

CLOSING LOOP FOR CONTINUOUS IMPROVEMENT

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Abstract

A program sustains by its effort of continuous improvement. Continuous improvement process is a feedback mechanism based on executable plans on smaller processes that constitute the whole process. The Criterion 4 of Technology Accreditation Commission of Accreditation Board for Engineering and Technology (TAC of ABET) accreditation process is named as “Continuous Improvement” which requires a documented mechanism to improving an academic program on a continuous basis. Many programs attempt to meet this requirement by analyzing numerical grades of students to indicate the trend of program improvements over a period of two or three years. ABET look for clear evidence of activities for “Closing the Loop” for improvement of the program. The activities related to “closing the loop” may spread for a time period of a single semester to several years. A simple plan can be a map of planned activities for a few semesters and their assessment to find the trend of achievement. The continuous improvement process may be illustrated by a flowchart of feedback loops each connected to the bigger loop in the process. Smaller loops are usually the constituents of the bigger loop. The bigger loop detects a bigger picture while the smaller loops are engaged with specific agenda for improvement. This paper presents some realistic plans to document the method for closing the loop to meet the ABET requirements for “Continuous Improvement.”

1. Introduction

To describe the requirements for the “Criterion 4 - Continuous Improvement”, the TAC of ABET [1] defines

Assessment as, “one or more processes that identify, collect, and prepare data to evaluate the achievement of program outcomes and program educational objectives, and

Evaluation as, “one or more processes for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which program outcomes or program educational objectives are being achieved, and results in decisions and actions to improve the program.”

The requirements include [1] the documentation “of the ongoing process that uses the results of the evaluations of the Program Educational Objectives and the Program Outcomes to continuously improve the program.” This paper presents some plans to document the method for closing the loop to meet the requirements for “Continuous Improvement.”

2. Methods of Continuous Improvement

Closing loop is an important approach of continuous improvement of a program because any improvement option requires active engagement in assessing program outcomes and educational objectives and thereby locating areas to improve on. A broad picture can be shown with flowchart as shown in Figure 1.

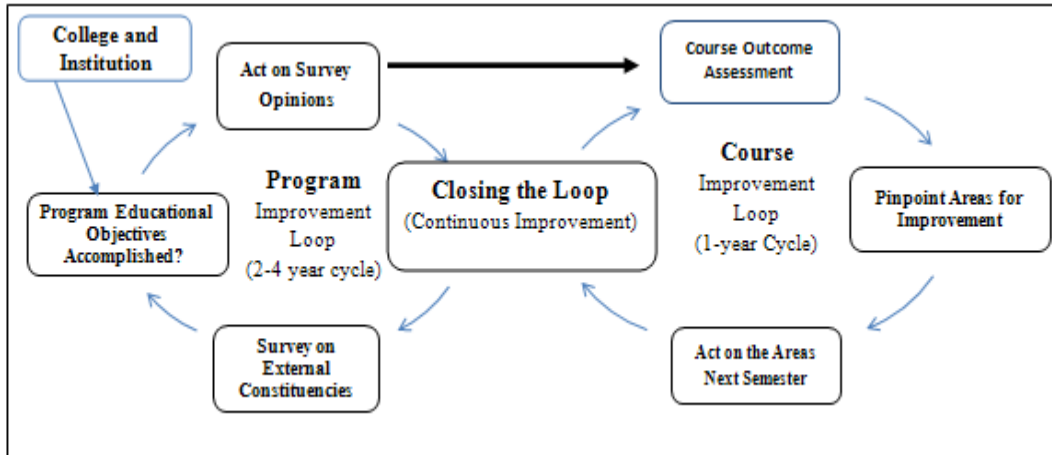


Figure 1. Method of continuous improvement

This diagram has two loops; one is course level improvement and the other is program level improvement. Each loop is directed to find areas to improve followed by measures or action to be taken for improvement. Finding areas to improve together with respective actions constitute what is called “closing the loop.”

The duration of the course level improvement is only a year because, based on the assessment of a course in a semester, an instructor can determine areas to improve. As well, the instructor can make specific recommendations/suggestions to implement when the same course is offered next time again. This process of suggestions/recommendations followed by implementation helps a loop to close. Implementation of the same method for all courses keeps a program in the path of continuous improvement.

