

Outcome Based Education (OBE)

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ABSTRACT

Outcome-Based Education (OBE) provides a structured approach to measuring student learning by aligning assessments with predefined Course Outcomes (COs) and Program Outcomes (POs). This project implements an automated OBE evaluation system that streamlines the process of collecting, analyzing, and mapping student performance data. Internal assessments, assignments, and end-semester examinations are systematically recorded in CO-mapped formats, with attainment levels calculated according to established benchmarks such as those recommended by the NBA. Direct attainment is derived from exam scores using weighted formulas, while indirect attainment is obtained from student feedback surveys, ensuring a comprehensive evaluation of learning effectiveness. The system also performs CO–PO mapping to determine the contribution of each course to program objectives, using numeric mapping strengths to compute overall PO attainment. By digitizing the OBE workflow, the project improves accuracy, transparency, and efficiency in academic performance measurement, enabling departments to continuously monitor and enhance curriculum delivery in line with outcome-based education principles.

INTRODUCTION

In contemporary higher education, the focus is shifting from traditional exam-centric evaluation to a student-centered approach that measures the actual achievement of learning outcomes. Traditional grading methods often fail to reveal whether students have truly acquired the competencies intended by the curriculum. Outcome-Based Education (OBE) addresses this issue by systematically tracking and analyzing how well students meet Course Outcomes (COs) and how these contribute to broader Program Outcomes (POs). This project implements an automated OBE system that enables faculty to assess, record, and analyze student performance across all types of assessments—including internal exams, assignments, and end-semester tests—using a structured, stepwise process. The system strengthens accountability, enhances transparency, and ensures that every department can align teaching and assessment with institutional goals for quality learning and accreditation standards.

Objective:

1. To design and implement a system that automates the mapping and analysis of student achievement against defined Course Outcomes (COs) for every subject in each department.
2. To provide a structured workflow for faculty to enter and process assessment data, including internal tests, assignments, and end-semester marks.
3. To calculate attainment levels using NBA guidelines, allowing for quantitative comparison and continuous improvement.
4. To combine direct and indirect assessment measures for holistic evaluation of student learning.
5. To generate a comprehensive CO–PO mapping and calculate Program Outcome (PO) attainment, supporting program accreditation and curriculum enhancement.
6. To ensure the process is scalable, transparent, and practical for use across varied academic disciplines and large student cohorts.

LITERATURE SURVEY

- **Early Approaches in Outcome-Based Education**
 - Initial OBE implementations focused on manual tracking and paper-based assessment of student outcomes within departments.

- Issues included complexity in managing large data, inconsistencies in attainment calculation, and limited usability for faculty and administration.
- **Modern Techniques in OBE Automation**
 - Digital systems now use automated CO attainment calculation by integrating internal assessments, assignments, and end-semester exams.
 - Weighted formulas and target benchmarks (e.g., NBA guidelines) standardize performance measurement across different courses and programs.
 - The inclusion of indirect assessments such as student feedback surveys further refines attainment analysis.
 - Dynamic CO–PO mapping aligns course-level outcomes with program goals, enabling comprehensive program evaluation.
- **Comparative Studies on OBE Effectiveness**
 - Research shows automated OBE frameworks improve transparency, consistency, and ease of data management compared to traditional methods.
 - Studies confirm that combining multiple assessment types provides a more accurate picture of student learning and program success.
- **Usability Challenges in OBE Systems**
 - Balancing detailed outcome analytics with user-friendly interfaces remains critical for adoption by faculty and departments.
 - Systems that simplify input processes and automate calculations promote wider usage and reduce errors.
- **Conclusion and Future Trends**
 - OBE systems are evolving to include AI-driven analytics, real-time performance dashboards, and predictive insights to further enhance curriculum design.
 - Future developments may integrate learning management systems (LMS) and institutional databases seamlessly for end-to-end educational quality assurance.

METHODOLOGY

The methodology for the Outcome-Based Education (OBE) system starts with analyzing academic needs and current assessment practices to establish requirements for automated and accurate outcome evaluation. A structured design is developed to incorporate internal exams, assignments, and end-semester results linked to Course Outcomes (COs) and Program Outcomes (POs). The system includes faculty input interfaces, automated attainment calculations following NBA guidelines, and integration of direct and indirect assessments. The prototype is implemented using web or software tools to enable dynamic data entry, real-time calculations, and detailed reporting of CO attainment and CO–PO mappings. The system is tested for accuracy, usability, and scalability, with user feedback guiding improvements. Finally, optimizations are made to enhance performance, usability, and accreditation compliance, with future plans to integrate learning management systems and advanced analytics.

