

Institutionalizing Outcome Based Education and Facilitating Accreditation through IonCUDOS[®]

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ABSTRACT

India produces more than a million engineering graduates per year. Although this is a large number, the real question is whether these graduates are employable. To address issues of employability, relevance and quality of engineering education, several engineering institutions in India have embarked upon the process of Accreditation and have started adopting an Outcome Based Education (OBE) philosophy. OBE is a process which involves alignment between learning outcomes, curriculum, instruction and assessment. The end goal of the OBE process is to ensure quality of engineering education as per global standards. Engineering institutions that adopt an OBE framework can ensure that they are offering global quality standards of the engineering profession and thus get accredited. In this paper, we highlight an innovative software platform, IonCUDOS[®] that facilitates the process of OBE and Accreditation. In particular, we present the salient characteristics of IonCUDOS[®] that helps institutions to achieve OBE and Accreditation in an effective and efficient manner. Finally, we end with a discussion on how IonCUDOS[®] has been a trusted partner to Institutions, enabling them to meet their goal of providing a quality education to all students.

Keywords: Outcome Based Education, Accreditation, IonCUDOS[®], Engineering Education.

INTRODUCTION

National Board of Accreditation (NBA), India became the permanent signatory member of the Washington Accord on 13th June 2014 and laid down a set of specific guidelines for the institutes in India to achieve OBE. This involves framing cohesive Program Education Objectives (PEOs), Program Outcomes (POs), Course Outcomes (COs), and ensuring assessment and attainment of these outcomes [1], [2]. Institutions adopting and implementing OBE through manual processes typically face the following challenges:

1. Involving all the faculties in appropriate roles
2. Faculty time and resources involved in documentation
3. Non-uniform process practiced in establishing curricula and calculation of attainments at various outcome levels
4. Inadequacy of mapping between CO and PO

- 5. Overwhelming volume of data across batches
- 6. Complex data analysis to isolate problem areas

An innovative software platform, IonCUDOS® is designed to address all the above issues.

IonCUDOS®

Figure 1 shows the curriculum management system of IonCUDOS®. It mainly focuses on curriculum design enabling faculties to create appropriate lesson plan, frame COs and mapping COs to POs and frame question banks. The curriculum delivery and assessment methods followed by the institutions will be intact and the software platform is compatible with all the delivery and assessment methods followed by the institutions and generates reports for students' attainments, CO attainments, PO attainments and PEO.

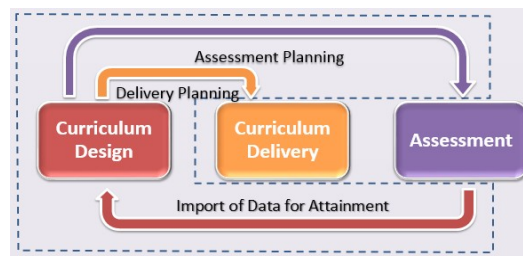


Fig. 1: Curriculum Management System

IonCUDOS® OBE platform helps institutionalizing OBE practices, achieving transparency, optimizing data inputs, standardizing computation of attainments, isolating areas for improvements, trends from large historical data from batches, and generating Self- Assessment Report (SAR) in a timely manner.

MAIN CHARACTERISTICS OF IONCUDOS®

OBE follows a continuous improvement model and IonCUDOS® is also built on this continuous improvement model as shown in Figure 2 below [3].

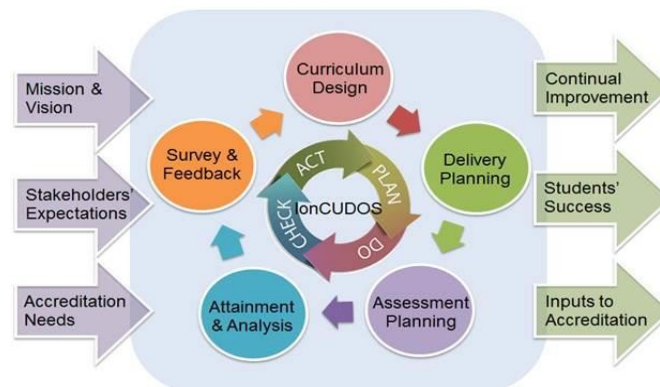


Fig. 2: Continuous Improvement Model

The inputs to the IonCUDOS[®] are the vision and mission of the institution along with the department, stakeholders' expectations and needs of accreditation. The outputs from IonCUDOS[®] platform are various attainment reports, students' success reports and performance indicators and exhaustive reports to the key sections of NBA SAR. The subsequent sections describe the main features of IonCUDOS[®].

