A REVIEW OF UNSUPERVISED LEARNING METHODS IN ATTAINMENT OF PO'S AND CO'S WITH REFERENCE TO OUTCOME BASED EVALUATION

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Abstract:
This article presents analysis of research evidences on Outcome Based Evaluation System using Unsupervised Learning Methods. The objective of this review is to study the different automated systems used for attainment of PO's and CO's with reference to Outcome Based Evaluation by identifying the techniques adopted by Teachers for mapping of PO's and CO's. The outcome based evaluation mainly depends upon the usage of different taxonomies for formulating PO's and CO's. The current attainment systems of PO's and CO's mainly include different automated systems which range from desktop applications to Machine Learning Algorithms. This article mainly highlights the research gap to identify the scope of unsupervised learning methods.

Keywords*: Outcome Based Evaluation(OBE), Program Outcome(PO's), Course Outcome(CO's), Evaluation, Attainment, Unsupervised Learning, Outcome Based, Machine Learning*

I. INTRODUCTION:

As the growing need for quality education institutions are adopting Outcome Based Evaluation (OBE). Outcome Based Evaluation (OBE) has been one of the most important tools in education in recent years and for the last few years; Indian education system has already adopted Outcome Based Education (OBE).

Today, everyone is aware of 'what is OBE in education?' and what importance it holds. Outcome-Based Evaluation (OBE) is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve stated objectives and outcomes.

India has started implementing OBE in higher technical education like diploma and undergraduate programmes. The National Board of Accreditation (NBA) a body for promoting international quality standards for technical education in India and NAAC has started accrediting only the programmes running with OBE from 2013.

Outcome Based Evaluation is becoming important tool, it covers Program Outcome (PO), Course Outcome (CO) and also mapping and attainment of PO's and CO's. As NAAC and NBA given importance to Outcome Based Education it's become mandatory to Universities and institutes the setting of PO's and CO's for every course. And there must be a documented process in place to measure the attainment of defined POs and the defined Cos. Most of the Universies are using Bloom's Taxonomy as standard taxonomy for formulating PO's and CO's and different automated tools, systems are also used for attainment of PO's and CO's.

Each subject has Course outcomes (COs). CO's can be mapped with PO's based on Intended Learning Outcomes and Performance Indicators given. COs can be assessed using Direct assessment tools that reflect the knowledge level and skills of the students based on their performance in Continuous Assessment Test, Assignments, Tutorials, Concept Test, Rubrics etc. Direct assessment is taken to attain individual Course Outcomes (COs). In direct method once the overall attainment percentage of each COs is calculated, the PO attainment is calculated by taking the cumulative average of the entire course's CO attainment which contributes to the specific Program

Outcomes. In Indirect method information about student learning is gathered from survey report considering the indicators of learning. So if CO-PO attainment process is considered then the unsupervised learning method like clustering is very appropriate to categories students based on CO-PO mapping outcomes. Hence This paper is to take a review to study that any researcher has used unsupervised learning method like clustering in CO-PO attainment with reference to Outcome Based Evaluation or not.

II. LITERATURE REVIEW:

Neeta Deshpande, Rahul Pawar (2017):

In their research paper entitled "Attainment of Course Outcomes: - A Sample Empirical Case Study for incorporating Outcome based education" an empirical method was proposed to find the correlation between the course outcomes and the program outcomes. Three direct attainment methods and two indirect attainment methods were developed to find the overall attainment of the course.

Through the three direct methods researchers have considered University, Unit test, practical results and Question paper following levels of Blooms taxonomy for attainment. For Indirect method they have considered course exit survey form and Seminar/ Workshop survey forms for attainment. They have taken average of direct and indirect methods through they got expected result. Hence not just direct method but indirect method should also require to be considered for CO-PO attainment.

