

FACULTY PERFORMANCE EVALUATION AND DATA MINING*

BY

Preeti Jain*

Research Scholar, MSIT, MATS University, Raipur Chhattisgarh India
preeti.jain3077@gmail.com

Dr. Gyanesh Srivastav*

Research Supervisor, MSIT, MATS University, Raipur Chhattisgarh India
gyaneshnkshrivastava@gmail.com

Dr. Umesh Kumar Pandey*

Co-Research Supervisor, United College of Engineering and Research, Prayagraj Uttar Pradesh India
umesh6326@gmail.com

Abstract—Data mining proved worth in every domain of subject. This research paper explores data mining exposure in the field of faculty performance evaluation. Most organizations fail to develop any data collection mechanism about the faculty performance, and those who have a mechanism to collect data never study that data in a broader aspect. In the digital age, data mining will use for the study of faculty performance. The research paper discusses various faculty performance indicators, which include the evaluation parameter. Faculty score is the summation of all evaluation parameters considered by the institute administrator. The research paper argues about supervised or unsupervised learning in the context of faculty performance evaluation.

Keywords— Faculty Performance, supervised learning, unsupervised learning

Received 06Apr 2021, Accepted 27Apr 2021, Published 15May 2021

* Correspondence Author: Dr. Gyanesh Srivastav

Introduction

Educational data mining usage is applied to study the hidden information from academic domain data. Educational data mining makes it dimension using learning analytics, artificial intelligence, database management, psychometrics, data science, statistics. An EDM is a field of interdisciplinary research used to understand intrinsic knowledge of educational domain data. Association, clustering, classification neural network, regression commonly use methods/algorithms to interpret the data. All methods/algorithm falls in two categories supervised and unsupervised. Supervised learning studies include those methods/algorithms in which class is well known. Unsupervised learning studies include a method/algorithm in which groups make using distance-

based fuzzy membership.

The formal performance evaluation process of a faculty in higher education is always a wild goose chase. Evaluation parameters use to encourage, motivate, and reduce the bullying experience at the workplace. Every organization realizes the need for an evaluation process but establishing any system is difficult because of various parameters. Globally, Government and society expect teaching faculty at higher education to engage in real-life problem-solving teaching.

The present research work focuses on developing evaluation methods identified for faculty performance and how does data mining utilize for better decision making.

Literature Review

Hassna et al. [7] assessed that Qatar's universities and colleges have three primary appraisal systems: Teaching, Scholarly endeavor, and Service to the university/College. For achieving the desired excellence, all components should have harmony. They have developed the Structural Equation Model approach for finding the relationship between these three components. They see the significant result between Teaching and Service and no academic endeavor support with either teaching or service performance [15][16][18].

The OECD, 2009 [17] study report said that appraisal and feedback increase job satisfaction and a lesser degree of teacher's job security. Also, it is fair and useful to teacher development. Moreover, the teacher reports that appraisal and feedback have contributed to their development as teachers suggest that such systems contribute to school improvement. According to teachers' reports of their impact, strengthening teacher appraisal and feedback can develop schools' teaching skills.

Numerous initiatives developed by policymakers aiming to lift school improvement have had teacher development at the core [14].

Teachers' feedback on their performance helps them better shape and improve their teaching practice and support effective school leadership to develop schools as professional learning communities. Simultaneously, teachers should be accountable for their performance and progress based on demonstrated effective teaching practice.[17]

Developing a comprehensive approach may be costly but is critical to conciliate the demands for educational quality, the enhancement of teaching practices through professional development, and the recognition of teacher knowledge, skills, and competencies.

Teachers are critical to raising education standards, so teachers are considered a significant resource in the educational environment. Improvement of school efficiency and equity depends, in no small measure, on ensuring that teachers are highly skilled, well resourced, and motivated to perform at their best. Raising teaching performance is perhaps the policy direction most likely to lead to substantial student learning gains [14].

School evaluation and teacher appraisal and feedback systems aim to maintain standards and improve student performance. There are likely to be significant benefits from the synergies between

school evaluation and teacher evaluation. School evaluation focus should either be linked to or affect teacher evaluation priority to achieve the most significant impact [16].

By contrast, teachers and their unions expect social recognition of their work and opportunities for professional growth by developing a formative system of teacher evaluation [6].

