Predicting Change: What Increases Faculty use of Design and Group Projects?

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Abstract

Stakeholders often want evidence that curricular and pedagogical reforms will endure, but institutionalization of reforms is typically assessed superficially, if at all. This study involved developing and testing an Institutionalization Process Model. The model was developed from a qualitative investigation of factors influencing institutionalization of externally-funded curricular and pedagogical reforms at seven engineering schools. The reforms focused on content (design), method (group projects) and improving the climate for students underrepresented in engineering. The model posits that regulative, normative, and cognitive institutionalization processes affect the likely diffusion of curricular and pedagogical reforms beyond those directly involved in the reform effort. Institutional data and a faculty survey conducted at the seven engineering schools were used to test the model using logistic regression. Findings showed that cognitive institutionalization indicators had a stronger influence than regulative or normative indicators on diffusion of design and group projects. The normative indicator of perceived support for teaching was the only significant predictor of increased sensitivity to the needs of underrepresented students.

Introduction

Many engineering colleges and departments have spend much money, time, and effort to revise and reform their undergraduate curricula and encourage teaching improvement. Many of these reform efforts are also supported by external funding agencies such as the National Science Foundation. Although funding and accrediting agencies often want colleges and universities to provide evidence that recent curricular reforms will endure, institutionalization of change is typically assessed superficially—if at all.

Institutionalization occurs as organizational participants no longer perceive the change as an innovative special project, but as an integral part of organizational functioning. Institutionalization of curricular and pedagogical change in colleges and universities is likely to involve regulative changes in organizational structures, normative changes in organizational values, and cognitive changes in beliefs and behaviors. Structural evidence of institutionalization might be found in mission and policy statements, administrative positions, and budgets. For example, a college might attempt to regulate changes by including a

statement about the importance of making learning experiences relevant to engineering practice in its mission statement, and by allocating funds for a undergraduate studies coordinator to help faculty incorporate design projects in their courses. Such structural modifications are unlikely to lead to make much difference in practice, however, unless there are also corresponding changes in the normative climate of the college. "Unless an innovation becomes valued, it will lack a constituency capable of lobbying for its continuation"[1]. Thus, team-based design projects are more likely to persist as part of a college's curriculum when administrators and faculty value them as a means to improve students' overall learning experiences. They are less likely to persist when administrators and faculty view such experiences as peripheral to students' learning of content. Despite its importance to the change process, institutionalization often receives little consideration by organizational participants[2]. To address this gap, this study developed and tested a conceptual model of institutionalization processes.

This study was conducted as part of the evaluation of Engineering Coalition for Excellence in Education and Leadership (ECSEL), a coalition funded by NSF from 1990-2000 to increase active and collaborative learning in the form of team-based design projects, and to increase the participation of women and underrepresented minorities in engineering. ECSEL schools include City College of New York (CCNY), Howard University, Massachusetts Institute of Technology (M.I.T.), Morgan State University, Penn State University, and the Universities of Maryland and Washington. This study was conducted in two phases, first developing and then testing the institutionalization model.

Phase 1: Model development

The first phase of the study began after ECSEL had already implemented the first series of curricular reforms and was beginning the next series. ECSEL reform efforts from 1990-95 focused on development of hands-on design courses for first-year students. Reforms from 1996-2000 focused on adding design projects to existing or new upper division courses. This shift in emphasis provided an opportunity to examine what happened to reforms of first-year courses when attention and funding shifted to new projects.

As part of the coalition evaluation, nearly 200 interviews were conducted in 1996 with administrators, faculty, and staff and ECSEL engineering schools. Interviews included questions about how the shift in ECSEL's goals had affected institutionalization of the initial reforms undertaken at each school during the first five years, and whether or not they perceived congruence between their personal goals, ECSEL goals, and the goals of their engineering schools. Participants' comments revealed what they regarded as indicators of permanent change. These indicators were classified using institutional theory, a sociological framework for understanding both change and resistance to change[3]. Institutionalization is defined as the process by which a significant new structure or practice is incorporated into a system of existing structures and practices[4]. Institutionalization processes may be regulative, normative, or cognitive. The Institutionalization Process Model (see Figure 1) posits that diffusion of curricular and pedagogical reforms is the product of regulative, normative, and cognitive institutionalization processes.