VA Kulkarni, B. B. Ahuja, MR. Dhanvijay:

In their research paper named "CO-PO Mapping and Attainment Booklet for Tier-II students with Rubrics Assessment" they have developed a case study for Second Year Engineering students and designed booklet having Rubrics Assessment. For attainment, students were asked to submit the completed booklet as mini project as part of term work and oral submission.

Through the study they suggested that,

1) More emphasis has to be given for inculcating originality habits amongst the students, involvement of students along with completed for sake of compulsion.

2) Students have well taken concept of CO-PO mapping and attainment booklet, as gap filling strategy between curriculum and actual field expectations.

3) Extent of completion of booklet and use of key points, facts and data are notable encouraging responses from students. This also indicates applicability of Outcome Based Education (OBE) as students are welcoming any extra efforts for achievement of desirable outcomes.

Devasis Pradhan:

The research paper named "Effectiveness of Outcome Based Education (OBE) toward Empowering the Students Performance in an Engineering Course" researcher has focused on importance of OBE and introducing key standards of implementation. It then proceeds with defining what effects are and discusses how the definition of consequences demands paradigm shift in evaluation and evaluation practices. Also it will give detailed idea regarding attainment of outcomes i.e. attainment of PO's and CO's. Researchers have noted some difficulties in implementing OBE like unclear and ambiguous setting of sure results.

At the end researchers have proposed some traits and ideas for Implementation of successful OBE in Engineering Programme like truly described 'go out outcomes' to clear the curriculum framework an collaborative attempt from administrators, educators, teachers and students should guarantee a success in making plans and implementation and to assure dedication and decrease resistance

Glendell R. Jadraque, Allemar Jhone P. Delima, Ramcis N. Vilchez:

Through the research paper named "Algorithmic Analytics for Outcomes-based Tertiary Education Performance Assessment". The study aims to identify the probability of the student to pass practical evaluation following OBE methodology, using selected WEKA-based classifiers, namely Naive Bayes, C4.5, and Random Forest.

The researchers have taken a review of Educational Data Mining(EDM) and some classifier techniques like Naïve Bayes, C4.5, Random Forest. For predicting the student's performance, they have carried out some tests and noted the findings that most algorithm that gave a highly satisfactory result is the Random Forest with an accuracy of 95.99% — followed by C4.5 with an accuracy result of 93.07% — and Naive Bayes with an accuracy result of 78.1%. So Random Forest is most accurate method of classification.

Ritika Saxena:

The research paper named "Educational Data Mining: Performance Evaluation of Decision Tree and Clustering Techniques Using WEKA Platform" researchers has used two Data Mining techniques i.e. Clustering and Decision Tree in order to understand Student's Performance. Researcher has evaluated the performance of the clustering, decision trees algorithm after performing both the techniques concluded that decision tree using J48 algorithm is more efficient than clustering k-means technique.

Francis Ofori, Dr. Elizaphan Maina & Dr. Rhoda Gitonga:

Through the research paper titled "Using Machine Learning Algorithms to Predict Students' Performance and Improve Learning Outcome" researchers have taken empirical review indicated contentious results on machine learning model that best predicts students' performance. Researcher concluded that the predictive model will help teacher to find out students with poor internal assessment marks so that teachers may take some extra efforts to improve student's performance in final examination. But for better learning outcome predictive model should be designed by considering the attainment of PO's to CO's.

Buenaño-Fernández, Gil and Luján-Mora (2019):

Through the research paper i.e. "Application of machine learning in predicting performance for computer engineering students" the research showed the effectiveness of machine learning techniques to predict the performance of students. Nevertheless, several studies related to the prediction of academic performance. The study focused in predicting students without suggesting how to improve model.

Further, they have shown how machine learning has been used to improve learning outcome presenting conceptual gap. Moreover, the study only suggested that decision trees methodology is the best model to predict students' performance, whereas empirical literature presents conflicting results on which machine model is most accurate in predicting students' performance.

