Yet many barriers complicate the achievement of these benefits. In general, too much of contemporary education focuses on education inputs, not outputs. Educational institutes are measured based on seat-time, faculty-student ratios, library size, and amount spent educating students. Accreditors use these metrics to determine which educational institutes are providing the highest level of resources for students and are therefore in a position to do the most effective job. Even though this information is important, it misses the end result of education, which is producing well-trained and knowledgeable graduates. Educational institutes and Accreditors should emphasize outputs as well as inputs. Educational institutions should be judged not just on what resources are available, but whether they do a good job delivering an effective education. Real-time assessment means that educational institutes can evaluate how much students have learned and how much progress there has been towards educational objectives.

Data analytics can support continued and real time assessment on student progress. Data analytics is concerned with methods for exploring types of data that come from educational information system. By focusing on data analytics, teachers can study learning behavior of the student, analyze what students know and what techniques are most effective for each student. Using prediction models based on absenteeism of students, disciplinary problems, changes in course structures, students performance, financial status, family background, and overall grades, analysts can discover reasonable probability of identifying students who drop out, can determine which students will likely to fail a class in advance so that educational institutions (faculty members) can identify the students and motivate them by guiding them for certain subjects which student feel as difficult subject. It will improve students' performance. Discovered knowledge in Educational data analytics can be used to identify which courses are preferred by the students, enrollment of the students for particular course. Educational institutions (Educationist) top management must get better at data collection, record-keeping, analysis, and reporting. Data analytics help in each of these areas. Education system can concentrate upon curriculum restructuring, paper pattern, internal examinations for improvement in final examination. It will help the students to get better job opportunities in different sectors. Digital systems in education enable real-time assessment and more effective systems for mining information. This increases learning, transparency, and accountability, and makes it easier to evaluate trends in educational institutions, universities.

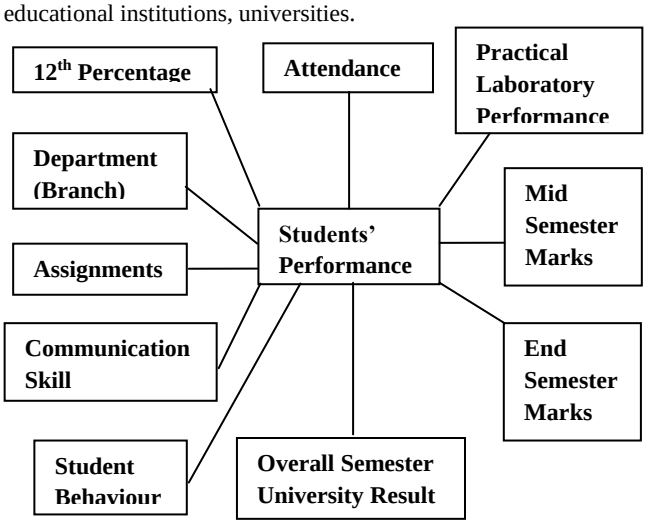

Fig3: Parameters considered for Students' Performance

Performance systems will contribute to informed decision-making. It will allow administrators to identify trends, find out problem areas, and direct resources in an efficient manner. Digital technologies are helpful in terms of overall performance, also improving the learning process. Bringing teachers into the discussion is crucial because they are the ones, along with parents and students, who will benefit from advances in research and analysis.

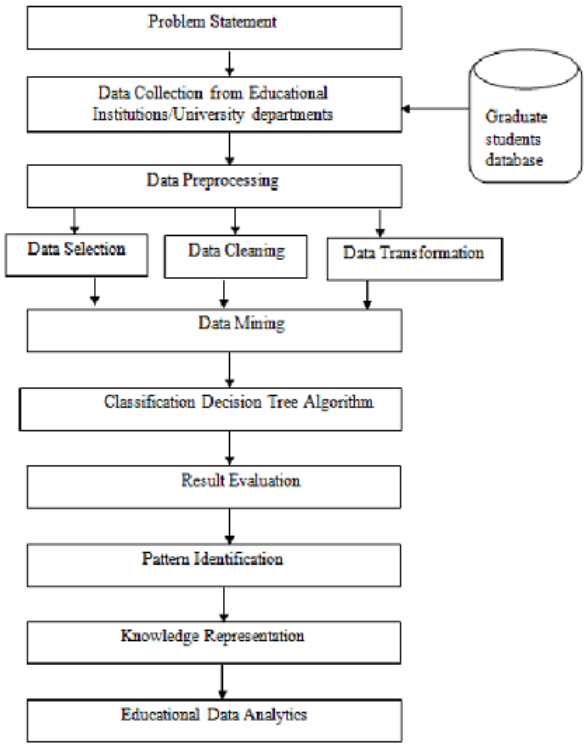

Fig4: Work Flow Methodologies

5. TOOLSOF DATACOLLECTION&ANALYSIS

In order to build an efficient decision support system, there must be combined several techniques and methods that can improve the performance and the accuracy of the analysis from two major perspectives: knowledge base data and future forecasts. This requirement can be obtained by combining data mining and business intelligence tools for analyzing and reporting purposes for more accuracy in the future forecasting. Various tools are needed for that project some foranalyzing data,some for designing, implementation and some developing software tools such as SPSS, MATLAB, WEKA, Tangara, KNIME, Rapid Miner, R, Orange, WEB MINER, MYSQL, Excel, Ms Access etc.

6. CONCLUSION

The current education system does not involve any prediction about failor pass percentage based on the performance.The system doesn't deal with dropouts.There is no efficient method to caution the student about the deficiency in attendance. It doesn't identify the weak student and inform the teacher in early stage. Another common problem in larger colleges and universities, some students may fee llost in the crowd. Whether they're struggling to find help with course work, or having difficulty choosing the courses they need. Many students are fearful by the task of working through the collegiate administration. Since the proposed model will identify the weak students, the teachers can provide academic help for them. It will also help the teacher to act before a student drops or plan for recourse allocation with confidence gained from knowing how many students are likely to pass or fail.

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