In their research, Avalos and Assael [6] grouped teacher's responsibilities into four significant areas – Planning and Preparation, Classroom Environment, Instruction, and Professional Responsibilities. Each of these components consists of several elements to evaluate. The proposed framework influenced a large number of teacher evaluation systems around the world. For instance, Chiles's four domains and twenty criteria of assessment were inspired mainly by the framework.

Anup K Ghosh et al. [3] proposed a model and a flexible demonstration compared to other models. It grabs the decision maker's confusion and minimizes the vagueness in human (expert) decision-making. The imprecision of human judgment nullified using linguistic variables. All the feedback took to keep the view of an optimistic, most likely, and pessimistic decision-making environment. The model presented in this work is also taking care of crisp inputs for evaluating faculty performance and fuzzy criteria weights to make the overall performance evaluation more realistic. This method applies to measure faculty performance in the different fields of education with greater efficiency. Further, the use of software makes the data collection more manageable and more comfortable, but the outputs error-free and easy to interpret.

Akbar Jesarati et al. [2] used a descriptive survey and multistage sampling method for data collection and applied it to four randomly selected faculty of the Islamic Azad University of Tabriz. They identified the order of faculty performance evaluation factors.

Gorji and Siyami [28] opined that faculty and evaluation criteria' performance has a healthy relationship.

Rajabi and Popzan's [29] research suggests integrating qualitative and quantitative design tools for faculty performance evaluation.

Malekashahi et al. [30] study identified that majority of responses favored workshops.

Sivasankari S et al. [25] proposed semantic web architecture for online feedback systems and report generation using the automatic process. The advantage of the system highlighted was the removal of manual effort, easy management.

Sampson J P et al. [8] work clarified the elements responsible for faculty performance success. Along with this, they opined that faculty vision must be clear for successful faculty performance.

Las Johansen B Caluza et al. [9] recommended giving attention to professionalism, subject knowledge, commitment, and teaching for independent learning.

Jyoti G et al. [11] work uses a fuzzy expert system to assess faculty performance. They opined that an expert system is suitable for doing quantitative and qualitative facts about the faculty. The fuzzy

expert system model converts the qualitative value into a numeric value. Evaluation of qualitative and quantitative data encourages satisfaction, quality, and efficiency among the faculty members.

Mustafa A. [12] discussed instructor performance prediction. Priyanka R Shah et al. [20] discussed the use of distributed data mining to predict faculty.

Moghtodia Leila et al. [10] discussed performance study according to higher education faculty's talent management approach.

R K Banu et al. [21] discussed using the NLP approach to assess the faculty's success pattern.

Rand kh Hemaïd et al. [22] and Thy Van et al. [26] used a data mining approach to improve the faculty.

Ajay Kumar Patel et al. [1], Archana Bhardwaj et al. [4], Asanbe M O et al. [5], Nirmala G et al. [13], Priti Ughade et al. [19] and Renuka Agrawal et al. [23] also discussed faculty performance evaluation using data mining.

Parameter for Faculty evaluation

From the discussion presented in the literature review, regulation 2018 of UGC [27] and AICTE regulation 2019 following parameter must study while evaluating the performance of a faculty:

- **Teaching:** Teaching is one of the primary responsibilities of the faculty serving in any institution. Especially for the self-financed, students are the financial backbone. Evaluation of the teaching process is very complicated. UGC regulation discusses a ratio that represents classes taken out of allotted classes. However, the teaching evaluation literature includes delivery effectiveness, effective mentoring, academic advising, enhanced teaching service. Still, it is infeasible in many ways. Class counting is a simple task, but other measures evaluation is stringent.
- **A feedback system** could be one of the solutions to cope up with this problem. Feedback questions must be prepared with consultation of the academic's laureates so that respondents never become bias while providing their responses.
- **Research and Publication:** Research and publication are the expected responsibility of any higher education teaching faculty, irrespective of a research degree. The research publication process must exclude Supervision of the research scholar number completed, submitted, and continuing. Research and book publishing is an individual's effort for knowledge up-grading, whereas scholarly research supervision is not the faculty's direct effort. Thus, research and book publication use for faculty performance. Research book publication must classify into various tiers, i.e., international, national reputation, and allocate its weight.
- **Service:** Wisdom, knowledge, and information; all three words are distinct. An individual becomes wise as time elapses, but it is not valid in all respect. If a person is not in active participation in any activity, this could leave the individual's negative growth performance. So active service is one of the critical parameters for faculty evaluation.

