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Outcome-Based Education: A Case Study on Course Outcomes, Program Outcomes and Attainment for Big data Analytics Course

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Abstract: The key aspect of Outcome-Based Education (OBE) is an assessment of learning outcomes. OBE assessment of the outcomes of the course is the most critical feature required to improve the quality of education. Learning outcomes are concrete, formal statements that state what students are expected to learn in a course. Program Outcomes (POs) are the knowledge, skills, and attitudes that students should have at the end of the course. POs can be measured through Course Outcomes (COs) which are broad statements indicating knowledge, skills acquired at the end of the course. The results of each course are based on COs and POs. An innovative method is needed for assessing the COs and POs. This paper details the CO-PO matrix analysis and CO-PO attainment analysis for Big data analytics course. This study aims to give an effective strategy for evaluating COs and POs, beginning with the formulation of COs using Bloom's Taxonomy. In this methodology by using the students' performance in internal assessment, end exam, assignments, and course exit feedback; calculate the attainment of the course. The proposed method assists in the creation of effective lesson plans, high-quality question papers, and effective rubrics for course evaluation. The outcome-based approach necessitates a paradigm shift in the curriculum process and how the learner is empowered to achieve outcomes.

Keywords: Attainment, Course Outcomes, Outcome Based Education, Program Outcomes, Program Evaluation, Student Evaluation.

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1. Introduction

With the tremendous growth in education providers, the need for quality assurance becomes essential. Outcome-based education (OBE) has become one of the main concerns of major academic institutions in the world. The OBE is an instructional method focused on the effort to obtain concrete outcomes in terms of individual learning for students [03]. Any graduate student is required to have such attributes before and after completion of the program and is referred to as POs, sometimes referred to as Graduate Attributes [04]. Nowadays provided the big growth for education providers, quality of education is essential. The gap is observed between academia and industry, current education goal is to reduce the gap between academia and industry, they provide industry-ready engineers. It is very necessary to change the old traditional method to the new outcome-based education system. A shift from the teacher-centered education system to a student-centered education system [01]. Accreditation is the formal recognition by an external body of the educational program based on a quality assessment. It is a quality assurance and improvement process in which a program within an institution is critically examined to ensure that the institution or program continues to

meet and surpass the appropriate designated agency's norms and criteria [02]. The program for the graduate students is planned for students who are taught basic courses that prepare them to take advanced courses in the curriculum in the form of electives or advanced courses. As a result, the course outcomes for each essential course are emphasized. Following that, the course outcomes must correspond to the program outcomes [05]. The basic terms to be understood in the analysis of program outcomes attainment by the students undergoing the various courses include graduate attributes, program outcomes, course outcomes, rubrics, criteria, etc. An initial database of the student's marks is tabulated using various measuring tools like tests, quizzes, seminars, etc [07]. The method of evaluation using the marks scored by the students or by using rubrics is explained in detail in this paper. The organization of this paper, section 2 explains the OBE and accreditation, section 3 explains the related work of outcome-based education, section 4 elaborates the assesment methodology, section 5 elaborates the results and discussions, section 6 explains the conclusion.

2.Outcome-based Education(obe)& Accreditation

The outcomes are specified in terms of individual student learning. OBE is an instructional approach that focuses on what students can do after they have been trained, or on the attributes that they should develop. OBE involves the reorganization of curricula, assessment methodologies, and more practical-based laboratories are in education to gain the achievement of advanced learning and expert in subjects rather than the increase of course credits. The advanced curriculum is used to achieve certain qualities or capabilities. Outcome-based education (OBE) is an educational philosophy that focuses on results for any aspect of the educational program. Each student should have achieved the target by the end of his/her education. There are no particular teaching methodologies or assessment methods in OBE; the courses, quizzes, assignments, and tests will all help students to achieve the particular outcomes [06]. The faculty adapts to the desired outcomes as a teacher, trainer, facilitator, and mentor. Equipment of students with 21st-century attitudes and skills, i.e. UG engineering students need to take even more responsibility for their self-learning than is currently the case. Lifelong learning, communication skills, working in communities, in addition to domain-specific information are important learning outcomes [07].