Curriculum Design

The curriculum in IonCUDOS[®] is created by the Head of the Department (HOD) feeding PEOs, POs and mapping between PEOs and POs. Afterwards, faculties are allocated specific subjects. The faculties will then login and create a lesson plan and frame the course outcomes (COs) and perform the mappings to the program outcomes (POs), frame Topic Level Outcomes (TLOs) and map TLOs to COs, frame competencies and performance indicators.

Delivery Planning

Faculties while framing COs specify the delivery method used to deliver each CO to the students and also specify the appropriate Bloom's level [4] for that particular CO. This process helps to maintain consistency in delivering the curriculum.

Assessment Planning

Once the curriculum is delivered to the students and assessments are to be conducted. This requires assessment planning and use of rubrics indicating how students are assessed for a particular course. Different methods can be used to assess students like class tests, final exam, quiz, assignments, mini projects, seminars etc. Faculties will prepare question paper indicating CO, Bloom's level, performance indicator for each question.

Attainment Calculation

The parameters required for the calculation of attainment of outcomes are shown in figure 3.

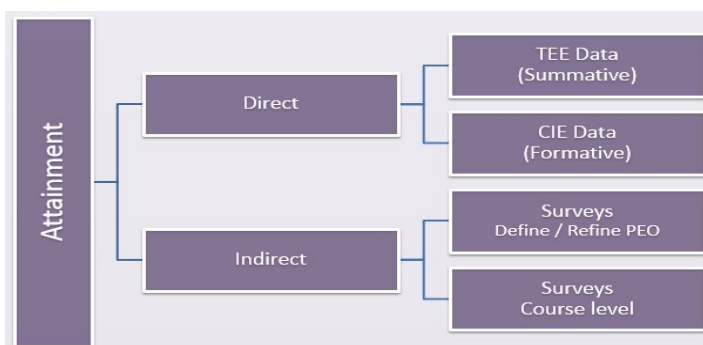


Fig. 3: Attainment Parameters

TEE – Term End Evaluation (Semester), CIE – Continuous Internal Evaluation (Tests).

For attainment calculation direct and indirect approaches are used. The direct attainment comprises of results from class tests and final exam. Indirect attainment consists of various surveys like CO exit survey, PO survey, alumni and employer survey etc. Final attainment is calculated by considering a percentage weightage of both direct and indirect attainments.

For the calculation of attainments two methods are considered as shown in figure 4 below.

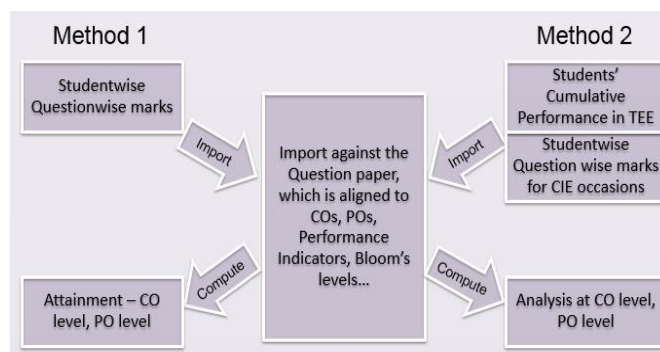


Fig. 4: Approaches of Attainment Calculations

Method 1 is used when student wise question wise marks are available, typically suitable for autonomous colleges, private/deemed universities. Method 2 is used in affiliated colleges where the student wise question wise marks are not available. In this case, CGPA or final exam marks will be used with class test marks to compute attainments.

Survey and Feedback

Survey and Feedback module facilitates the institute to conduct various survey like CO exit survey, PO survey, alumni and employer survey etc. Institutes can customize the survey templates and conduct their own surveys. IonCUDOS® will calculate indirect attainments based on the inputs from the survey questionnaires.

