OBACIS IV: THE CLOSED-LOOP TEACHING AND LEARNING FRAMEWORK

Mohamed Ismail
Industrial Systems Engineering, University of Regina
mohamed.ismail@uregina.ca

Abstract – OBACIS is a tri-platform outcome-based assessment and continues improvement system. The system is composed of three integrated platforms/applications: a Win app, an Excel app, and a Web-app. In this paper, a Closed-Loop Teaching and Learning Framework (CTLF) is presented. The framework is composed of two layers: a program layer and a course layer. At the heart of the program layer lies the program-level closed-loop teaching and learning process (P-CTLP) with an overarching process concerned with the analytics and the continuous improvement activities located in the feedback loop. P-CTLP has several inputs or constituents that affect its quality outcomes, namely the successful engineering graduates and the continuously improving program outcomes, a.k.a. Graduate Attributes. At the course layer, there is a simplified course-level closed-loop teaching and learning process (C-CTLP) with its simplified feedback loop, inputs and outputs. P-CTLP and C-CTLP are a sort of master-detail closed-loop continuous improvement system. C-CTLP is managed and controlled by individual faculty members, while higher administrative and executive staff manages P-CTLP and the overall CTLF. Since the outcome-based accreditation is still locked in the data collection phase, the framework presented will be the foundation for creating a data-driven analytics engine and a continued improvement system at the program and faculty levels. The proposed framework should be instrumental in justifying the effort and the investment spent on the new outcome-based accreditation process.

Keywords: OBACIS, Graduate Attributes, Accreditation Software, Outcome-Based Accreditation

1. INTRODUCTION

Programs are accredited when they meet the standards or the criteria regarding students, curriculum, faculty, facilities, and support [1]. Starting from 2014, Outcome-Based Assessment and continuous program improvement are now mandated by CEAB [2]. The relatively new process is a radical step forward, but unfortunately, it is still unfathomed, and we are yet to know how we can implement it and create an accompanying closed-loop continuous improvement process. The idea of establishing a new framework that has a clear description of what to be measured and how to take advantage of its outcomes needs further investigation. The process is still having a significant way to go before its impact is fully realized [3]. Switching from just an event-based process that happens over a course of six years to a continuously improving one makes the process very time consuming and costly. In order to be successful, the process has to be simple, well-defined, and fast. The time of process execution and the time to reap its benefits should be reduced.

Software tools are much needed to assist in data collection, data analytics and closing the continuous improvement loop. Unfortunately, there is no such a comprehensive off-the-shelf solution that is readily available to facilitate, organize or guide the process of data collection. Many institutions have been developing their systems to collect, manage and distribute this data [4]. Moreover, there is little information on how institutions are developing their respective systems, and even less information on their specific aspects, viewpoints, goals or barriers [5]. The current tools are still premature, and there is a dearth of integrated frameworks that address the new accreditation and its continuous improvement cycle.

At the course level, Excel is the most commonly used one for graduate attributes data collection and course activities assessment. Brennan et al. [6] have used Excel forms for linking course learning outcomes to course assessments activities. Student achievement reports have been generated and utilized for continual improvement activities. At the program and faculty level, web tools are common for distributed data collection. The ABET’s course assessment tool (ACAT) system [7] of the University of Nevada, and the CEAB’s Accreditation Management System (AMS) of University of Alberta [8] are typical examples. Another example of using Web tools for course learning outcomes mapping and analytics is reported in [9].

OBACIS is a tri-platform outcome-based assessment and continues improvement system. The system is composed of three integrated platforms/applications: a Win app, an Excel app, and a Web-app. OBACIS has been created with following three design goals in mind:

1. Accelerate the accreditation reporting workflow
2. Cut down the reporting cost by an order of magnitude

3. Close the data-driven continuous improvement loop

OBACIS I [10] was presented in CEEA 16 and demonstrated the tri-platform integrated framework in addition to a data-driven course assessment system. OBACIS II [11] and OBACIS III [12] were presented in CEEA 17. OBACIS II introduced the parsing engine and the auto-generated course information sheets (CIS), demonstrated how 80% of CIS data collection time could be saved, and demonstrated how to make compiling CIS data an ongoing continuous improvement activity. OBACIS III introduced the Excel Application that collects the data missed by the parsing engine of OBACIS II and introduced the simultaneous grade and accreditation reporting system. OBACIS III demonstrated how the time required to do the two tasks could be cut down by at least 50%. OBACIS I-III addressed the first and the second goal. OBACIS Closed-Loop Teaching and Learning Framework (CTLF) or OBACIS IV addresses the uncharted the third goal: close the data-driven continuous improvement loop.

