

Hisight: A Generic CQI-based OBE System for Regulatory Compliance

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Abstract: In 2012, the Commission of Higher Education (CHED) released a memorandum that requires higher education institutions (HEI) in the Philippines to shift their approach to outcomes-based education (OBE) and, at the same time, establish quality assurance systems that ensure adherence to the OBE framework. Furthermore, in 2024, CHED will be evaluating the compliance of HEIs with their OBE framework. Despite this, not all HEIs can follow the OBE framework as they cannot consistently perform program and course-level continuous quality improvement (CQI), an essential part of the OBE framework. This is primarily due to three main issues experienced by HEIs, which are their inability to monitor program implementation, their lack of an instrument to assess the effectiveness of program implementation, and their difficulty in processing term-end reports.

The proponents gathered insights into what causes these issues through research and stakeholder interviews to solve these issues. Afterward, Hisight, a CQI-based OBE System for Regulatory Compliance, was developed as a solution. Hisight aims to provide a platform for HEIs to adhere to CHED's OBE framework. The solution comprises several modules that aim to address the aforementioned problems experienced by HEIs. Such functionality of the modules includes alignment of graduate attributes to program outcomes, creation and alignment of learning outcomes to performance indicators, term-end report generation, and monitoring dashboards for data visualizations. The proponents conducted unit and integration testing to determine if the solution worked as intended. Curricular test data spanning (4) four years were also generated to simulate realistic usage. All test cases were passed, showing that the system can handle most OBE-related HEI processes.

Key Words: Outcomes-Based Education; Continuous Quality Improvement; Outcomes Attainment, Higher Education Institutions, Quality Assurance System;

1. INTRODUCTION

Outcomes-Based Education (OBE) is a teaching-learning student-centered method that stresses the significance of specific and quantifiable learning outcomes (Chabeli, 2006). OBE has been increasingly

adopted in higher education institutions (HEIs) in the Philippines to improve the overall quality of education and produce graduates that meet the demands of the local and global workforce. In 2012, the Commission on Higher Education (CHED) released CHED Memorandum Order (CMO) 46, which requires HEIs to shift their approach to OBE and establish quality assurance

systems adhering to the CHED OBE framework. This authorizes HEIs to incorporate graduate outcomes, program outcomes, performance indicators, and learning outcomes into their curricula and syllabi while practicing continuous quality improvement (CQI). Moreover, CHED will be evaluating the compliance of HEIs with the OBE framework in the year 2024, which makes it essential for institutions to adhere to the requirements.

To assist in complying with the CHED OBE framework, the project involved developing a solution to help HEIs design curricula based on the conditions stated in CHED CMO 46. The solution is Hisight, a generic CQI-based OBE system designed for regulatory compliance with the CHED OBE framework. It includes modules allowing users to input the needed graduate attributes, program outcomes, performance indicators, and learning outcomes for the curriculum, integration with the Canvas Instructure LMS for data fetching and exporting, analytics, and report generation to assist in CQI processes.

2. PROBLEM BEING ADDRESSED

The suggested OBE framework of CHED involves implementing a quality assurance system that follows the Deming cycle or is recognized as the plan-do-check-act (PDCA) cycle. The PDCA cycle enables HEIs to continuously improve the quality of education by gathering and assessing the attainment of program and course outcomes and identifying from it what changes and improvements should be planned for and implemented in the next cycle (Hamsan et al., 2020). As such, the HEI needs to efficiently collect and analyze outcome attainment data to perform the continuous quality improvement (CQI) process (Al-Atabi et al., 2013). Despite the importance of performing CQI, not all HEIs can and can perform it at the program and course level, mainly due to the following reasons:

1. Inability to monitor program implementation
2. Lack of an instrument to assess the effectiveness of program implementation
3. Difficulties in processing term-end reports

An integral part of the program-level CQI process is monitoring the effectiveness of the program implementation. However, as stated in one of the interviews conducted by the proponents (C. Cheng, personal communication, Oct 17, 2023), their department experiences difficulties in monitoring the performance of specific programs due to complexities

such as the nature of the open enrollment system adopted by most HEIs. The open enrollment system allows students to choose what courses they enroll in and when to take them. Because of this, students under the same batch and program may choose to take the same course at different times. Depending on when they have taken the course, significant differences may have been made with the course that may affect their performance and outcomes attainment. The differences between the course versions may be in terms of learning outcomes, outcomes alignment, topics, and major assessments.