Existing system:

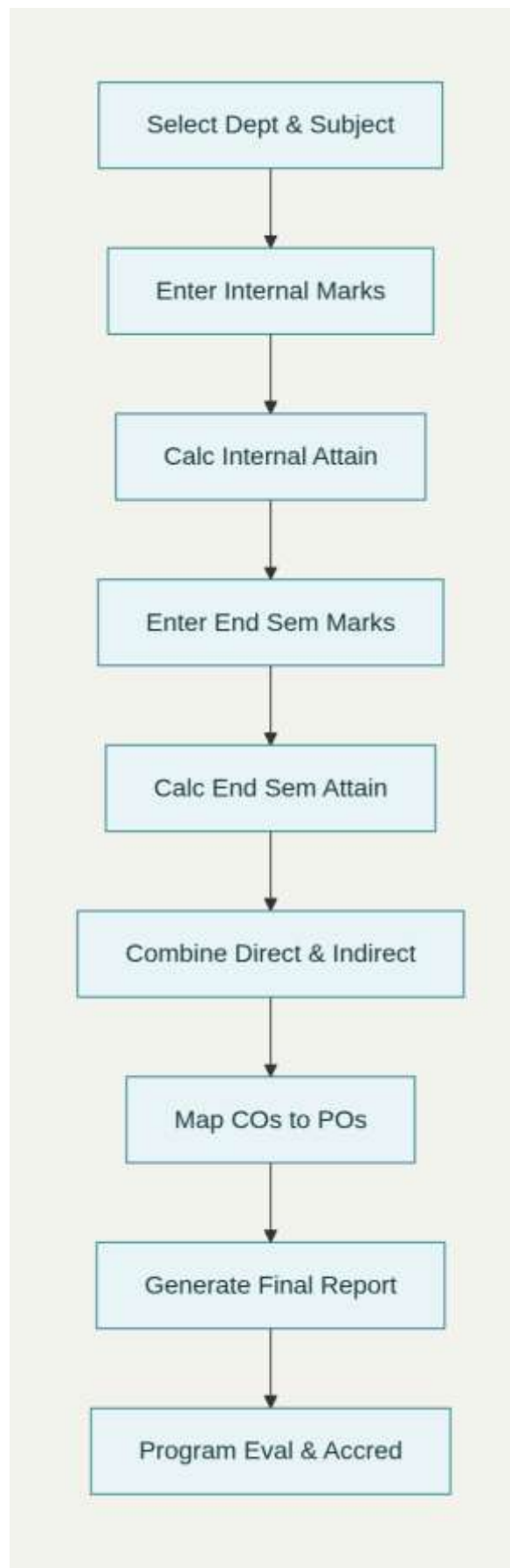
In existing Outcome-Based Education (OBE) systems, evaluation is often manual or semi-automated, with faculty entering marks and calculating attainment separately. Many institutions rely on spreadsheets or standalone applications, which can lead to inconsistent data handling and errors. While some automated tools exist, they often lack full integration across internal assessments, assignments, and end-semester exams, limiting comprehensive outcome analysis. Additionally, most systems do not seamlessly link Course Outcomes (COs) to Program Outcomes (POs), reducing their effectiveness for program-level evaluation and accreditation.

Disadvantages

1. Prone to errors and inconsistencies due to manual data entry and separate tools.
2. Limited automation prevents efficient handling of large student cohorts across multiple courses.
3. Incomplete integration between different assessment types hampers holistic attainment calculation.
4. Lack of dynamic CO–PO mapping reduces the ability to analyze program outcomes effectively.
5. User interfaces in existing systems may be complex, impacting faculty engagement and usability.

Proposed system:

The proposed system automates Outcome-Based Education (OBE) by integrating internal assessments, assignments, and end-semester exams into a unified platform that calculates Course Outcome (CO) attainment automatically. It features dynamic CO–PO mapping to link course achievements with broader program goals, aiding accreditation and quality assurance. The system prioritizes usability with intuitive data entry interfaces for faculty and real-time performance reporting. It incorporates standard benchmarks and weighted calculations based on NBA guidelines to ensure consistent evaluation. Additionally, the system supports scalability across departments and courses, includes error-checking to improve data accuracy, and offers detailed analytics for continuous curriculum improvement, aligning academic goals with measurable outcomes.