Hussain, Muhsin, Salal, Theodorou, Kurtoğlu and Hazarika (2019):

Researchers have undertaken a study on prediction model on student performance based on internal assessment using Artificial Neural Network. The highest classification accuracy achieved in this study was 95.34% produced by Artificial Neural Network . The Precision, Recall, F Score, Accuracy, and Kappa Statistics Performance were calculated as a statistical decision to find the best classification methods. Artificial Neural Network has been largely employed in predicting students' performance. The Use of Artificial Neural Network in improving learning outcome has not been explored presenting a conceptual gap. Conflicting empirical results on which machine model is most accurate in predicting students' performance is evident and comparative study using various machine models is required.

Obsie and Adem (2018):

Researchers have conducted a study on prediction of student academic performance using Neural Network (NN), Linear Regression (LR) and Support Vector Regression (SVR). All the experiments gave valid results and can be used to predict graduation CGPA the study has used the models from SVR and LR methods for designing an application to do the prediction task. The various machine learning models have not been employed to improve learning outcome presenting conceptual gap. Moreover, conflicting results on model that accurately best predicts students' performance is evident as highlighted by empirical results in this paper

Rajalaxmi, Natesan, Krishnamoorthy and Ponni (2019):

Researchers have undertaken a study on regression model for predicting engineering students' academic performance through the research paper published in International Journal of Recent Technology and Engineering (IJRTE). Based on the proposed study, the questionnaire was prepared to gather information from the students. The input data on student performance in academics was collected from students of 150 undergraduate engineering disciplines. The results showed that the regression model gives the better accuracy in prediction. The study failed to show whether regression model can be used to improve learning outcome.

Vinod and Bhatt (2019):

Through the research paper titled "Investigated performance prediction for post graduate students using Artificial Neural Network" researchers have presented a comprehensive study on predicting student performance in R Programming for postgraduate students using deep l earning (which is a small part of the artificial neural network).

Based on the prediction accuracy, it can be stated in this paper that Artificial Neural Networks exhibit more consistent behaviour and illustrate better classification outcomes than other traditional classifiers.

Agrawal and Vishwakarma and Sharma (2017):
Conducted a study; using data mining classifier for predicting student's performance in UG level. The performance of students is evaluated using our distinct classifiers named as decision tree, random forest, Naive Bayes and rule induction. These analysed results are explicitly used to predict the upcoming grades of the students and the relevant features (like access to the Internet, study time, etc.) which affect the academic performance of the students.

Sandesh Dandin, Rohan Jinde, Naresh Kamble:
Through the research paper titled "An Attainment Tool for measuring Course Outcomes and Program Outcomes" researchers have proposed one computerized method of CO PO attainment through spread sheet. The method uses data that has been obtained from student's marks in final theory and practical exams. The findings of analytical process are used for continuous evaluation process.

III. RESEARCH ANALYSIS:
After studying the Literature Review research gap has been analysed this is as follows:
1. Most of the researchers have proposed CO-PO attainment techniques for faculty of Engineering only.
2. Most of the researchers have used Data Mining tools to test students' performance
3. Few researchers have used Machine learning and AI techniques (mainly ANN) for predicting Students' performance
4. No researcher has used unsupervised learning method for outcome based evaluation.
5. No researcher has designed an automated system for CO PO attainment.
6. Most of the time researchers have not used any standard Taxonomy for formulating PO's and CO's

IV. CONCLUSION
The main objective of this review is to evaluate the value of Outcome Based Evaluation and the role of attainment of PO's and CO's in the Outcome Based Evaluation. This review emphasized the importance of formulating the syllabus in such a way as to develop a platform for student learning outcomes. The review focused on the fact that OBE shows positive effects towards improving learning outcomes. Also a gap has been found, one of the significant findings of the literature is the identification of the issues in formulating PO's and CO's that, no standard methodologies used to formulate PO's and CO's. The current study will be helpful for Educational reforming bodies, teachers, students, as well as the community. This study would become a guiding tool for educationalists to implement the OBE. The review can also be useful for checking whether NAAC and NBA defined Higher Educational goals are accomplished or not.

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