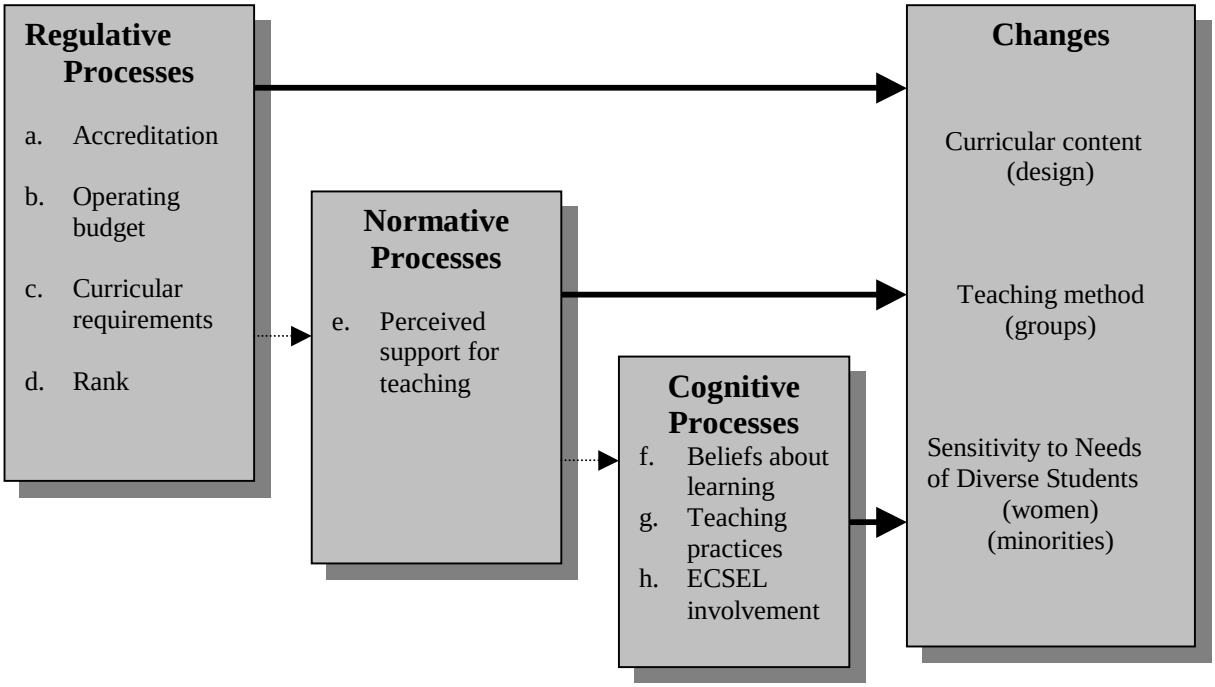

Figure 1: Institutionalization Process Model

Regulative Institutionalization Processes

Regulative processes involve formal rule-setting, monitoring, and sanctioning activities. Individuals may acknowledge the existence and even the validity of institutionalized rule systems without necessarily believing the rules are fair, right, or appropriate. Institutionalization occurs as individuals find it expedient to comply with the rules. Indicators of regulative institutionalization processes (as discussed by ECSEL participants) include:

a) Accreditation: By 2001, all engineering schools must be reviewed under new Accrediting Board for Engineering and Technology (ABET) criteria which require that colleges demonstrate that their students have achieved skill competencies in areas such as design, communication, and teamwork. Many ABET-required competencies are introduced in ECSEL first-year courses. ECSEL participants believed that ABET's new requirements legitimized their reform efforts. As one department chair said, design courses would continue even without external funding because the courses met ABET criteria. The Institutionalization Process Model hypothsizes that the sooner a school was due for accreditation review, the more faculty would implement design, group, and diversity reforms that met accreditation criteria.
b) Operating Budget: Initially, NSF-funding designated for ECSEL provided most of the financial support for the innovative courses and pedagogical reforms. Deans and

department heads at several ECSEL schools indicated these efforts were more than a soft money fad when they began paying for them from regular department or school budgets. Institutionalization appears less certain for programs that are still primarily supported by funding from external sources. A dean asserted, "questions of institutionalization are financial." When administrators assume financial responsibility for reforms by funding them from the operating budget rather than "soft" money, faculty are likely to perceive the importance of the reforms to the department or college.