IMPLEMENTATION CASE STUDY

In this section, we discuss the implementation case study of IonCUDOS® in a reputed autonomous academic institute in India. This institute adopted OBE practice in 2011 and used IonCUDOS® software platform extensively. Within a span of 2 years, NBA SAR as per OBE norms was submitted. The following subsections show how the software platform can be effectively used to calculate various attainments of CO, PO, Bloom's level, competencies and performance indicators. This institute followed a similar process, and sample data from an undergraduate Computer Science course in the academic year 2013-2014 is used to illustrate this process.

Course Outcome Attainment

CO level attainment is calculated from direct source of data (based on students' performance in formative assessments, summative assessments) and indirect source of data (students' feedback on

course delivery and outcomes) and normalised based on percentage weightage of direct and indirect sources. The attainments computed are matched against threshold and goal of the department to compute actual average attainment and actual percentage of students above threshold as shown in Table 1 and Figure 5.

Table 1: Sample Course Outcomes Attainment

Course Outcomes	Threshold Attainment	Actual Average Attainment	Goal - % of Students above Threshold	Actual % of Students above Threshold
CO1	75%	72%	70%	69%
CO2	75%	78%	70%	73%
CO3	75%	81%	70%	78%
CO4	75%	79%	70%	72%
CO5	75%	71%	70%	66%

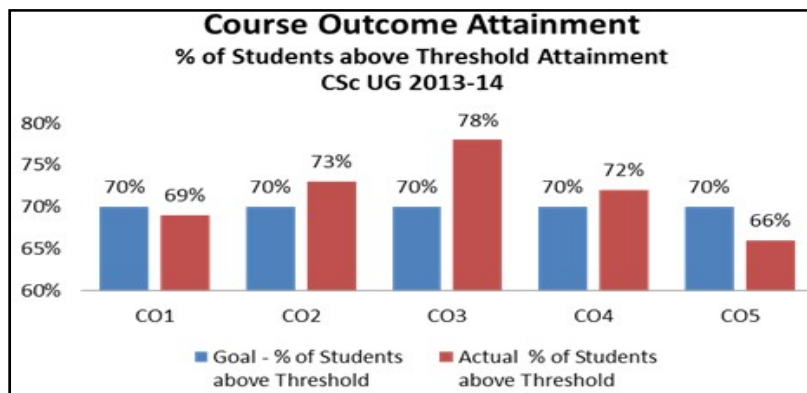
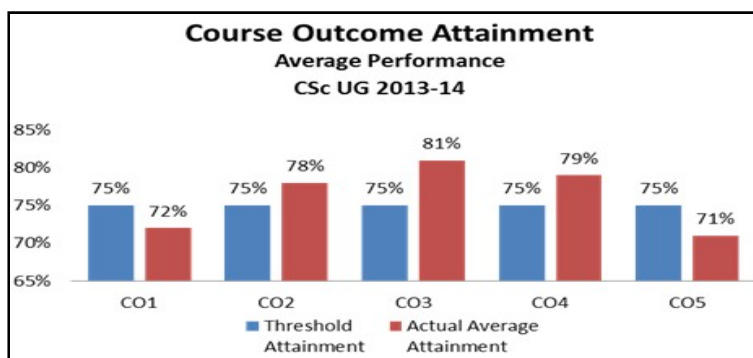


Fig. 5: Course Outcome Attainment

Program Outcome Attainment

PO attainment is based on the mapped CO level performance of students across the terms. It also takes into consideration feedback and surveys from various stakeholders at the program level and

final attainment is normalised based on percentage weightage of direct and indirect sources. The attainments computed are matched against threshold and goal of the department to compute actual average attainment and actual percentage of students above threshold as shown in Table 2 and Figure 6.