An assessment process in which the authoritative committee (accrediting body) reviews the training program to ensure that it meets the minimum requirements set by accreditation body and industry experts. Accreditation is often a statement of compliance with minimum requirements. Students with an approved undergraduate degree from one country may / should receive better recognition in another country than students with an unaccredited undergraduate program [08]. The Washington Agreement is an international union between the bodies responsible for accreditation in their signatory countries and regions for the accreditation of graduate degrees in technical engineering. " The Washington Accord Signatory is formed in 1989, Australia, Canada, New Zealand, Pakistan, Russia, Singapore, South Africa, Peru, Philippines, China, Hong Kong, Malaysia, Sri Lanka, Taiwan, Turkey, United Kingdom, India, Ireland, Japan, Korea, and the United States are the full signatories as of 2018. The countries with their representation and year of approved by Washington Accord Signatory: United States - Accreditation Board for Engineering and Technology (1989), United Kingdom – Engineering Council UK (1989), Australia - Engineers Australia (1989), Ireland - Engineers Ireland (1989), Canada - Engineers Canada (1989), New Zealand - Institution of Professional Engineers NZ (1989), Hong Kong China - The Hong Kong Institution of Engineers (1995), South Africa - Engineering Council of South Africa (1999), Japan - Japan Accreditation Board for Engineering Education (2005), Singapore - Institution of Engineers Singapore (2006), Chinese Taipei - Institute of Engineering Education Taiwan (2007), Korea - Accreditation Board for Engineering Education of Korea (2007), Malaysia - Board of Engineers Malaysia (2009), Turkey – MUDEK (2011), Russia - Association for Engineering Education of Russia (2012), India - National Board of Accreditation (2014), Sri Lanka - Institution of Engineers Sri Lanka (2014) [09]".

3. Related Work

Science and technology have prompted many pedagogical strategies to emerge that have gained influence in almost all educational systems. Portions of the syllabus require a rethink for every academic program against the backdrop of changes taking place both within society and at the level of Information gained in related areas. However, one reason to support OBE is that we cannot avoid the Global standardization, classification, and ranking strategies

[11]. Implementation of Outcome-Based Education has been a key focus of academic institutions. Accreditation is a quality assurance and improvement mechanism whereby an organization-based system is objectively reviewed to ensure that the entity or system continues to meet and surpass the requirements and expectations established by the relevant appointed authorities [12]. The assessment of the course outcomes (COs) is the most prominent aspect needed in Outcome-Based Education (OBE) to enhance the quality of education [13]. Accreditation is a variant of outcome-based education, because of increasingly demanding jobs, qualities such as expertise, abilities, beliefs, and attitude must be given due importance [14]. Outcome-Based Education (OBE) has been one of the major concerns of most academic institutions in Malaysia, particularly among engineering departments since the Engineering Accreditation Council (EAC) made it mandatory to accredit the program. However, different interpretations of the principle of OBE resulted in the different achievements of the program outcome (PO) depending on the course outcome (CO). The aim of introducing OBE is to ensure that the curriculum design fulfills the goal of the program and the educational program objectives, which represents the accomplishment of the mission and vision of the institution/university [15]. The basic words to be grasped by the students attending the different courses in evaluating program results include program educational objectives, program outcomes, course outcomes, rubrics, other requirements, etc [16]. The challenge in implementation is to define appropriate COs that map outcomes of the program and instructions for planning that help students demonstrate learning. Measuring achievement is much more complicated and redefines as it requires more time [17]. Educators should understand the OBE system for the successful implementation of OBE. The traditional approaches should not all of a sudden be thrown away but should be used as a means to implement OBE. Educators should alter or develop the way they teach and accessing jobs for the learner [18]. Currently, OBE is deployed in various forms with varied interpretation styles, which is not at all in line with the expectations. Consequently, it is recommended to obey the recommendations as suggested by the auditors to develop a sound curriculum that meets the program's expectations [19]. Implementation at the higher education level is recorded and accreditation and regulatory purposes with academic programs. Over the years, there has been much talk about the goal of achieving each policy as a result of the inadequate implementation, with the introduction of new educational policies [20]. In a discussion, the findings show how reflective journals could be used as a learning tool, and as a means of measuring teacher preparation through the Outcome Based Education system [21]. Action research plays an important role in teacher's professional development as it is linked to practical knowledge research and shows that improving education means analysing and changing on the individual as well as on the group side [22].

