

ASSESSMENT IMPLEMENTATION AT COOPER UNION

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Abstract ---- *For the past few years Cooper Union has been working on the implementation of assessment processes in engineering projects, courses, and programs, as required in the new criteria for accreditation by the Accreditation Board for Engineering and Technology (ABET). The assessment program has been successful and is now fully institutionalized. Faculty participation in assessment has contributed to student learning progress, as measured by competency development. Assessment, in addition, has contributed to make students' participation in the educational process more active, to raise their confidence in their own skills and abilities, and to make their learning a more successful one.*

Index Terms --- *Formative and summative assessment, one-on-one interaction, implementation processes and strategies*

I. INTRODUCTION

Cooper Union is a small, innovative engineering school in Manhattan routinely ranked among the top three undergraduate engineering schools in the United States. Cooper belongs to the Gateway Coalition, an educational enterprise participated by six other American engineering schools and fully funded by the National Science Foundation with the purpose of promoting educational innovation. One such innovation has been the introduction of competency-based curricula, and the use of assessment processes to monitor progress.

Gateway support and expertise have been critical in the development and institutionalization of an increasingly comprehensive Assessment Program at the Cooper Union School of Engineering. Just before Gateway started in 1992, a few assessment practices were in place at Cooper, mainly procedures conducted at the institutional level with little effect within the classroom.

II. THE PROCESS

Gateway's vision and implementation strategies established the initial impetus and provided continued support for a process that at Cooper developed gradually in several steps: a) assessment of Gateway projects; b) assessment of courses; c) extension of assessment to other courses and programs; d) preparation of Departmental Assessment plans; e) school wide assessment plans.

The assessment program was introduced by the

Director of Assessment, Mr. Gerardo del Cerro, on a one-to-one basis, and started with a few Gateway projects. Mr. del Cerro spent time with each faculty member explaining the value of the assessment program, illustrating how it would work, describing his role as special resource and facilitator, and gaining trust.

The program development strategy was to present assessment as useful for the pedagogical work of engineering faculty and to extend it to courses and programs whenever possible. In order to do that, an effort was made to customize a set of ABET criteria with the interests and needs of specific courses and projects. Faculty could this way see assessment as a tool of their own, rather than a strategy to monitor their work, and began to participate.

Engaging faculty in assessment often required continued explanation of the process at each of the implementation levels (planning, data gathering, feedback). The institutional commitment to the process by the Dean of Engineering and the Gateway IAL were critical for advancing our goals.

Especially important was also the collaboration of the Department Chairmen who, in different degrees, contributed to the acceptance and development of assessment procedures by faculty within their own Departments. The Civil and Mechanical Engineering Departments started early. The Electrical and Chemical Engineering Departments followed. Since the assessment program developed simultaneously at different levels (institutional, program, and classroom), the results created a multiplier effect that gave impetus to the whole process. Assessments being done within the classroom had an effect on the ongoing departmental assessment plans, and the lessons learned in implementing these plans were used for developing school wide assessments.

Today, the Assessment Program is practically institutionalized through the Office of Assessment. The feedback process (see Fig. 1) is designed to involve in various degrees all parties in the Cooper community (Administration, Faculty, Staff, Students, Alumni, and Employers), and to utilize the information generated for an effective and continuous improvement of the educational program. To this effect, a number of school wide assessments are routinely conducted. The content, scope and results of assessment at Cooper can be grasped in Table 1 below.

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III. LESSONS LEARNED

1. Assessment can be a powerful and effective communications tool. The development of the assessment process has enhanced the interaction between faculty and students at Cooper Union over a fundamental, common concern: the educational process. Assessment has also helped to focus attention on the benefits of a *competency-based, learner-centered education*, which is making students more aware of, and more responsible for, their own education, and is also contributing to notable changes in faculty's teaching habits.

The process of assessment of courses that has contributed to these changes is shown in Fig. 2. It is important to note that assessment focuses on the students' learning process rather than faculty performance. This is reflected in the thrust of the assessments being conducted at Cooper and the nature of the questions asked to the students.