- **Belongingness to the institution:** The institution always looks for faculties active participation. Thus, belongingness is an essential parameter for faculty evaluation. Sidika Gizir [24] studied a hypothetical model to understand students' belongingness and four other factors. Other studies also did in various domains. Faculty belongingness factors needed to explore.
- **ICT Mediated teaching-learning:** Traditional teaching-learning activities include chalk and board, limited educational on-field activity, and a resource for visualizing any scenario. ICT mediated teaching learning brings the opportunity of virtualization. The virtual world has the opportunity to grow in diverse ways, and because of this, education has become everyone's doorstep. ICT also visualizes n-dimensional complex architecture to express knowledge. ICT also changed the teaching pedagogy. Today we hear about blended learning, flipped classroom, personalized learning, game-based learning. ICT efficient faculty will increase effective knowledge communication and adopt modern high-tech teaching pedagogy.
- **Projects and Policy Documents:** Higher education teaching staff relates knowledge with current human life problems. It is a general perception that laureates will study this problem and identify the best possible solution. The Government also expects the same from them. Through project work and policy documents, the researcher explores issues and suggests possible solutions. All policy documents and projects are high-level knowledge presentations of teaching faculty.
- **Reach out of the institution:** Higher education faculty have depth in their field of knowledge. So, faculty responsibility is to share their experience, familiarity with the community. This knowledge is attained from his/her teaching ability improvement, research work, creative work, and/out campus service. Thus, reach out activity becomes another essential parameter to evaluate faculty performance.
- **Other:** Nowadays, various social platforms try to connect faculty and provide their research publication effectiveness. Some parameters are H index, i10, journals impact factor. These factors use for evaluating faculty performance.

Problem formulation

Teaching, research, publication, service, belongingness, ICT mediated education, project, and policy documents, reaching out of the institution, refer to a group. The teaching group will include various teaching evaluation methodology, i.e., student feedback, peer review, refer to evaluation parameters. Conceptual framework for the problem presented in figure 1:

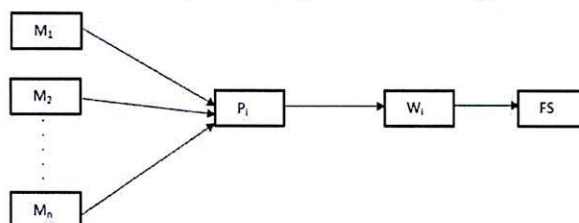


Fig1: conceptual framework for faculty score computation

P_i represent evaluation category. Getting a value for evaluation category depends on value obtained in the method of evaluation. Only one method could lead biasness, so multiple methods must used for each evaluation category. In figure 1, M_1, M_2, \dots, M_n represent method of evaluation for any parameter. Value for each evaluation category is obtained using equation:

$$P_i = \text{Average}(M_j)$$

All M_j must be on same scale. All evaluation category is not equally important for faculty performance. Second fact is that few categories is completely dependent of faculties individual effort of performance. This two fact motivates for weight of each category group, so respective weight must be assigned to any category. In figure 1, W_i represent the weight of the i^{th} evaluation category. Thus, mathematically faculty score computed as:

$$\text{faculty score} = \sum_{i=1}^n \beta_i P_i$$

Where

β_i refers to the weight of that evaluation parameter.

P_i refers to the score obtained in the respective evaluation parameter.

i refer i^{th} the evaluation parameter.

Supervised and unsupervised learning

Grouping data into the absolute number of groups is possible in two ways, i.e., unsupervised (clustering) or supervised (classification) learning. Supervised learning requires a well-defined class label and range of values utilized for mapping into the respective class. The limitation of supervised learning is that levels of each group defined before being mapped. Defining each group's levels needs well-proven research or a researcher's biased level because of researchers' perception and belief. Secondly, some levels never mapped with any data because no data qualify for mapping to that class. On the other side, unsupervised learning groups data into a pre-decided number of groups. Since no pre-defined level is needed, unsupervised learning preferred in the scenario where the level of any group is not available or the scenario in which the researcher group data into a specific group. Unsupervised learning is beneficial because each group has a few numbers.

Effectiveness of the supervised learning algorithm tested using confusion matrix and particular statistical function, i.e., precision, recall, f score. Unsupervised learning effectiveness measured using various cluster validation indexes, i.e., partition entropy, silhouette index.