4. Assesment Methodology

The process of assessment involves both direct and indirect methods; Fig. 1 shows the total process including assessment methods, mapping, CO attainment, PO attainment.

a. Course Outcomes

A Course Outcome (CO) is a tangible, observable, and precise statement that clearly shows what students should think, and what they can do by learning. Course Outcomes are statements that specifically explain the important, tangible, and measurable knowledge, skills, and/or arrangements students will acquire during this course. To gain the graduate qualities of accreditation, all of the course outcomes in a four-year engineering program are mapped to program outcomes. Big data Analytics is the examine the bulk amount of data [23]. The course outcomes for big data analytics are given in Table 1, these outcomes of this course are attained at the end of this course.

Table 1 : List Of Course Outcomes Of Big Data Analytics Course

COs	Course Outcomes
CO1	Master the HDFS(Hadoop distributed File System) and Map Reduce framework concepts
CO2	Investigate Big Data Analytics tools relevant to Hadoop, and conduct simple Hadoop administration
CO3	Recognize the role that business intelligence, data storage, and visualization play in decision making
CO4	Learn how important core data mining techniques are for data analysis
CO5	Compare and contrast various text mining techniques, SVM (Support Vector Machines), and web mining

b. Program Outcome's (PO's)

The graduate attributes (GA) adopted by signatories of the Washington Accord apply to all streams of engineering education. Classify the graduates should learn, the skills they should exhibit, and their attitudes. The graduate attributes have been developed in 2013; all the signatories adopted them as the standard against which to determine significant equivalence of their accreditation criteria. Graduate attributes are called Program Outcomes (POs).

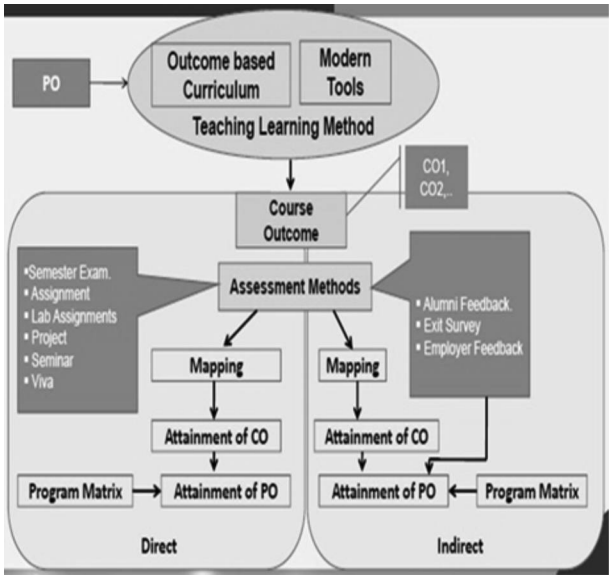

Fig. 1 : Process of Direct and Indirect Attainment Process [10]

c. Mapping of COs to Pos

Mapping of course outcomes to program outcomes shown in table 2, mapping of big data analytics course outcomes to all domain-dependent (PO1to PO5) and domain-independent (PO6 to PO12) program outcomes.

d. Assessment and Attainment Process

Assessment is conducted by one or more processes of outcome-based education, implemented by the institution/university; define, collect, and prepare data to determine the outcome of course achievement. There are two types of approaches used for evaluation, i. Direct Assessment Methods, ii. Indirect Assessment Methods. In table 3 shows the parameters used for direct and indirect assessment.

A rubric is a sort of scoring guide that tests and articulates specific components and aspirations for an assignment, Internal Assessment, University/End exams, Quiz, Projects, etc. Based on the rubrics only evaluate the direct assessment and indirect assessment.

To measure the achievement of the course outcomes, it is suitable to determine the target value of the marks indicating that the COs has been accomplished. If the set goals are achieved, all of the course outcomes are fulfilled, and the level of achievement is calculated.