Section 2 of this paper introduces the CTLF and program-level closed loop teaching and learning process (P-CTLP) and the course-level closed loop teaching and learning process (C-CTLP). Section 3 sheds light on CTLP assessment and the tri-mapping perspective adopted by OBACIS. Section 3 discusses the aggregation and disaggregation of data from the course level to program level and vice versa. Section 4 lists, in brief, the design goals of the analytics engine that will be created to support the CTLF workflow. Section 5 summarizes and concludes the paper.

2. CLOSED-LOOP TEACHING AND LEARNING FRAMEWORK

In this paper, we propose a closed-loop teaching and learning Framework. The framework is composed of two layers: A program layer and a course layer. At the heart of the program layer lies the program-level closed-loop teaching and learning process (P-CTLP) with an overarching process concerned with the analytics and the continuous improvement activities located in the feedback loop. P-CTLP has several inputs or constituents that affect its quality outcomes, namely the successful engineering graduates and the continuously improving program outcomes, a.k.a. Graduate Attributes. At the course layer, there is a simplified course-level closed-loop teaching and learning process (C-CTLP) with its simplified feedback loop, inputs and outputs. P-CTLP and C-CTLP are a sort of master-detail closed-loop continuous improvement system. C-CTLP is managed and controlled by individual faculty members, while higher administrative and
The proposed CTLF is supposed to be generic and might be adopted for non-engineering or non-accredited higher education programs as well. However, for the rest of this paper, we will assume the CTLF is used to meet the requirement of the CEAB outcome-based accreditation process.

Through the master P-CTLP, see Figure 1, our engineering students are exposed to a lot of engineering and science, design, and complementary studies already defined in the program curriculum. Their performance is assessed using several assessment tools. The teaching and learning experience is facilitated by faculty members, lab instructors, and teaching assistants. Facilities, equipment, library, classrooms, etc. are essential resources as well. Some support is needed that could come in many ways, financial, regulatory, professional development, counseling, advising, etc.

The overall process is supposed to be streamlined and guided by a set of internal drivers: the mission, the program objectives, and core competency of that program that could be easily assessed using SWOC analysis: strengths, weaknesses, opportunities, and challenges.

Some external bodies might affect the overall process as well: industry, advisory boards, professional reorganization, and regulatory bodies and last but not the least accreditation boards or CEAB in our case.

The output of the CTLF in CEAB context should be successful competent engineering graduate and successful continually improving engineering programs. The 12 graduate attributes mandated by CEAB 3.1 are the major data driver of the improvement process.

The proposed P-CTLP has a secondary overarching review process or a feedback loop through which several performance indicators of teaching and learning process could be measured, reviewed, and analyzed. As a result, a lot of opportunities for improvement could be identified, and actions plans could be easily drafted. The improvement actions or projects could be mapped back to one or many of the constituents of the inputs of the P-CTLP. Improvements could be both evolutionary or revolutionary. Due to the rigid structure of most academic institutions, the former could be more dominated; however, the latter might have an order of magnitude on the quality of the outcomes. The utmost goal is continually improving the quality of the graduates and keep magnifying program outcomes.

Similar to P-CTLP, a course level one could be easily developed. The program outcomes could be incrementally developed. No wonder that CEAB has developed the IDA [2] notation to differentiate between the three levels of program outcomes development. The successful teaching and learning experience is considered a second output and could be easily assessed using instructors and course evolutions. The drivers of C-CTLP could be mainly the course learning outcomes and calendar course description. The deliverables are lecture notes, assessment tools, lab experiments etc. and the resources course instructors and his assisting team: TAs, lab instructors, etc. The continuous improvement feedback loop is concerned with the content and delivery improvement and program outcomes/graduate

[Diagram: Course Continuous Improvement Loop at Course Level]
attributes improvements. Outcome-based assessment is the cornerstone of the new outcome-based accreditation process, and it will be discussed in the next section.