Grouping faculty

Faculty score is the summation of various evaluation parameter scores. Faculties may score in all evaluation parameters or any combination of all evaluation parameters. Thus, defining the lower or higher value of faculty score is impossible. Specifying the range for supervised learning may cause problems in skewed classification.

Unsupervised learning prefers over supervised learning when the range of the group is not known. Thus, unsupervised learning is best for grouping of faculty score. The advantage is that data will be grouped into a pre-defined cluster when the data is distinct from the group. Secondly, faculty score will never skew to any class.

Conclusion

Faculty performance measurement is challenging for any institution. Modeling evaluation parameter in mathematical form gives only a glimpse of faculty effectiveness.

Discussion in this paper identifies various faculty performance measurement group, which represents the evaluation parameter. Weights to the evaluation parameter give importance to any evaluation parameter. Weight values need to be set by the institution administrator so that faculties motivate to increase their overall score by increasing specific evaluation parameters. The unsupervised learning method implements the faculties' collected scores to group them into a pre-specified number of groups. Administrative decision-makers utilize these groups to either incentivize the best group or identify, support, and motivate the lagging faculties.

References

- [1] Ajay Kumar Pal, Saurabh Pal (2013), "Evaluation of Teacher's Performance: A Data Mining Approach," A Monthly Journal of Computer Science and Information Technology ISSN 2320088X, IJCSMC, Vol. 2, Issue. 12th December 2013, pg.359 – 369.
- [2] Akbar Jesarati, Nasser Rahmat, Salar Ghanbari Erdi, Hossein Babazadeh, Yosef Hajnazary and Asgar Jesarati, An investigation of performance evaluation index from the perspective of Islamic Azad University of Tabriz faculty members in 2012, Euro. J. Exp. Bio., 2013, 3(4):165-172
- [3] Anup K Ghosh, Debmallya Chatterjee, Biswarup Ghosh, A conceptual framework of faculty performance evaluation, Asian Journal of Management Research, ISSN 2229-3795, pp. 217-229.
- [4] Archana Bhardwaj], Mamta Bhusry, "Two Approach Comparisons for Relative Evaluation of Faculty Performance Using Data Mining Techniques," IEEE, 978-1-4799-3064- 7/14/\$31. 00©2014.
- [5] Asanbe M.O., Osofisan A.O., William W.F., "Teachers' Performance Evaluation in Higher Educational Institution using Data Mining Technique," International Journal of Applied Information Systems (IJ AIS) – ISSN: 2249-0868 Foundation of Computer Science FCS, New York, USA Volume 10 – No.7, March 2016 – www.ijais.org.
- [6] Avalos, B. and J. Assael (2006), "Moving from resistance to agreement: The case of the Chilean teacher performance evaluation," International Journal of Educational Research, Vol. 45, No. 4-5, pp. 254-266.