Due to the inherent differences with the implementation of the same course, course versions need to be tracked to assess better the impact of specific changes implemented on student performance and outcomes attainment (Duerden & Witt, 2012). Additionally, the inability to monitor program implementation affects how they perform CQI at the course and program level as they are unable to use historical data on previous changes done to the curriculum and course and how each change has affected the performance and outcomes attainment of students (E. Tighe, personal communication, Nov 22, 2023).

It was mentioned during the interviews conducted for the study that HEIs do not currently have an instrument to assess the effectiveness of program implementation, thus incapacitating them from adequately performing CQI. This is primarily due to the HEIs relying on observations from faculty members to guide them in evaluating the state and performance of a program (E. Bertumen, personal communication, Sept 29, 2023). One of the significant disadvantages of using data gathered from observations is the possibility of biases from the observer that may influence and damage the reliability of the data (Satapathy, 2023). As mentioned in CHED's (2014) handbook on OBE, there should also be four (4) elements that should be included in the assessment and evaluation of programs. The four (4) elements are performance indicators, assessment methods, standards, and efficiency. Unfortunately, due to the reliance of HEIs on data from observations, most of these elements are not considered when evaluating and assessing programs.

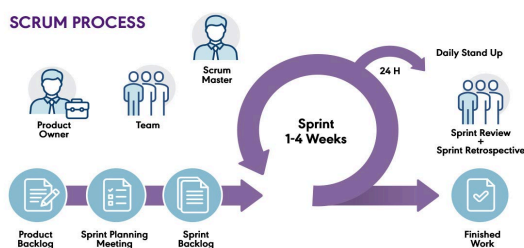
Lastly, one of the critical components of the CQI process is the evaluation and creation of term-end reports. However, HEIs rely on office productivity tools such as Microsoft Excel to produce the reports, which is time-consuming and demanding due to manual data processing. This proves to be an issue as they cannot

fully utilize the data to determine their weaknesses and strengths due to the limitations of the tools (Lapidario et al., 2017). All this reflects their inability to comply fully with CHED's OBE framework, as they cannot consistently perform CQI at both the course and program level (C. Cheng, personal communication, Oct 17, 2023).

3. METHODOLOGY

Several phases were identified to develop and complete the project: the Planning, Prototyping and Designing, and Developing phases. The (1) planning phase primarily focused on gathering and analyzing data to conceptualize the project. During this phase, the proponents interviewed several stakeholders to identify problems they might have encountered. The (2) prototyping and designing phase focused on the solution and system proposed for the project. During this phase, the proponents identified and finalized the modules and features of the system while ensuring that the stakeholders' requirements were properly met. The (3) developing phase primarily focused on building the proposed solution or system following the scrum methodology (see Figure 1 from PM Partners, 2024) and meeting user requirements. Additionally, unit and integration testing were done in this phase to ensure that modules were working as expected. The scrum is composed of 5 sprint cycles corresponding to the modules of the system. The sprints were performed in this order: curriculum management, course management, program monitoring, course monitoring, and program assessment. The sprints were conducted with essential and foundational modules being first.