Table 2 : List Of Mapping Of Course Outcomes To Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	Domain dependent Pos					Domain independent Pos						
CO1	3	2	3	2	2			1				2
CO2	2	2	3	2	3			1				1
CO3	3	2	2	2				1				2
CO4	2	2	3	2	2			1				1
CO5	3	2	3	2	3			1				1
AVG	2.6	2	2.8	2	2			1				1.4
High(H) -3, Medium(M)-2, Low(L)-1												

Table 3 : Illustrates The Direct And Indirect Assessments Considered For A Course

Direct Assessment Methods	Internal Assessment
	Semester End Examinations/University Exams
	Assignments
	Quiz
	Project/Mini projects
	Practical Semester Examination
Indirect Assessment Methods	Course Exit Feedback

Table 4 : List Of Attainment Levels For An Internal Assessment

Assessment outcome	Attainment Level
If 70% achieved	3
60 – 69%	2
50 – 59%	1
Less than 50%	0

Table 5 : Target Achieved For An Internal Assessment

Total # of students	36
70% of the students score 70% of the maximum marks (14 out of 20)	34
% of students who scored this target	94
Remarks	Target Achieved
Attainment Level	3

Table 6 : Target set and attainment levels for direct attainment

COs	Set Target	Attainment Level
CO1	60%	>=60 If achieved – 3 55 – 59 % - 2 50 – 54 % - 1 Less than 50% - 0
CO2	60%	
CO3	60%	
CO4	60%	
CO5	60%	

e. Course Target Set for Internal Assessment(IA)

For Final IA, Set a target of -70% of the students to score 70% of the maximum marks (14 out of 20). Table 4 indicates the final IA assessment outcome and attainment levels (Scale of 3). Here considering the 70% target, selecting the target is dependent on the instructors and department advisory board.

As per the set of attainment levels for final IA, table 5 shows the Big data analytics course has 34 students (Total of 36 students) who achieved the attainment level 3, 94% of students have achieved the target.

For Direct Attainment (DA) we are considering 20% internal assessments (including assignment and Quiz, etc) + 80% University/end exams. For total attainment considering 80% direct attainment and 20% indirect attainment. For Indirect attainment considering the course exit survey. Here for considering 80% direct attainment and 20% indirect attainment is based on the department advisory board instructions.

Total Attainment = 80% Direct Attainment (DA) + 20% Indirect Attainment (IDA)

The same target is identified for all the CO's of a course. Based on the instructor and department advisory board suggestions, different targets were also identified for CO's. For example – the target can be 60% of the maximum marks to be scored, table 6 shows for the direct attainment, considering students marks in Internal assessment and University/end exams as criteria (In a scale of 3) if >=60% is considered as 3, < 60 and > 55 considered as 2, <55 and > 50 considered as 1, if it is < 50 considered as zero.

For direct attainment, table 7 shows the direct attainment of all the students, here we are considering the 80% of University/end exam result and 20% of internal assessments including assignment and quiz, the reason for selecting this is internal assessments is evaluated for fewer marks and university/end exams are evaluated for more marks. It shows the individual student performance in percentage; at the end, each CO has an average value of all students, for DA CO1-66.80, CO2-65.08, CO3-68.10, CO4-68.30, and CO5-67.15.

For IDA (Indirect Attainment), table 8 indicates the set target for CO and attainment levels, considering

course exit feedback with questionnaires, it includes a set of questions related to course outcomes and based on the students understanding they gave the feedback to that particular course, and set attainment levels, based on the students feedback based on each CO, calculate the percentages for each CO per individual student. Table 9 shows the indirect attainment (IDA) of the individual students.

f. Calculation of Final Attainment (80% DA+ 20% IDA)

To calculate the final attainment considering 80% of direct attainment and 20% of indirect attainment, values obtained are final attainment values for the individual student and individual CO. Table 10 shows the students with final attainment values of COs in the scale of 3, at the end consider the average of all the students, it's the final attainment value for each CO, Average of all COs becomes the Course attainment value, this value is used for calculation of Pos.

Considering student 17 in table 10 for CO1, he got 57% for DA in table 7 in terms of percentage, it is converted to in scale of 3 based on the attainment levels of DA in table 6 this 57% becomes a 2(two), IDA for CO1 is 100% in table 9, this 100% for CO1 is converted to scale of 3, it becomes 3 (three) based the attainment of IDA in table 8. To calculate the final attainment of CO1 for student 17, considering the 80% DA and 20% IDA; For DA 100% value for CO1 is 2, but consider 80% it becomes 1.6; For IDA 100% value for CO1 is 3, but consider 20% it becomes 0.6; for final attainment considering 80% DA and 20% IDA: 1.6+0.6=2.2, 2.2 is the final attainment value for CO1 for Student17 from Table 10.