The other loop is the program level improvement which can be assessed over a longer duration usually by conducting surveys on the performances of the alumni. The participants in the alumni survey are the alumni themselves and their supervisors. Improvement elements (survey opinions) found from these surveys are fed to the course level improvement cycle. Actions are taken in the form of updating course contents and possible introduction of new course(s) to reflect the growth and development in the industry. Thus the program level improvement relies on the course level improvement alone.

3. Closing Loop at Course Level

A set of selected courses, particularly junior and senior levels, are assessed to measure student performances in the program. Each course is designated to assess two or more outcomes. The outcomes, preferably called as a-k outcomes, prescribed by ABET [2] are used in the assessment process. The right hand loop in Figure 1 indicates the method of closing loop at course level for continuous improvement process. Figure 2 elaborates this loop.

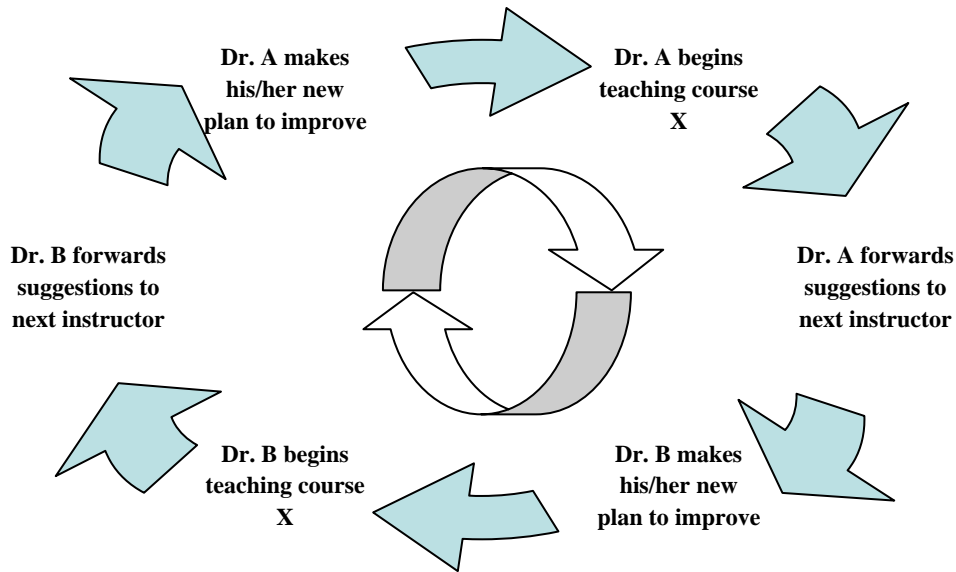


Figure 2. Closing loop for continuous improvement at a single course level

In this Figure, Dr. A prepares his/her lesson plan embedding the suggestions forwarded by Dr. B to improve the student performance in course X. After the semester is over Dr. A documents suggestions for further improvement when the same course is offered next time. This time the next instructor, Dr. B, picks up suggestions made by Dr. A and prepares new plan to teach the same course. This process makes a continuous loop in which one professor always implements suggestions of others and he/she makes suggestions for others to implement. Table 1 gives an example of how a professor prepares his/her lesson plan. Notice that the 5th and 6th columns are empty which are filled in with suggestions at the end of the semester which is exactly seen in Table 2.

Table 1. Action Plan for Continuous Improvement (to close loop) for Spring 2009. Submitted at the beginning the semester by Dr. A

Courses to teach (1)	Out-Comes (2)	Suggestions made by the Previous Instructors (3)	Action Plan for Continuous Improvement (4)	Problems Identified this Semester (5)	Suggestions Made to the Next Instructor (6)
CPET 1023	[f]	Emphasis should be on developing <u>strategy</u> to solve problem	Emphasis on problem understanding, analysis and problem design. Also stressed on modular programming approach using function		
	[k]	Strict timing rule should be in place	Report submission format presented and helped initially. Strong deadline of report submission maintained		
CPET 4113	[d]	Emphasize on problem design before programming.	Emphasize on problem analysis and design and progress at a slower pace		
	[f]	Modular programming approach.	Emphasize modular programming approach with procedures and macros.		
CPET 4111 (Lab)	[e]	Team of two students. Monitor each student contribution	Contribution of each member monitored. Asked to report each member's contribution to each lab.		
	[f]	Pre-lab need to be emphasized consistently. Student should be allowed to work in team.	Students worked in teams of two and they completed pre-labs most of the time.		