Figure 1. SCRUM Methodology



4. ARCHITECTURE OF THE SOLUTION

The solution architecture (see Figure 2) used to formulate, design, and implement the solution highlights

the inputs, modules, functionalities, and outputs of Hisight. The five (5) main modules are curriculum management, course management, program monitoring dashboard, course monitoring dashboard, and program assessment modules. The modules provide the following:

- a. Curriculum Management - alignment of graduate attributes (GA) to program outcomes (PO), alignment of program outcomes to performance indicators (PI), assigning courses' level of development of performance indicators, curriculum map
- b. Course Management - learning outcomes (LO), alignment of learning outcomes to performance indicators, data exporting to Canvas, data fetching from Canvas, and generation of term-end reports for CQI.
- c. Program Monitoring - Online analytical processing or Analytics and Data Visualization at the program level for CQI
- d. Course Monitoring - Online analytical processing or Analytics and Data Visualizations at the course level for CQI
- e. Program Assessment - assessment matrix of the overall performance of a program in terms of outcome attainment

The curriculum (see Figure 3) and course management (see Figure 4) modules mainly handle compliance with the OBE framework. The curriculum management module allows the alignment of the institution's graduate attributes (or institutional outcomes) to program outcomes and the alignment of program outcomes to performance indicators via the curriculum map. The curriculum map also allows the users to identify the courses that target the program outcome and performance indicators (level of development). Moreover, the curriculum map also allows users to identify the recommended assessments to achieve the indicators. Once the curriculum has been developed, the institution can start creating the learning outcomes of the courses. The course management module handles the creation of learning outcomes and the PI-LO alignment. The system utilizes a course template functionality based on the details from the curriculum map the course is used in to determine a course's performance indicators, assessments, and alignments. A course version (for the course offering) can be created based on the course template. This allows the system to track what course versions each student is taking.

For continuous quality improvement, four (4) modules handle it. First, the course management module can generate term-end reports that summarize the students' performance (passing/failing rate, grade, and outcomes attainment) in a specific course, which is collected from Canvas LMS at the end of the term. It also collects input from faculty members who teach the course that term, containing their experiences and recommendations. The program monitoring dashboard module (see Figure 6) provides analytics and data visualizations that will allow the users to see performance at the program level in a more actionable format. Similarly, the course monitoring dashboard module enables the monitoring of the program and the attainment of learning outcomes at the course level. Lastly, the program assessment module (see Figure 5), based on CHED's Program Outcomes-Performance Indicators-Assessment Evaluation Methods-Standards Matrix, allows department chairs to assess the program results. It shows the total percentage of students who have achieved an outcome attainment of 2.0 and above for courses that demonstrate the program outcome.

5. RESULTS AND DISCUSSION

To assess the reliability and functionality of the system, the proponents have created test cases for each module of the system. The test cases (see sample test cases in Figure 7) covered two types of system testing: unit and integration. Unit testing is done to ensure that individual modules function correctly. Afterward, integration testing was done using the Big Bang integration approach to ensure that interconnected modules within the system were working as intended. In conducting the test cases, the system was populated with four years of curricular data for two programs, BS-IS and BS-IT. The test data includes outcome attainment and grade data from approximately 400 students who took 16 courses.

Table 1. Test Case Results

Module	Passed Test Cases	Failed Test Cases
Curriculum Management	8	0
Course Management	15	0
Program Monitoring	4	0
Course Monitoring	6	0
Program Assessment	5	0
Total	38	0

The system successfully passed all 38 test cases for all available modules. The test cases were designed to

simulate the system's usage throughout the school year, covering OBE processes such as curriculum creation and CQI at both the program and course levels. The test case results show the system can handle most of the HEI's OBE-related processes.

6. CONCLUSIONS

With higher education institutions (HEI) adopting or have already adopted the Outcomes-based Education (OBE) approach in designing their curricula, there is a need for a tool to assist them in ensuring compliance with CHED's OBE framework. This is especially important as CHED had planned to start evaluating the institution's compliance with the framework in 2024. With difficulties such as (1) inability to monitor program implementation, (2) lack of an instrument to assess the effectiveness of program implementation, and (3) difficulties in processing term-end reports, educational institutions struggle to adhere to the requirements fully.