Table 2: Sample Program Outcomes Attainment

<i>Program Outcomes</i>	<i>Threshold Attainment</i>	<i>Actual Average Attainment</i>	<i>Goal - % of Students above Threshold</i>	<i>Actual % of Students above Threshold</i>
PO1	65%	63%	70%	68%
PO2	65%	67%	70%	73%
PO3	65%	68%	70%	75%
PO4	70%	67%	70%	66%
PO5	70%	71%	70%	70%

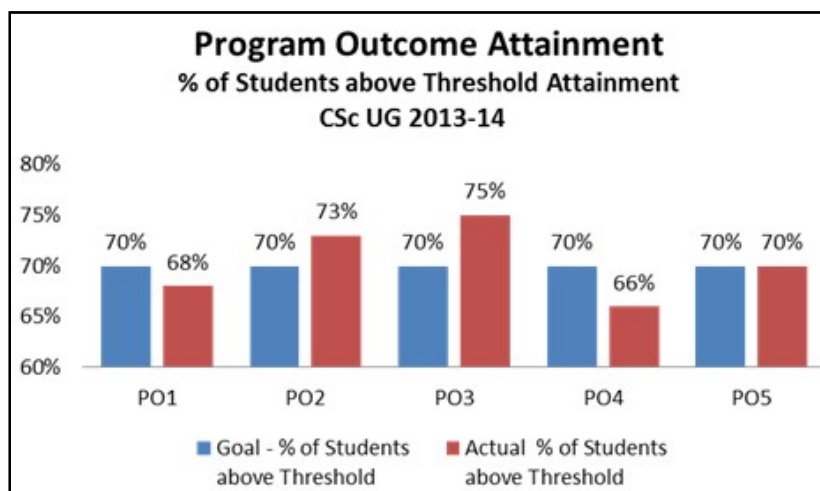
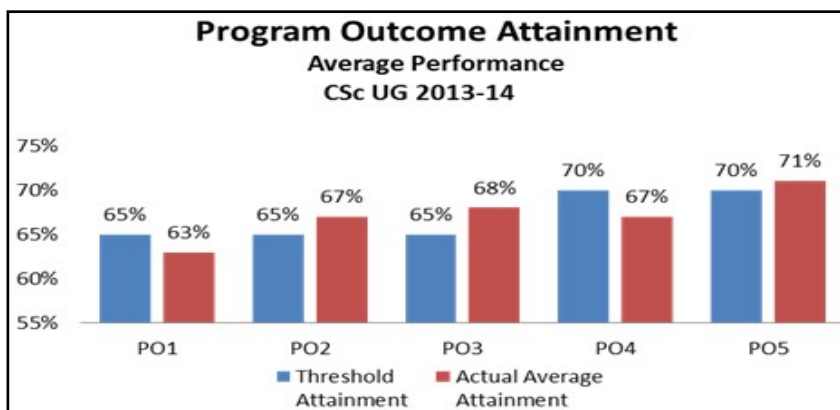


Fig. 6: Program Outcome Attainment

Bloom's level wise Performance

Bloom's level wise performance is a measure of students' performance through various activities measured through established rubrics for various levels. The attainments computed are matched against threshold and goal of the department to compute actual average attainment and actual percentage of students above threshold as shown in Table 3 and Figure 7.

Table 3: Sample Bloom's Level Attainment

<i>Bloom's Level</i>	<i>Threshold Performance</i>	<i>Actual Average Performance</i>	<i>Goal - % of Students above Threshold</i>	<i>Actual % of Students above Threshold</i>
L1	65%	63%	70%	68%
L2	65%	67%	70%	73%
L3	65%	68%	70%	75%
L4	65%	67%	70%	66%
L5	65%	68%	70%	70%