Table 2. Loop Closed for Spring 2009. Submitted at the end of the semester by Dr. A.

Courses Taught (1)	Out-Comes (2)	Suggestions made by the Previous Instructors (3)	Action Plan for Continuous Improvement (4)	Problems Identified this Semester (5)	Suggestions Made to the Next Instructor (6)
CPET 1023	[f]	Emphasis should be on developing <u>strategy</u> to solve problem	Emphasis on problem understanding, analysis and problem design. Also stressed on modular programming approach using function	Lack of practice on programming was observed	Some designated in – laboratory programming work should be implemented
	[k]	Strict timing rule should be in place	Report submission format presented and helped initially. Strong deadline of report submission maintained	Students were seen to respect the timeliness in submitting take home tests. Some did not pay attention in block diagram	Strict timing rule on report submission should be in force
CPET 4113	[d]	Emphasize on problem design before programming.	Emphasized on problem analysis and design, progress at a slower pace.	Some students were seen less interested in making graphical presentation required in the program analysis and design	Problem analysis, design and problem solving should be emphasized.
	[f]	Modular programming approach.	Emphasized modular programming approach with procedures and macros and progressed at a slower pace.	Modular programming approach with function emphasized.	Weakness in programming noticed. Some did not emphasize on the basic structure (requirements) on microprocessor programming

	[e]	Team of two students. Monitor each student contribution	Contribution of each member monitored. Asked to report each member's contribution to each lab.	Some students remained absent during lab time making assessment of team effort difficult	Absentee students should be regrouped to assess team work
CPET 4111 (Lab)	[f]	Pre-lab need to be emphasized consistently. Student should be allowed to work in team.	Students worked in teams of two and they completed pre-labs most of the time.	Some students remained absent labs. These made difficult to manage teams. They were allowed in a different schedule. Lab report preparation remained as a concern.	Pre-lab need to be emphasized consistently. Student should be allowed to work in team. Lab report should be emphasized more on Result and Discussion section.

4. Results and Discussion

Student performance improvement depends on various factors. Since the student population in a course is different every semester, comparison of performance in two semesters is not adequate scientific validation. However, such comparison can show the trend of student performances. Nonetheless, this trend is informative and can be useful to act upon. Table 3 shows a sample of results in which lesson plans were based on suggestions made by previous instructor. In most cases, student performances are seen to improve. However, the performance in outcome [k] for course, CPET 1023 declined. One possible reason is the different student populations in the course in two semesters. The other reason may be a reduction of emphasis from the instructor as the student performance in the previous semester (Fall 2008) was good enough (84.2%) to pay attention.

Table 3. Results of closing the loop by embedding suggestions of previous instructors

Courses	Mapped Outcomes	Average Scores				Comments
		Spring 2008		Spring 2009		
		n	Average Scores, %	n	Average Score, %	
CPET 1023	[f]	15	68.4	24	72.1	Improved
	[k]		84.2		72.4	Declined
CPET 4111	[e]	8	73.9	18	78.1	Improved
	[f]		59.2		81.0	Improved
CPET 4113	[d]	24	72.8	19	80.2	Improved
	[f]		65.0		79.2	Improved

5. Conclusion

Continuous effort on closing the loop helps improve student performances. Comparing the performances between two different student population groups may not have scientific importance. However, the trend of performance that it provides is certainly useful in decision making in an effort to continuous improvement. Table 3 is an example of such effort of continuous improvement via the effort of closing the loop.

References

- [1] ABET Self-Study Questionnaire, 2007. <http://www.abet.org/Linked%20Documents-UPDATE/Program%20Docs/T003%20Self-Study%20Questionnaire%206-28-07.doc>. p.10
- [2] PROGRAMS Criteria for Accrediting Engineering Technology Programs, 2009. <http://abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/T001%2009-10%20TAC%20Criteria%208-27-09.pdf> p.6

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ⁱ The courses in column 1 are mapped to measure these outcomes. These outcomes are taken from the so-called a-k outcomes of ABET [2]