The system discussed in the paper, Hisight, addressed the aforementioned difficulties by providing modules that allow them to create curricula and syllabi adhering to the OBE framework and practice continuous quality improvement. Modules such as Curriculum Management and Course Management provide users with the foundations for the other modules to achieve their functionalities. On the other hand, modules such as Program and Course Monitoring Dashboards and Program assessments and features such as term-end report generation are used to monitor program implementation, assess program implementation effectiveness, and streamline the processing of term-end reports. Due to the capabilities and functionality of Hisight, compliance with the OBE framework and CQI are integrated into the system processes.

7. ACKNOWLEDGMENTS

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Figure 2. Overall Architecture of the Solution

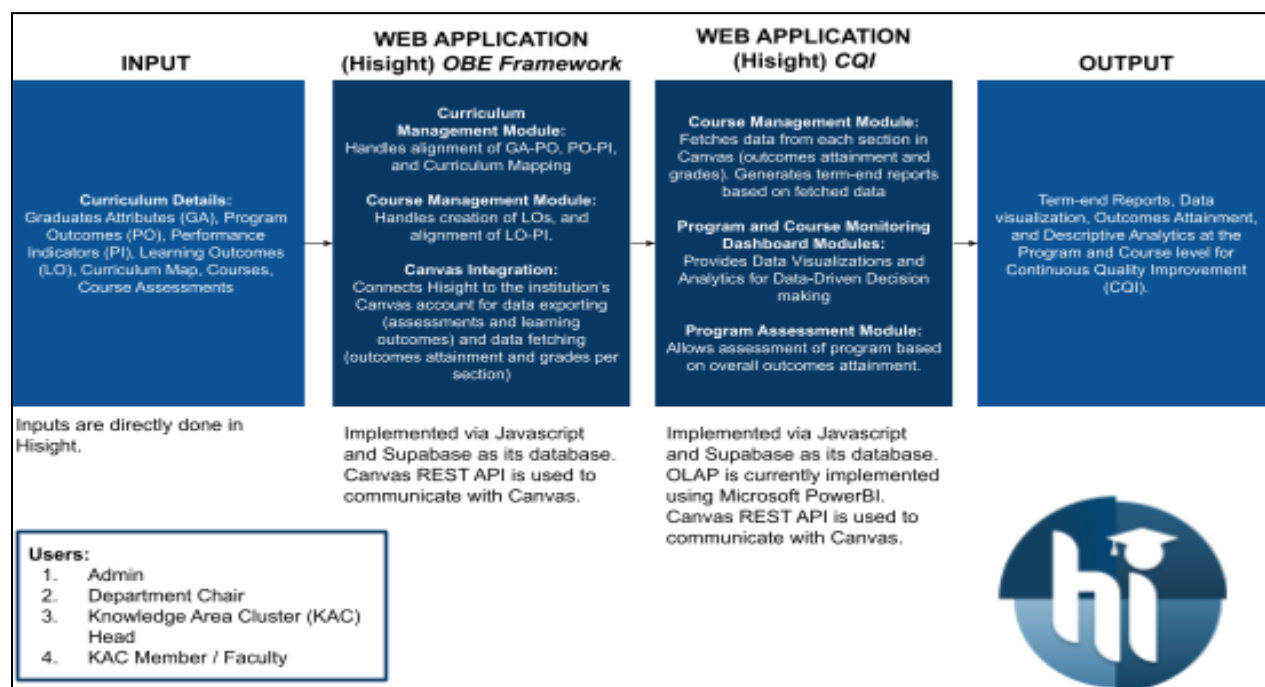


Figure 3. Curriculum Management: Curriculum Map

Bachelor of Science Major in Computer Systems Engineering
BSCS-CSE 2024-2027

Steps: 1. Identify and arrange the courses that will be offered in the curriculum by term and year.
2. Identify the expected level of development of the performance indicators targeted by a course.
3. Identify the recommended assessments for each course.