SYSTEM REQUIREMENTS

1. Hardware Requirements

- **Processor:** Intel i3 or higher
- **RAM:** 4 GB minimum
- **Storage:** 100 MB free space
- **Display:** Monitor with minimum resolution 1024×768
- **Input Devices:** Mouse, Keyboard, or Touchscreen

2. Software Requirements

- **Operating System:** Windows 10/11, Linux, or macOS
- **Development Framework:** MERN stack (MongoDB, Express.js, React.js, Node.js)
- **Database:** MongoDB (preferred for MERN), or alternatives like MySQL
- **Browser:** Latest versions of Chrome, Firefox, Edge (for web deployment)

Module Description

1. Department & Subject Selection Module

- Staff selects the department and subject from dropdown menus.
 - Displays the **Course Outcome (CO) based question paper analysis table**.
 - Facilitates mapping of Internal Assessment Tests (IATs) to COs (e.g., IAT-1 → CO1 & CO2, IAT-2 → CO3 & CO4, IAT-3 → CO5).
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2. Student Information & Mark Entry Module

- Captures student details such as **Register Number, Name, Course Code, Subject Name, Academic Year, Semester, and IAT number**.
 - Provides an **Excel-like sheet** for entering marks.
 - Columns include **PT-1, Assignment-1**, further split into CO-based sub-columns (e.g., C103.1, C103.2, Total).
 - Calculates total marks automatically from staff inputs.
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3. Internal Assessment Attainment Module

- Performs CO-wise attainment calculation for each internal exam.
 - Uses benchmark (commonly **60% of maximum marks**) to set a **Target Score**.
 - Counts students who score \geq Target Score using **COUNTIF-based logic**.
 - Calculates Attainment % = $(\text{Students Attained} \div \text{Total Students}) \times 100$.
 - Maps results to NBA Attainment Levels:
 - $\geq 70\%$ → Level 3
 - 60–69% → Level 2
 - 50–59% → Level 1
 - $< 50\%$ → Level 0
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4. End Semester Attainment Module

- Staff enters End Semester exam marks mapped to multiple COs (C103.1 ... C103.6).
 - Calculates total score out of 100.
 - Applies target benchmark (e.g., 60/100) and measures attainment percentage.
 - Maps attainment to corresponding NBA Level (0–3).
-

5. Final Attainment Module

- Consolidates results from **IATs, Assignments, and End Semester** exams.
- Uses weightage formula:

$$\text{Direct Attainment} = (\text{IAT} \times 0.2) + (\text{Assignment} \times 0.2) + (\text{EndSem} \times 0.6)$$

- Includes **Indirect Attainment** from student feedback (20%).
- Calculates **Final Attainment** as:

$$\text{Final} = (\text{Direct} \times 0.8) + (\text{Indirect} \times 0.2)$$

6. CO-PO Mapping Module

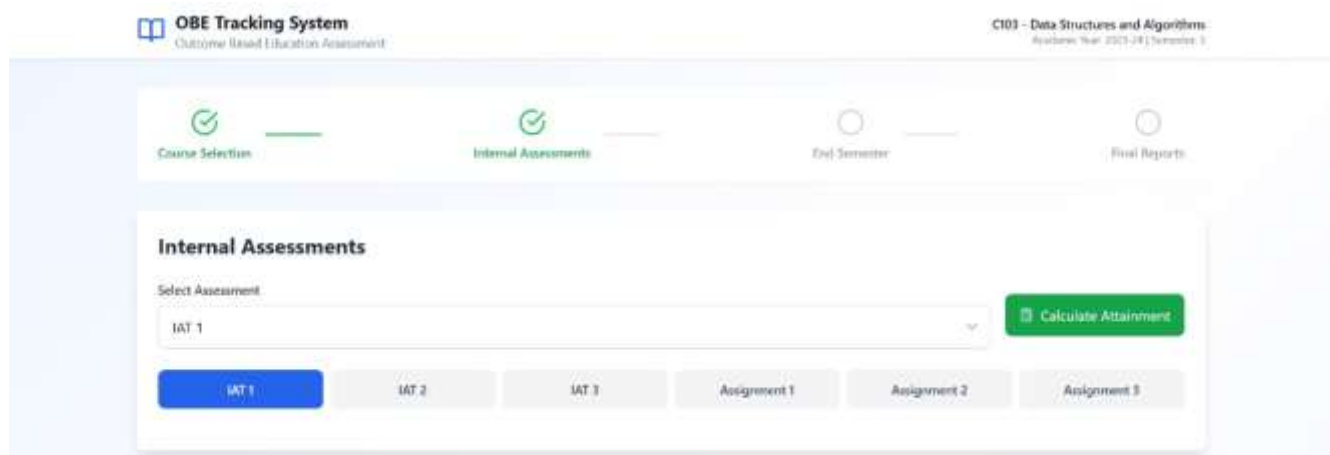
- Maps each **Course Outcome (CO)** with respective **Program Outcomes (POs)**.
- Assigns mapping strength:
 - 1 → Low
 - 2 → Medium
 - 3 → High
- Calculates **PO Attainment** using:

$$\text{PO Attainment} = (\sum \text{CO Attainment} \times \text{Mapping Value}) \div (\sum \text{Mapping Values})$$

- Ensures alignment of Course Outcomes with Program Outcomes and Educational Objectives.

MAINPAGE:

Page 1:



The screenshot displays the 'OBE Tracking System' interface. At the top, there's a header with the system name and a course identifier 'C103 - Data Structures and Algorithms'. Below the header, there are four tabs: 'Course Selection', 'Internal Assessments', 'End Semester', and 'Final Reports'. The 'Internal Assessments' tab is currently active. Within this tab, there's a section titled 'Internal Assessments' containing a 'Select Assessment' dropdown menu. The dropdown is set to 'IAT 1'. To the right of the dropdown is a green button labeled 'Calculate Attainment'. Below the dropdown, there are six buttons: 'IAT 1' (highlighted in blue), 'IAT 2', 'IAT 3', 'Assignment 1', 'Assignment 2', and 'Assignment 3'.

Page 2:

Program Outcome Attainment		
PROGRAM OUTCOME	ATTAINMENT (%)	LEVEL
PO1	0.0	Level 0
PO2	0.0	Level 0
PO3	0.0	Level 0
PO4	0.0	Level 0
PO5	0.0	Level 0
PO6	0.0	Level 0
PO7	0.0	Level 0
PO8	0.0	Level 0
PO9	0.0	Level 0
PO10	0.0	Level 0
PO11	0.0	Level 0
PO12	0.0	Level 0

Page 3:

OBE Tracking System

Outcome Based Education Assessment

C103 - Data Structures and Algorithms

Academic Year: 2023-24 | Semester

Course Selection

Internal Assessments

End Semester

Final Reports

Final Attainment Reports

C103 - Data Structures and Algorithms

Export PDF

Export Excel

Course Outcome Final Attainment

CO	AT (%)	ASSIGNMENT (%)	END SEM (%)	DIRECT (80%)	INDIRECT (20%)	FINAL (%)	LEVEL
C103.1	30.0	0.0	0.0	6.0	70.0	18.8	Level 0
C103.2	30.0	0.0	0.0	6.0	70.0	18.8	Level 0
C103.3	30.0	0.0	0.0	6.0	70.0	18.8	Level 0
C103.4	30.0	0.0	0.0	6.0	70.0	18.8	Level 0
C103.5	30.0	0.0	0.0	6.0	70.0	18.8	Level 0
C103.6	30.0	0.0	0.0	6.0	70.0	18.8	Level 0

CONCLUSION

In conclusion, the development of the **Outcome Based Education (OBE) Project** provides an effective framework to evaluate and improve student learning outcomes. By systematically linking assessments, course outcomes (COs), and program outcomes (POs), the system ensures that teaching and evaluation processes are transparent, measurable, and goal-oriented. The project enhances **academic quality** by allowing staff to analyze question papers, internal assessments, and end-semester results through data-driven methods. The automatic calculation of attainment levels helps identify students' strengths and areas for improvement, enabling continuous enhancement in teaching methodologies. Furthermore, the **CO-PO Mapping** ensures that each course contributes directly to the overall program objectives, aligning the curriculum with institutional and accreditation standards such as NBA. The integration of direct and indirect attainments also provides a balanced view of student performance, combining exam results with feedback-based insights. Overall, this project contributes to **improving educational transparency, accountability, and effectiveness**. It supports institutions in implementing a structured, measurable, and outcome-focused approach that promotes continuous improvement in both student performance and program delivery.

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