3. OUTCOME BASED ASSESSMENT: SHIFTING THE PARADIGM

The teaching and learning process is pretty complex, and it takes a very long period from the first-year enrollment to graduation. Students undergo a long series of courses, lab experiments, several assessment media, etc. The outcome-based accreditation shifted the paradigm from assessing what’s taught to what’s learned. What’s learned could be course level and could be program or degree level. The roots of graduate attributes or program outcomes date back to the late 1980s in the United States when there was a call to upgrade the engineering accreditation criteria to meet the industrial needs of developing skillset needed by industry, testing what’s learned rather than what’s taught, and incorporating continually improving engineering programs.

Outcome-based assessment measures what’s learned by identifying a set learning outcome. CEAB course information sheets mandate now allocation those learning outcomes for every and each course [2]. While working on OBACIS I [10] the issue of continues improvement was supposed to be addressed at the course level. The assessment or performance evaluation could be done in three ways:

1. Categorical assessment, performance activities can be grouped by categories: Assignments, Lab reports, projects, exams, etc.

2. Learning Outcomes Assessment, performance activities are mapped to individual course learning outcomes. Course assessment tools are mapped to learning outcomes and every learning outcome is mapped to a set of assessment tools.

3. Graduate attribution or program outcomes analysis. Course assessment tools are mapped to program outcomes or graduate attribute.

The three approaches could be classified as assessing what’s taught, what’s learnt, and what the market needs or what the program want to achieve. While the first and the second have major implications of individual improvement (course improvement or local improvement), the third has a major implication on overall program improvement.

The close-loop teaching, and learning process could be simplified at the course level. At that local loop every professor is empowered to lead the continuous improvement process from the three different perspectives of assessment.

The mapping process might seem more complicated; however, we already provided the tool that automate that mapping, the data collection, and the associated reports. The interested reader may refer to OBACIS I [10] for the tri-reporting system and OBACIS III [12] for the XI-App that should be handy to all faculty members.

4. GRADUATE ATTRIBUTES AT THE PROGRAM AND FACULTY LEVELS

Graduate attributes could be incorporated into the local course improvement loop or the overall program loop. For the former, the OBACIS XI-App [10] was designed, and for the latter, all courses for all professors are compiled at the program and faculty level analytics and assessment. This bottom-up approach is important for the overall assessment, identifying the course of actions to be taken, to compare different students’ performance across different course etc. The analytics engine of the OBACIS Win-App will be responsible for creating those comparative studies.

5. THE ANALYTICS ENGINE DESIGN GOALS

The analytics framework is designed to achieve the following goals:

1. Compile the data from different sources using well-structured document formats.

2. Analyze the performance of the students, the faculty, the program, and the faculty members, faculty administration, and staff.

3. Analyze the program maps and their associated indicators.

4. Develop periodic development.

5. Create resource management analytics.

6. Analyze Alumni and Industry surveys.
6. SUMMARY

The new outcome-based accreditation is still looked in the data collection phase. In this paper, we tried to unlock the paradigm and introduce a new closed-loop teaching and learning framework. The framework is composed of several constituents that influence the quality of the closed loop teaching and learning process (CTLP). The output of the CTLP is two-pronged: competent engineering students and continually improving program outcomes. The CTLF is assumed to model the overall teaching and learning process and incorporate a secondary continues improving process that analyze, review, and set courses of actions for improving the whole framework performance. CTLP could be monitored and improved at the program level using the P-CTLP conceptual model or at the course level using the C-CTLP conceptual model.

The outcome-based assessment shifted the paradigm from what’s taught to what’s learned. In this paper, we extended the notion to a third dimension where graduate attributes or program outcome should fit: what’s the market need. The data collected from the C-CTLP could be tracked down to the three perspectives since all of them may report different signals for different actions to serve the overall master goal of continuously improving our engineering programs. The OBAICS Data Analytics engine is currently being developed to support CTLF presented in this paper and is expected to be published in the near future.

REFERENCES

2. (CEAB), C.E.A.B., Questionnaire for Evaluation of an Engineering Program 2016.
7. Essa, E., et al., ACAT: a web-based software tool to facilitate course assessment for ABET accreditation, in The 7th International Conference Information Technology. 2010: Las Vegas, USA.