2. In a small school like Cooper Union, the implementation of assessment on an individual basis, through one-on-one, in-depth interaction with faculty, has proved to be an effective approach to changing the mind set. Indeed it has been critical in order to build faculty trust and support for the process.

The evaluator strategy was two-fold: first, to have faculty try assessment as an intellectual exercise rather than a duty imposed from above; second, to relentlessly disseminate the successful examples of assessment conducted in the school. Although there is still work to do in terms of embedding assessment in the classroom and making it effective as a learning-driver strategy, the results are encouraging so far. The evolution between Gateway Year 1 (1992) and gateway Year 8 (1999) is very positive as seen in Fig. 2 below.

3. When treated as *emerging professionals*, that is, when given the means to learn and develop competencies and abilities critical for their professional careers (as defined by Gateway and ABET), Cooper students behave very professionally indeed: their participation in the educational process becomes more active; their confidence in their own skills and abilities increases, and their learning is more successful.

Most Cooper students exposed to a competency-based approach to education in selected courses show very positive results, as measured by degree of competency development. Almost two thirds of the students participating in these assessments have developed the competencies "to a great extent" or "to a very great extent," and less than one quarter of the students manifest to have develop the competencies "to a limited extent" or "not at all" (see Table 2).

This table shows that a new type of engineer is in the making at Cooper: an engineer who communicates better with peers, instructors, and professional engineers; who is

sensitive to the importance of teamwork and is more exposed to it; who understands the importance of individual research and life-long learning; and who is aware that engineering is a design activity of open-ended, interdisciplinary solutions.

4. The assessment process contributes to changes in teaching styles, particularly when assessment serves the purpose of enhancing communication between instructors and students. At Cooper, more faculty are adopting new approaches to teaching because of Gateway's stress on curriculum innovation, but also because now faculty know more about the students' learning habits and styles. This is a consequence of various self- and peer assessments introduced in the classroom and of an overall emphasis on a learner-centered, individualized education promoted at Cooper under Gateway auspices.

5. Implementation of longitudinal tracking and dissemination of cohort data analysis and results, now a common practice at Cooper, represent a sea change in the practices of institutional data gathering, and have revealed important information about the educational *process* at Cooper Union. A more accurate appraisal of data on retention, graduation and drop out rates resulting from such longitudinal analyses has contributed to institutional actions which in turn have begun to yield positive results, visible in each of the indicators just mentioned.

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Assessment & Feedback Process**