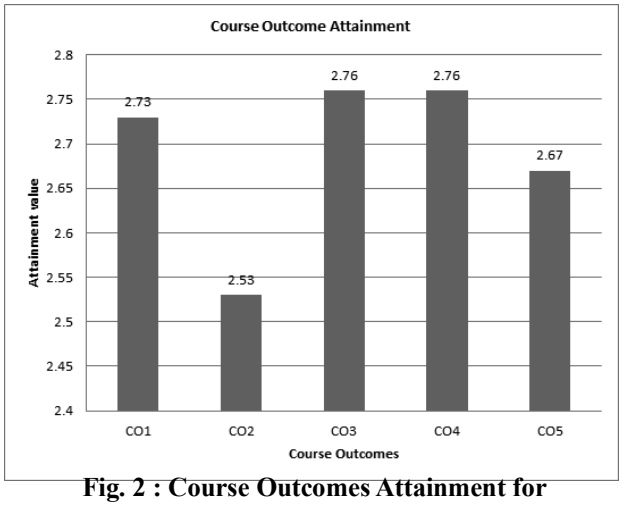

Fig. 2 : Course Outcomes Attainment for Big data analytics course

Course outcome attainment for all COs is shown in figure 2, CO3 and CO4 have maximum attainment, CO2 has less attainment on the scale of 3.

Table 7 : List Of Students With Obtained Direct Attainment (in Percentage) of Individual Course Outcomes

Sl. #	Student	CO1	CO2	CO3	CO4	CO5
1	Student1	72.30	72.30	78.24	74.79	81.00
2	Student2	61.00	61.00	63.62	60.71	63.18
3	Student3	69.39	71.13	69.71	72.00	72.00
4	Student4	68.00	58.91	65.93	65.14	68.00
5	Student5	77.47	75.12	81.00	78.24	77.36
6	Student6	78.00	74.36	77.31	78.00	78.00
7	Student7	66.00	58.73	63.24	61.86	66.00
8	Student8	71.00	69.55	74.31	75.71	71.36
9	Student9	76.00	72.36	76.00	76.00	76.00
10	Student10	70.00	78.00	76.62	78.71	78.00
11	Student11	60.24	57.12	59.00	58.86	61.18
12	Student12	56.00	48.73	55.31	55.31	54.18
13	Student13	63.00	63.00	61.62	60.24	59.36
14	Student14	45.78	46.29	47.00	51.71	45.55
15	Student15	74.00	68.55	73.31	72.26	74.00
16	Student16	64.00	64.00	71.31	72.00	72.00
17	Student17	57.00	57.00	57.00	54.24	55.18
18	Student18	85.00	85.00	85.00	85.00	85.00
19	Student19	69.55	73.00	71.62	73.71	69.36
20	Student20	71.00	67.36	70.31	71.00	67.36
21	Student21	70.00	68.55	73.31	74.00	70.36
22	Student22	68.52	71.13	71.31	77.00	64.00
23	Student23	53.00	47.91	53.55	54.86	53.36
24	Student24	46.04	49.36	53.00	48.86	49.36
25	Student25	63.00	59.73	61.78	64.86	59.00
26	Student26	58.78	59.29	64.00	61.24	60.36
27	Student27	65.00	59.55	64.31	65.00	65.00
28	Student28	66.00	66.00	65.31	66.00	64.18
29	Student29	88.00	84.36	87.43	85.39	88.00
30	Student30	72.39	73.62	75.00	75.00	75.00
31	Student31	56.39	54.65	58.31	64.00	51.00
32	Student32	68.00	64.36	66.62	66.62	66.18
33	Student33	74.00	65.27	78.00	78.00	78.00
34	Student34	71.00	71.00	71.00	70.31	69.18
35	Student35	66.00	62.36	63.93	64.26	66.00
36	Student36	64.00	64.36	67.31	68.00	64.36
Average		**66.80**	**65.08**	**68.10**	**68.30**	**67.15**

Table 8 : Target Set And Attainment Levels For Indirect Attainment

COs	Set Target	Attainment Level
CO1	80%	>= 80, If achieved – 3 75 – 79 % - 2 70 – 74 % - 1 Less than 70% - 0
CO2	80%	
CO3	80%	
CO4	80%	
CO5	80%	