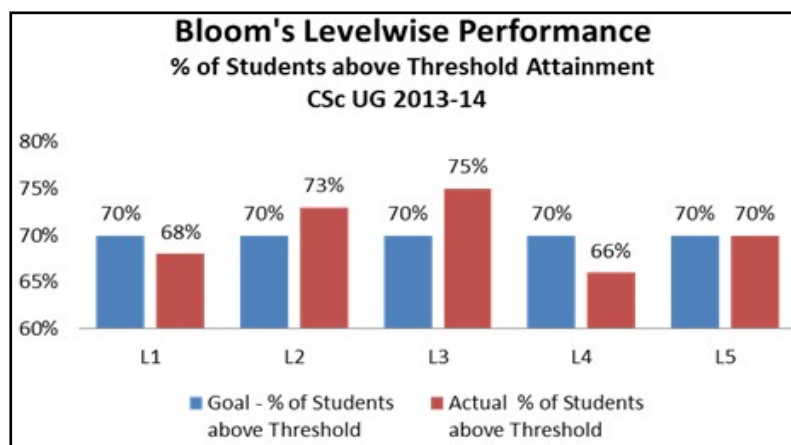
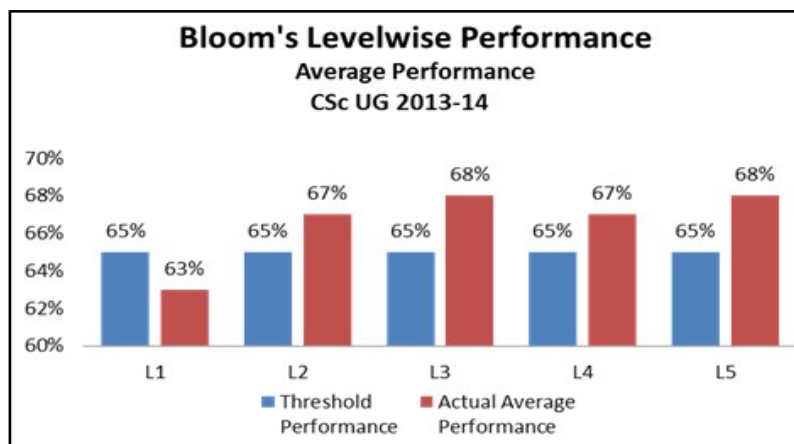


Fig. 7: Bloom's Level Wise Performance

Attainment of Competencies and Performance Indicators

Competencies and Performance indicators are computed from students’ performance for a particular competency, measured through its performance indicators across various activities in courses. The attainments computed are matched against threshold and performance of the students as shown in Table 4 and Figure 8.

Table 4: Sample Performance Indicators

<i>Performance Indicators</i>	<i>Threshold</i>	<i>Performance</i>
Research and Gather Information	75%	69%
Effective Team Player	75%	68%
Share and Ask Information	75%	72%
Listen, Communicate	75%	76%

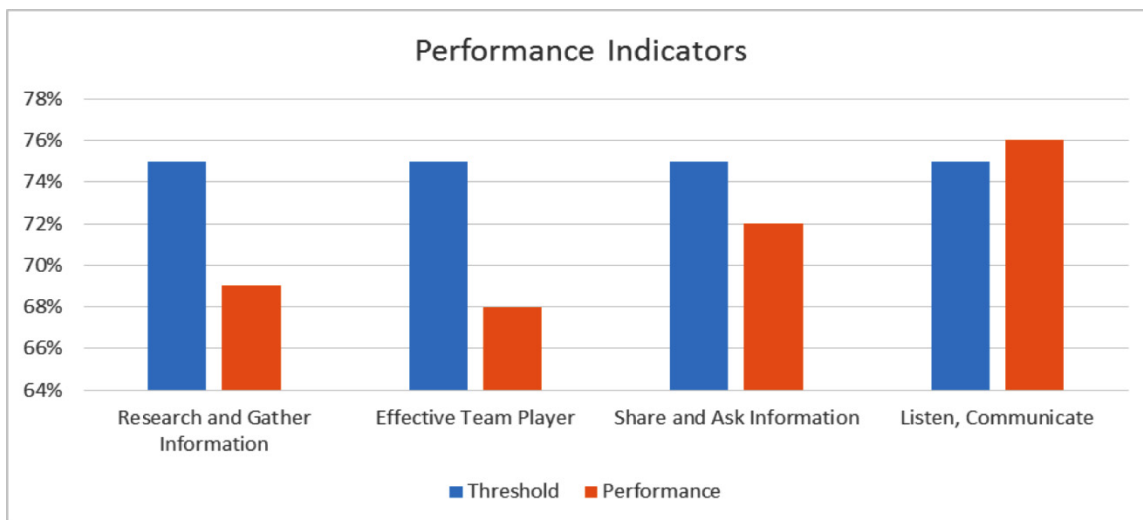


Fig. 8: Performance Indicators

RESULTS AND DISCUSSION

A survey was conducted to measure the impact of IonCUDOS® and was administered to 100 faculties of the institute. The survey was conducted two times i.e. before and after installation of IonCUDOS®. The survey results revealed that IonCUDOS® benefitted the institute in the following areas:

1. **Efficiency:** IonCUDOS® helped in achieving the error free attainment calculations as it eliminates the manual calculation using spreadsheets.
2. **Speed:** IonCUDOS® generates various reports such as CO-PO, PO-PEO mappings, program articulation matrix, lesson plan, question paper analysis, various attainment reports, survey reports in a click of button. This saves lot of time for HOD and faculties. Hence eliminates the manual work.