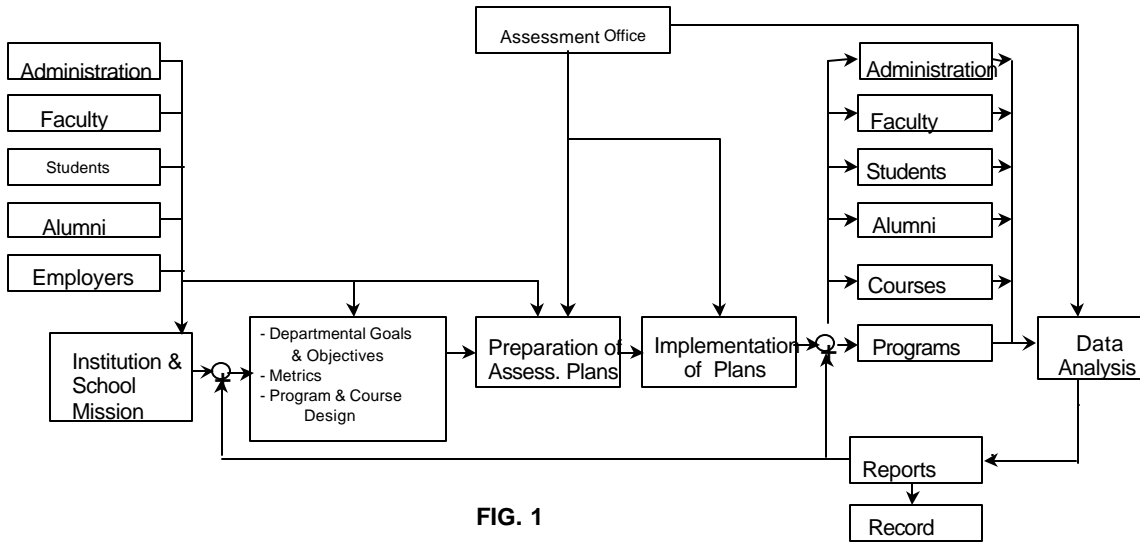


FIG. 1

**The Process of Assessment of Courses
The Cooper Union**

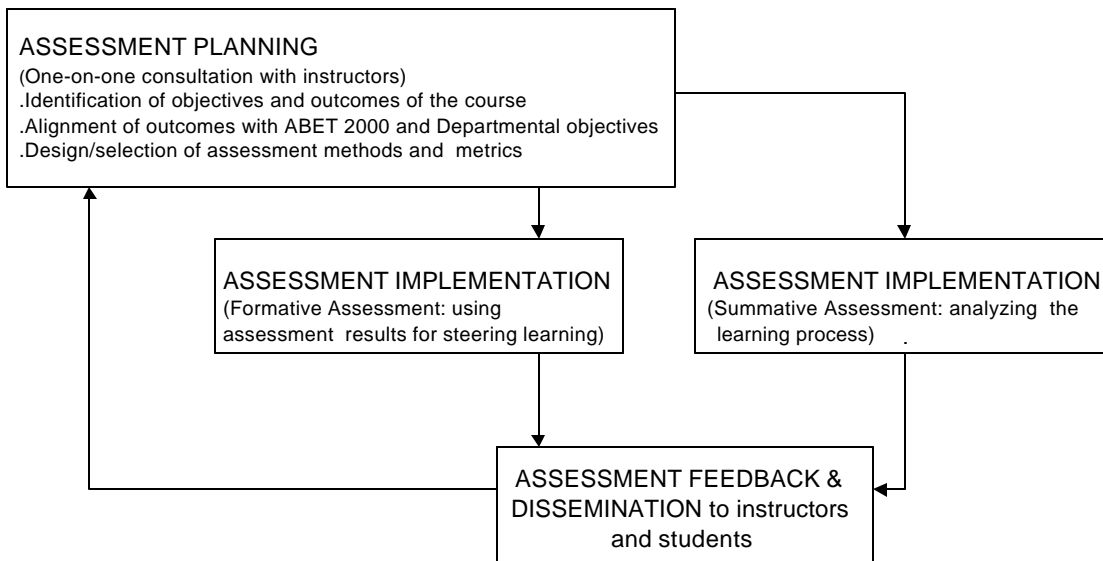


FIG. 2

Table 1. Institutionalization of Assessment at Cooper Union. School wide assessments.