Table 9 : List Of Students With Obtained Indirect Attainment (ida, In Percentage) of The Individual Cos

Sl. #	Student	CO1	CO2	CO3	CO4	CO5
1	Student1	100	80	80	100	80
2	Student2	100	80	100	100	80
3	Student3	100	80	80	100	100
4	Student4	80	100	80	100	80
5	Student5	80	100	100	80	100
6	Student6	80	100	80	100	80
7	Student7	100	80	80	100	100
8	Student8	100	80	80	100	100
9	Student9	80	80	100	80	80
10	Student10	100	80	100	80	100
11	Student11	80	80	100	100	100
12	Student12	100	80	80	100	80
13	Student13	100	80	80	100	100
14	Student14	100	80	80	100	80
15	Student15	100	80	100	100	80
16	Student16	100	80	80	100	100
17	Student17	100	80	80	100	80
18	Student18	100	80	100	100	80
19	Student19	100	80	80	100	80
20	Student20	100	100	100	100	100
21	Student21	100	100	80	80	100
22	Student22	80	80	100	80	100
23	Student23	100	100	80	100	80
24	Student24	100	100	80	100	100
25	Student25	80	100	80	80	100
26	Student26	100	100	80	100	80
27	Student27	100	80	80	100	80
28	Student28	100	80	80	100	80
29	Student29	100	80	100	100	80
30	Student30	100	100	80	80	100
31	Student31	80	100	100	80	80
32	Student32	80	100	80	100	80
33	Student33	100	80	80	100	80
34	Student34	80	80	100	80	100
35	Student35	100	80	100	100	80
36	Student36	100	100	80	80	100

5. Results And Discussion

a. Calculation of PO Attainment

PO attainment value = (Average of Corresponding cell value from Table x Overall CO attainment value for the course)/3

For PO1 = (2.6 *2.69)/3 = 2.33, attainment of PO1 is 2.33.

For PO8= (1*2.69) / 3 = 0.90, attainment of PO8 is 0.90.

Table 10 : List Of Students With Obtained Final Attainment (da+ida, Scale Of 3) of Individual Cos

Sl. #	Student	CO1	CO2	CO3	CO4	CO5
1	Student1	3.00	3.00	3.00	3.00	3.00
2	Student2	3.00	3.00	3.00	3.00	3.00
3	Student3	3.00	3.00	3.00	3.00	3.00
4	Student4	3.00	2.20	3.00	3.00	3.00
5	Student5	3.00	3.00	3.00	3.00	3.00
6	Student6	3.00	3.00	3.00	3.00	3.00
7	Student7	3.00	2.20	3.00	3.00	3.00
8	Student8	3.00	3.00	3.00	3.00	3.00
9	Student9	3.00	3.00	3.00	3.00	3.00
10	Student10	3.00	3.00	3.00	3.00	3.00
11	Student11	3.00	2.20	2.20	2.20	3.00
12	Student12	2.20	0.60	2.20	2.20	1.40
13	Student13	3.00	3.00	3.00	3.00	2.20
14	Student14	0.60	0.60	0.60	1.40	0.60
15	Student15	3.00	3.00	3.00	3.00	3.00
16	Student16	3.00	3.00	3.00	3.00	3.00
17	Student17	2.20	2.20	2.20	1.40	2.20
18	Student18	3.00	3.00	3.00	3.00	3.00
19	Student19	3.00	3.00	3.00	3.00	3.00
20	Student20	3.00	3.00	3.00	3.00	3.00
21	Student21	3.00	3.00	3.00	3.00	3.00
22	Student22	3.00	3.00	3.00	3.00	3.00
23	Student23	1.40	0.60	1.40	1.40	1.40
24	Student24	0.60	0.60	1.40	0.60	0.60
25	Student25	3.00	2.20	3.00	3.00	2.20
26	Student26	2.20	2.20	3.00	3.00	3.00
27	Student27	3.00	2.20	3.00	3.00	3.00
28	Student28	3.00	3.00	3.00	3.00	3.00
29	Student29	3.00	3.00	3.00	3.00	3.00
30	Student30	3.00	3.00	3.00	3.00	3.00
31	Student31	2.20	1.40	2.20	3.00	1.40
32	Student32	3.00	3.00	3.00	3.00	3.00
33	Student33	3.00	3.00	3.00	3.00	3.00
34	Student34	3.00	3.00	3.00	3.00	3.00
35	Student35	3.00	3.00	3.00	3.00	3.00
36	Student36	3.00	3.00	3.00	3.00	3.00
Average of Individual Cos		2.73	2.53	2.76	2.76	2.67
Average of all Cos		2.69 out of 3				