3. **Productivity:** IonCUDOS[®] helps to increase the productivity of the faculties as the manual work is eliminated and data is stored and retrieved in a safe and secure manner. Faculties can focus effectively on their other responsibilities.
4. **Security:** The data of the institution remains safe and secure in IonCUDOS[®] as the software platform provides access to the various stakeholders in a level based, privilege based manner.
5. **Process Institutionalization:** IonCUDOS[®] helps the institution to achieve process institutionalization of common practices across different programs by bringing all of them under one umbrella.

A comparative analysis of benefits of using IonCUDOS[®] is shown in Table 5 and Figure 9.

Table 5: Benefits of IonCUDOS[®] to the Institution

<i>Efficiency</i>		<i>Speed</i>		<i>Productivity</i>		<i>Security</i>		<i>Process Institutionalization</i>	
<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>	<i>Before</i>	<i>After</i>
52.3%	78.5%	34%	79.5%	42.5%	74%	46%	86%	64.6%	87%

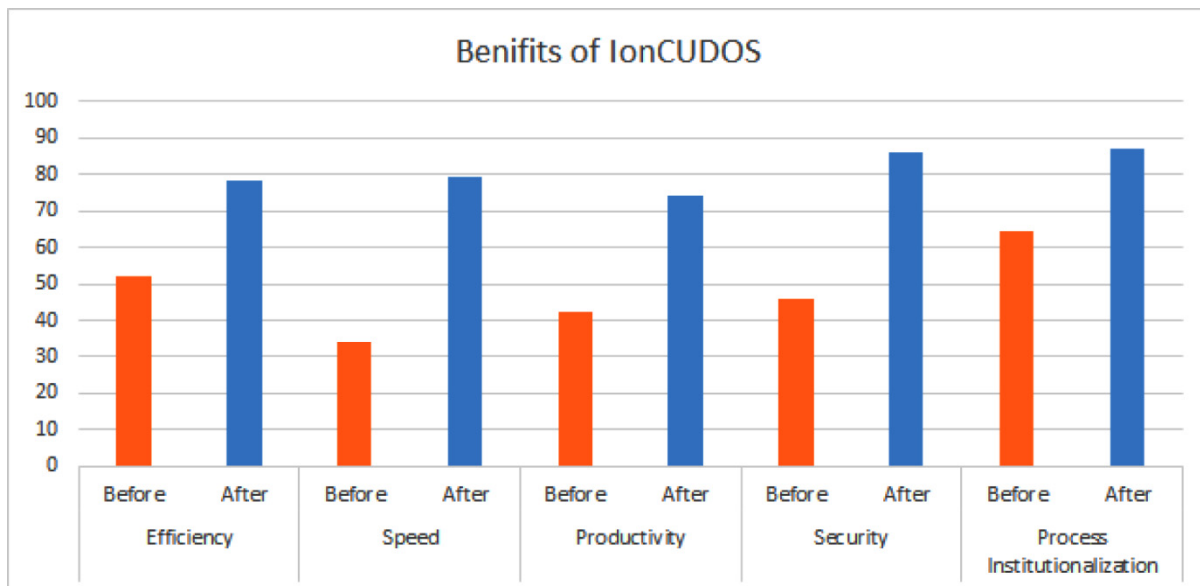


Fig. 9: Benefits of IonCUDOS[®] to the Institution

CONCLUSION

IonCUDOS[®] is a unique solution, which assists an Institution on its path to achieve OBE, equipping the institution for Accreditation and to meet stakeholders' expectations effectively and efficiently. By using IonCUDOS[®] platform, institutions ensure that they are offering global quality standards of engineering education, improve the students' employability and improve consistently by reaching higher goals of attainments and hence improve the overall quality of education.

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