Back Submit

*All changes done will be automatically saved.

Curriculum Information

Targeted All Program Outcomes: ✓ 2024
✗ 2025
✗ 2026
✗ 2027

Targeted All Performance Indicators: ✗
Total Number of Units: 9

Legend

Program outcomes in the current year level that have performance indicators that are **not targeted**.

Program outcomes in the current year level that have performance indicators that are **targeted**.

Academic Year	PO 1 Knowledge for Solving Computing Problems		PO 2 Individual and Team Work		PO 3 Communication	PO 4 Computing Professionalism and Society	
	PI 1.1	PI 1.2	PI 2.1	PI 2.2	PI 2.3	PI 3.1	PI 4.1
2024							
TERM 1 (3 units)							
CCPROG1		<div>Level: I</div> <div>Machine Project, Hands-On Exam...</div>			<div>Level: I</div> <div>Machine Project</div>	<div>Level: I</div> <div>Machine Project</div>	<div>Level: I</div> <div>Machine Project</div>
TERM 2 (3 units)							
CCPROG2		<div>Level: I</div> <div>Machine Project, Hands-On Exam...</div>			<div>Level: I</div> <div>Peer Evaluation, Machine...</div>	<div>Level: I</div> <div>Machine Project</div>	<div>Level: I</div> <div>Oral Presentation</div>
TERM 3 (3 units)							
CCPROG3		<div>Level: E</div> <div>Machine Project, Hands-On Exam...</div>			<div>Level: I</div> <div>Machine Project</div>	<div>Level: I</div> <div>Machine Project</div>	<div>Level: E</div> <div>Oral Presentation</div>

Figure 4. Course Management: Curriculum Map

Course Management / CCPROG1 / Template 2023 / Version 1231

Generate Term-end Report

Course Name: Logic Formulation and Introductory Programming

Course Code: CCPROG1

Version: Term 1, AY2023 [1231_CCPROG1]

Blueprint Course Tag: ✓ [BP_CCPROG1_1191]

Learning Outcomes

Create New LO + Import to Canvas

Tag	Name	Description	Perf. Indicators	Status
[CCLO-187]	LO-1	Analyze problem requirements by describing input specifications, processes and target output.	IS-1.1, IT-1.1, IT-5.5, IS-6.3, IS-8.2, IT-9.2	✓ In Canvas
[CCLO-188]	LO-2	Exhibit intellectual honesty, responsibility and punctuality, conforming to Christian principles.	IS-1.1, IT-5.5, IS-8.2, IT-8.2, IT-8.4	✓ In Canvas
[CCLO-189]	LO-3	Design and implement algorithmic solutions from defined problems and requirements by applying knowledge of computing fundamentals using appropriate data types and constructs including expressions, conditional statements, iterative statements and structured decomposition.	IT-1.1, IT-5.3, IS-6.3, IT-6.3, IS-8.2, IT-9.2	✓ In Canvas
[CCLO-190]	LO-4	Design, execute and document various classes of test cases and their corresponding results.	IT-5.3, IS-6.3, IT-6.3, IT-8.2	✓ In Canvas