PROGRAM	PURPOSE	STARTED/ PERIODICIT Y	RESULTS/COMMENTS	DISEMINATION
Department Assessment Plans	To measure achievement of departmental objectives and outcomes.	1998/ To be revised upon results	All four engineering Departments have drafted and discussed their assessment plans.	Department Chairmen, Faculty, Dean's Office
Course Assessment Plans	Student self - and peer assessment on development of specified learning outcomes.	1997/ Semestral	About 25% of all courses are routinely assessed and evaluated. About 300 students have participated in the process. About 2/3 of students have developed competencies "to a great extent" and "to a very great extent."	Instructors, Students, Department Chairmen
Alumni Survey	To gather feedback from cohorts of engineering alumni on their further education, employment status, and their perception of Cooper education.	1996(Revised 1999)/ Yearly	Survey sent-out via E-mail to about 1800 alumni; 29% response rate. On-going analysis of results. On-going feedback to Departments.	Dean's Office, Department Chairmen, Administration, Faculty, Student representatives
Exit survey	To gather feedback from graduating senior students on the quality of Cooper education.	1996(Revised 1999)/ Yearly	An electronic survey was pre-tested in the Fall 1999. Full implementation in early spring 2000. Analysis of results will include information from Dean of Students Office.	Department Chairmen, Dean's Office, administration, Faculty, Student representatives
Entry survey	Establishment of baseline on competency development for individual longitudinal tracking.	1996(Revised 2000)/ Yearly	Information on career plans is currently being gathered by Dean's Office staff.	Department Chairmen, Dean's Office, Administration, Faculty, Student representatives
Recruiters Survey	To gather feedback from recruiters on performance of students during job interviews.	1997/Yearly	Administered through Dean's Office	Dean's Office, Career Services
Employers Survey	To gather feedback from employers on job performance of Cooper graduates.	1998/Yearly	Administered through Career Services. Survey was modified in 1998 for ABET purposes.	Department Chairmen, Dean's Office, Administration, faculty, Student representatives
Summer Internships	To gather feedback from supervisors of Cooper interns.	1996/Yearly	Administered through Career Services. Survey was modified in 1998 for ABET purposes.	Dean's Office, Departments
Study Abroad Program	To gather feedback from supervisors on performance of Cooper students abroad, and from students on the quality of the program.	1998/Yearly	Administered through E-mail. Very high rate of response. Analysis of results will add to individual reports by students	Dean's Office, Departments, Student representatives
Longitudinal Tracking	Cohort data on retention, graduation and drop out rates, by department, gender and ethnicity.	1998/Yearly	Cohort data allowed accurate knowledge of program development and enabled institutional action. Initiated by Assessment Office; now conducted by Office of Admissions .	Dean's Office, Department Chairmen

FIG. 3

The Cooper Union Assessment at a Glance

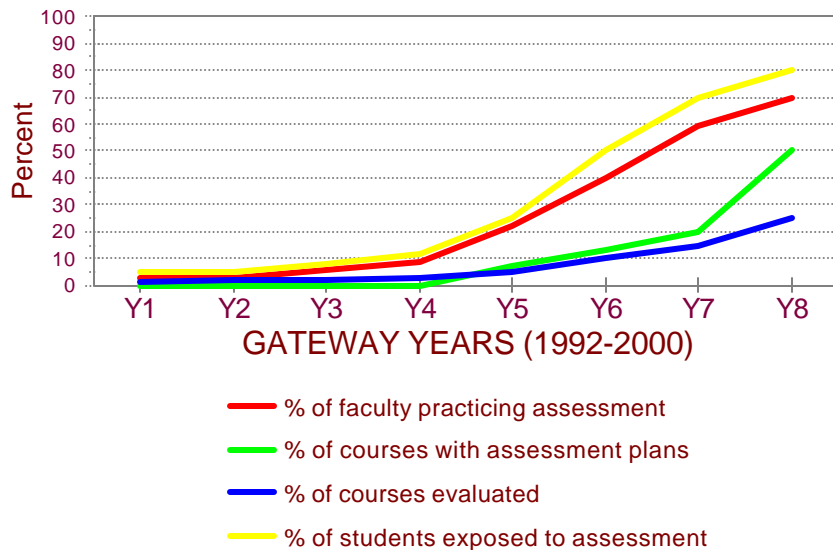


Table 2. Student Self-Assessment at Cooper Union

Student Perception of Competency Development Average of 15 engineering courses assessed between 1997 and 1999. N= 486. 300 students impacted.	% of students who developed the competencies...				
	Not at all	To a Limited Extent	To a Moderate extent	To a Great Extent	To a Very Great Extent
COMPETENCIES					
Ability to use technology	0	8	8	63	21
Analytical skills	0	14	7	59	20
Research skills	2	6	30	48	14
Understanding of the design/experimentation process	4	10	22	45	19
Communication skills	8	14	20	42	16
Teamwork	10	20	13	36	21
Creative problem solving	0	15	26	35	14
Life-long learning	13	17	13	34	13
Global awareness	12	25	18	33	12
Project Management/Leadership	6	20	26	32	17
Humanistic values	20	21	24	20	15
AVERAGE	7.2	15.3	18.6	41.3	17.7