- [7] Hassna L O, Raza S, "An assessment of the relationship between the faculty performance in teaching," scholarly endeResearch in Higher Education Journalavor, and service at Qatar University, pp. 1-18.
- [8] James P. Sampson, Jr., Marcy P. Driscoll, David F. Foulk, and Pamela S. Carroll, Successful Faculty Performance in Teaching, Research and Original Creative Work, and Service, Florida State University 2010 pp 1-17
- [9] Las Johansen B. Caluza, Devine Grace D. Function, Rommel L. Verrecio Jeffrey C. Cinco, Lowell A. Quisumbing, Mark Lester Laurente, Micheline A. Gotardo, Faculty Performance Evaluation in A Philippine University Information Technology Program, IOSR Journal Of Humanities And Social Science (IOSR-JHSS) Volume 22, Issue 9, Ver. 8 (September. 2017) P.P. 28-36 e-ISSN: 2279-0837, p-ISSN: 2279-0845. www.iosrjournals.org DOI: 10.9790/0837-2209082836 www.iosrjournals.org pp 28-36
- [10] Moghtadia Leila and Taji M., "Study of the Performance of Faculty Members According to Talent Management Approach in Higher Education," Academic Journals Vol 11(8) pp 781-790, 23rd April 2016 ISSN 1990-38
- [11] Ms. G. Jyothi, Mrs. Ch. Parvathi, Mr. P. Srinivas, and Mr. Sk. Althaf Rahaman Fuzzy Expert Model for Evaluation of Faculty Performance in Technical Educational Institutions, Journal of Engineering Research and Applications www.ijera.com ISSN: 2248-9622, Vol. 4, Issue 5(Version 7), May 2014, pp.41-50
- [12] Mustafa Agaoglu, "Predicting Instructor Performance Using Data Mining Techniques in Higher Education," Digital Object Identifier 10.1109/IEEE ACCESS.2016.2568756.
- [13] Nirmala G, P.B. Mallikarjuna," Faculty Performance Evaluation Using Data Mining "International Journal of Advanced Research in Computer Science & Technology (IJARCSST 2014), ISSN: 2347 - 8446 (Online) ISSN: 2347 - 9817 (Print) Vol. 2, Issue 3 (July - Sept. 2014).
- [14] OECD (2005), Teachers Matter: Attracting, Developing, and Retaining Effective Teachers, OECD, Paris.
- [15] OECD (2009a), OECD Review on Evaluation and Assessment for Improving School Outcomes: Design and Implementation Plan for the Review, OECD, Paris [OLIS Document EDU/EDPC(2009)3/REV1].
- [16] OECD (2009b), Creating Effective Teaching and Learning Environments: First Results from TALIS, OECD, Paris.
- [17] OECD 2009, Creating Effective Teaching and Learning Environments: First Results from TALIS, School Evaluation, Teacher Appraisal, and Feedback and the Impact on Schools and Teachers,– ISBN 978-92-64-05605-3, pp 138-139
- [18] OECD Review on Evaluation and Assessment Frameworks for Improving School Outcomes, Teacher Evaluation A Conceptual Framework and examples of Country Practices, December 2009, pp 1-37

- [19] Priti Ughade, S.W.Mohod," A Survey on "Analysis of Faculty Performance Using Data and Opinion Mining," International Journal of Innovative Research in Computer and Communication Engineering, ISO 3297: 2007, Vol. 4, Issue 1, January 2016.
- [20] Priyanka R shah, Dinesh B Vaghela, Priyanka Sharma," Predicting and analyzing faculty performance using distributed data mining," International journal of emerging technologies and applications in engineering, technology, and sciences, ISSN: 0974-3588, December 2014.
- [21] R K Banu and R Ravanam," A Competency Framework Model to Assess Success Pattern for Indian Faculties A NLP Based Data Mining Approach," Journal of Scientific and Industrial Research, Vol 75,November 2016, pp. 662-666.
- [22] Randa Kh. Hemaïd, 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.
- [23] Renuka Agrawal, Jyoti Singh, A.S. Zadgoankar," Formative Assessment for Performance Evaluation of Faculty using Data Mining", proceedings of IRF international conference, 31st July, 2016, Ernakulam, india, isbn: 978-93-86083-78-4.
- [24] Sıdıka Gizir, "The Sense of Classroom Belonging Among Pre-Service Teachers: Testing a Theoretical Model", European Journal of Educational Research 8(1):87-97 ISSN: 2165-8714. DOI: 10.12973/eu-jer.8.1.87
- [25] Sivasankari.S, Srimathi. P.S, Ramya.S, Dr.G.Fathima, Online Feedback System for Educational Institutions for Better Evaluation of Faculty's Performance Using Semantic Web (S.W.) Technology International Journal of Innovative Research in Science, Engineering and Technology An ISO 3297: 2007 Certified Organization Volume 5, Special Issue 2, March 2016 ISSN (Online): 2319 - 8753 ISSN (Print): 2347 – 6710
- [26] Thuy-Van T.Duong, Thuc-Doan Do, Ngoc-Phien Nguyen," Exploiting Faculty Evaluation Forms to Improve Teaching Quality: An Analytical Review," Science and Information Conference 2015, July 28-30, 2015 | London, UK.
- [27] UGC Regulation 2018: https://www.ugc.ac.in/pdfnews/4033931_UGC-Regulation_min_Qualification_Jul2018.pdf
- [28] Gorji, M and S. Siyami, Journal of Knowledge Management. 2007, 5 , 11
- [29] Rajabi, S. and A. Pop Zan, Journal of Higher Education, 2010, 3, 1.
- [30] Malekshahi, F. Sheikh. Ali and MJ Tarrahi, J of Nursing Research. 2010, 5,19.