⚡ No. of Pis Targeted: 11 out of 11 are targeted. ✓

Recommended Assessments

Import to Canvas

Tag	Name
[AS-2]	Hands-On Exam
[AS-1]	Machine Project
[AS-11]	Exercises

Sections

[1231_CCPROG1_S14] Logic Formulation and Introductory Programming

Figure 5. Program Assessment Module

Program Outcomes	Perf. Indicators	Courses	Assessments	PI Attainment	Overall Attainment	Evaluator's Comment
[IS-1] Knowledge for Solving Computing Problems Apply knowledge of computing, mathematics, science, and domain knowledge appropriate for information technology practice to the abstraction and conceptualization of solution models from defined problems and requirements.	IS 1.1 Apply knowledge of computing, mathematics and science to the... Show More	ITISHCI (D), ITISDEV (D), ISANDEZ (D), PRC-IS1 (D), CAP-IS0 (D), ISPRENL (D), CAP-IS1 (D), CAP-IS2 (D)	Machine Project, Hands-On Exam, Case Analysis, Exercises, Laboratory Exercises, Quizzes, Capstone Project, Capstone Paper, Job Training	75.2% PI Attainment	75.8% Outcomes Attainment	No comments yet... Add Comment
	IS 1.2 Apply knowledge of information technology to the abstraction and... Show More	ISANDEZ (D), PRC-IS1 (D), CAP-IS0 (D), CAP-IS1 (D), CAP-IS2 (D)	Machine Project, Hands-On Exam, Case Analysis, Written Exam, Exercises, Project Presentations, Reflection Paper, Quizzes, Concept Exam, Capstone Project, Capstone Paper, Research Paper, Job Training	80% PI Attainment		
[IS-2] Problem Analysis (Problem) Analyze complex problems, and identify and define computing requirements appropriate for its solution using fundamental principles of mathematics, computing fundamentals, technical concepts and practices in the core information technologies, and relevant domain disciplines.	IS 2.1 Determine if a problem can be solved by information and... Show More	ITISDEV (D), PRC-IS1 (D), CAP-IS0 (D), ISENTAR (D), CAP-IS1 (D), CAP-IS2 (D)	Case Analysis, Capstone Project, Capstone Paper, Job Training	81.5% PI Attainment	81.2% Outcomes Attainment	No comments yet... Add Comment
	IS 2.2 Review and compare related literature... Show More	PRC-IS1 (D), CAP-IS0 (D), ISENTAR (D)	Machine Project, Group Reporting, Case Analysis, Written Exam, Exercises, Capstone Project,	80% PI Attainment		