As per the course outcomes in table 1 and CO-PO matrix in table 2; calculate the course outcome attainment 2.69 (Scale of 3) and based on the course outcome attainment calculate the Pos for big data analytics course, PO attainment values are shown in table 11. For this course PO1, PO2, PO3, PO4, PO5, PO8, and PO12 are attained, big data analytics course all the students understand the engineering knowledge(po1), problem analysis(po2), development of solutions(po3), investigations of complex problems(po4), modern tool usage (po5), ethics (po8), lifelong learning (po12) are very well and based on the CO's mappings also; PO6, PO7, PO9, PO10, and PO11 are not attained because engineer and

society(po6), environment and sustainability (po7), individual and teamwork(po9), communication (po10), project management and finance (po11) are not much suitable to this course outcomes based on the mappings. After observing these attained values to improve the CO and PO attainment next subsequent year/semester change the teaching-learning methodologies. To adopt the innovative teaching methodologies like crossover learning, learning through argumentation, incidental learning, context-based learning, computational thinking, adaptive teaching and easily understood by the students.

Figure 3 shows the Pos on the X-axis and attainment value (scale of 3) on the Y-axis, PO3 has the highest 2.51 attainment, and PO8 has the least 0.90 attainments.

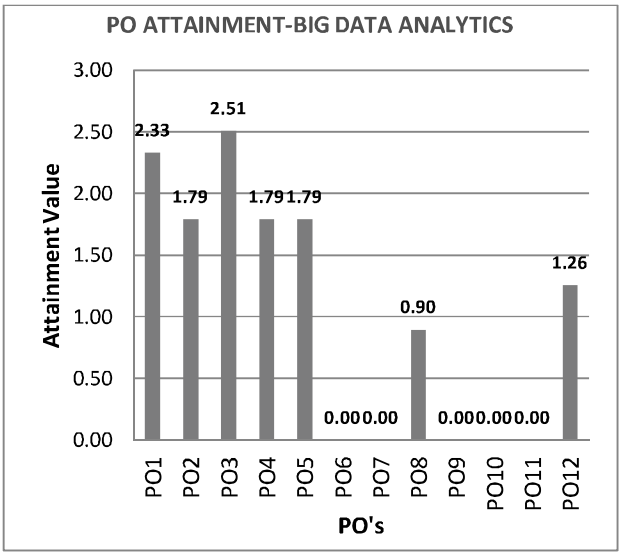

Fig. 3 : Program Outcome Attainment for Big data analytics

Table 11 : Average Co Attainment (scale Of 3) And Po Attainment (scale Of 3) For Big Data Analytics Course

Overall Average CO Attainment											
2.69											
Average CO-PO Matrix											
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
2.6	2	2.8	2	2			1				1.4
PO Attainment											
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
2.33	1.79	2.51	1.79	1.79			0.90				1.26

6. Conclusion

This paper discusses an efficient method for determining curriculum outcomes using Microsoft excel data. Curriculum, Assessment, and Evaluation are the major tools by which Program Outcomes are attained and this attainment is assessed by direct and indirect methods. The main contributing factor to indicate the performance of a program is the attainment of COs and Pos. If the attainment is satisfactory, the teaching-learning process is continued; otherwise, changes in the learning process may be required to improve the attainment. If the attainment is high, it is simple to raise the level of attainment by modifying the attainment formula. The evaluation of the results of the course involves the systematic collection of data and the use of student learning information for improvement purposes. Hence the simplified approach is proposed in this paper towards the attainment calculation in synchronization with framing COs, CO-PO Mapping with proper justifications. Analysis of these attainment values will help the course/program to implement innovative methodologies to improve the quality of the performance of students as a part of continuous improvement in the subsequent years. The institution should create a system that standardizes the CO-PO attainment process. The effectiveness of the OBE process can be traced back to the practice of the relevant academic members. Appropriate planning should undoubtedly result in a fruitful outcome in dealing with the accreditation body's additional requirements.

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