Figure 6. Program and Course Monitoring Dashboard Module: Sample Analytics

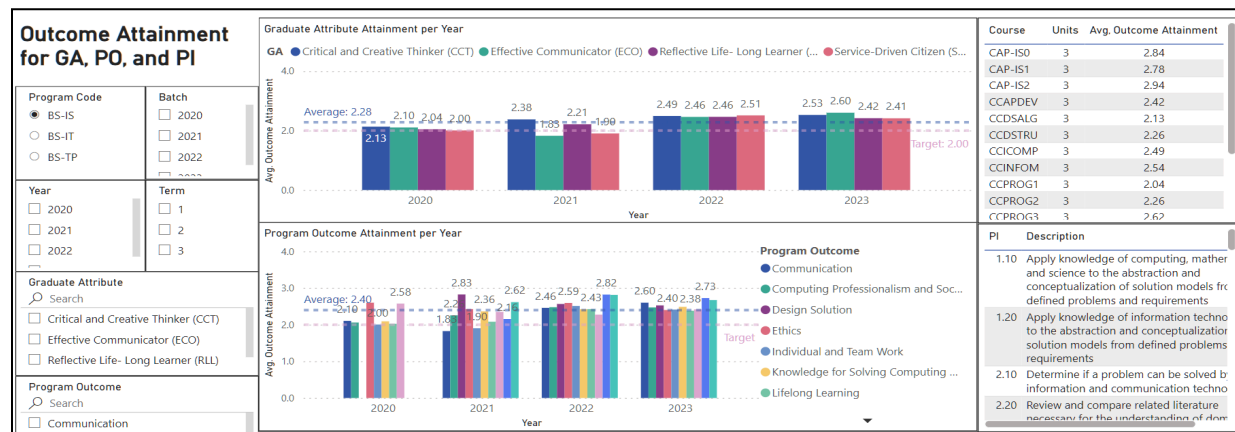


Figure 7. Sample Test Cases for Internal Testing

ID	Test Case	Test Data	Expected Result	Actual Result	Status
#1	Creation of new curriculum for a new program	New Program: BS-CSE	New blank curriculum for BS-CSE has been created	New blank curriculum for BS-CSE has been created	PASS
#2	Creation of new curriculum with previous curriculum as basis	Previous Curriculum: BS-IS 2023-2026 New Curriculum: BS-IS 2024-2027	New BS-IS curriculum for 2024 - 2027 with same POs, PIs, assessments, and level of development	New BS-IS curriculum for 2024 - 2027 with same POs, PIs, assessments, and level of development	PASS
#3	Creation of new curriculum with previous curriculum as basis with changes in PO and PI alignment	Previous Curriculum: PO1 aligned to 3 PIs New Curriculum: PO1 aligned to 2 PIs	New curriculum has PO1 aligned to 2 PIs	New curriculum has PO1 aligned to 2 PIs	PASS
#4	Adding a course in a specific term and year in a curriculum map	Term 1, Year 2024 Department: Software Technology KAC: Programming Fundamentals Course Name: Logic Formulation and Introductory Programming Course Code: CCPROG1	Course CCPROG1 has been added to term 1 of the year 2024 in the curriculum map	Course CCPROG1 has been added to term 1 of the year 2024 in the curriculum map	PASS
#5	Adding and creating of a new course in a specific term and year in a curriculum map	Term 2, Year 2024 Department: Software Technology KAC: Programming Fundamentals Course Name: Programming With Structured Data Types Course Code: CCPROG2	New course CCPROG2 has been created and added to term 2 of the year 2024 in the curriculum map	New course CCPROG2 has been created and added to term 2 of the year 2024 in the curriculum map	PASS
#6	Adding level of development for a specific course	Course: CCPROG1 PI: PI1.1 Level of Development: I	Course CCPROG1 has a level of development of I for PI1.1	Course CCPROG1 has a level of development of I for PI1.1	PASS
#7	Adding an assessment to align with a course and its target PI with level of development	Course: CCPROG1 PI: PI1.1 Level of Development: I Assessments: Machine project, Hands-on Exam	Course CCPROG1 has assessments Machine Project, and Hands-on Exam targeting PI1.1	Course CCPROG1 has assessments Machine Project, and Hands-on Exam targeting PI1.1	PASS
#8	Adding and creating a new assessment to align with a course and its target PI with level of development	Course: CCPROG1 PI: PI1.1 Level of Development: I Assessments: Oral Presentation	The assessment Oral Presentation is created and is targeting PI1.1 for CCPROG1	The assessment Oral Presentation is created and is targeting PI1.1 for CCPROG1	PASS
#9	View overall outcome attainment for BS-IT	Program BS-IT Years 2020 to 2024	overall outcome attainment for the the first program outcome is 75.8%	overall outcome attainment for the the first program outcome is 75.8%	PASS
#10	View PI attainment for BS-IT	Program BS-IT Years 2020 to 2024	IS1.1 has a PI attainment of 75.2% and IS1.2 has a PI attainment of 80%	IS1.1 has a PI attainment of 75.2% and IS1.2 has a PI attainment of 80%	PASS
#11	View LO attainment of a specific course version	Slicer Inputs: Course Code CCPROG1 Course Version 1231 Program Code BS-IS	LO attainment for BS-IS students in CCPROG1 version 1231 is 2.19	LO attainment for BS-IS students in CCPROG1 version 1231 is 2.19	PASS
#12	View PO attainment of a specific course version	Slicer Inputs: Course Code CCPROG1 Course Version 1231 Program Code BS-IS Program Outcome Communication	Attainment for PO Communication for BS-IS students in CCPROG1 version 1231 is 2.48	Attainment for PO Communication for BS-IS students in CCPROG1 version 1231 is 2.48	PASS
#13	Viewing alignments of GA to PO, PO to PI, and PI to LO	Alignments: GA: Critical and Creative Thinker PO: Knowledge for Solving Computing Problems PI: IS1.1, IS1.2	Correct outcome alignments with corresponding data for each outcome	Correct outcome alignments with corresponding data for each outcome	PASS