c) Curricular Requirements: At some ECSEL schools, first-year design courses are required for graduation and enrollments are high. At other ECSEL schools first year design courses are electives. After initial student interest, enrollments declined. Thus, when an reformed course becomes either a major or school requirement for graduation or a prerequisite for other classes, enrollments appear to remain high, and the course becomes an enduring part of the curriculum.
d) Faculty Rank: During ECSEL's first five years, a few junior faculty who invested extra time and effort to develop and teach first-year design courses were denied tenure by their university review committees. The shock reverberated throughout the coalition. Since then, active participation in ECSEL reforms at a national level has contributed to positive promotion decisions for some faculty at several ECSEL schools. Pre-tenure faculty may be more likely to be attuned to promotion and tenure criteria consistent with ECSEL's goals than their colleagues who already have tenure.

Normative Institutionalization Processes

Normative processes are grounded in a collective sense of what is appropriate. Similar to regulative processes, normative processes involve a sense of following rules. Individuals follow normative rules, however, because they perceive that doing so is morally appropriate as well as legally correct. Institutionalization occurs as individuals deem it socially responsible to honor informal obligations.

e) Perceived support for teaching: Deans' and chairs' abilities to regulate faculty behavior directly are limited. In academic settings, effective administrators lead by moral persuasion. ECSEL experiences suggest that visible administrative commitment to teaching contributes to diffusion and durability of reforms. At some ECSEL schools, deans and chairs even taught sections of the first year design course themselves. In addition, faculty may feel more comfortable adopting innovative teaching methods if they perceive their colleagues are also supportive of teaching and curricular reform. Initially, ECSEL did an excellent job of involving faculty who were already interested in design, often because of their prior experiences working in industry. Other faculty because interested in implementing design or group projects only after they had been assigned to teach the first-year course. In some cases, however, practical responsibility for teaching design was consigned to an enclave of adjunct faculty and graduate teaching assistants.

Cognitive Institutionalization Processes

Cognitive processes involve widespread acceptance and practice of an activity. Institutionalization occurs as individuals take it for granted that a certain way of doing an activity is the best or only way. Further evidence is provided when individuals carry aspects of

the activity into other endeavors, or when other individuals or organizations adopt similar activities[5]. After being assigned to teach ECSEL first year courses, some faculty who had initially resisted ECSEL reforms began to incorporate team-based design projects in other courses they taught.

f) Beliefs about learning: One predictor of cognitive institutionalization of curricular and pedagogical reforms may be when more and more faculty members believe that undergraduate students should—and, in fact, *do*--learn the concepts and practices advocated by the reform effort. In the ECSEL coalition such concepts include design, teamwork, and open-ended, real-world problems.
g) Faculty behaviors: Faculty members' use of innovative practices such as using computers or active, student-centered practices in their teaching may also be associated with adoption of innovations advocated by ECSEL.
h) ECSEL involvement: Finally, involvement in reform efforts constitutes a special category of faculty behavior for this analysis. The model hypothesized that faculty who were involved with ECSEL would be more likely that faculty who were not directly involved to adopt changes consistent with the coalition's goals.

Changes

Institutionalization occurs as increasing numbers of individuals adopt the behaviors and attitudes associated with the innovation. ECSEL's two primary goals were to incorporate engineering design in undergraduate courses and curricula, and to increase the diversity of engineering graduates by improving the climate for women and underrepresented minority students. Design can involve both curricular content (principles and processes of problem identification, specification, solution, building, and testing) and teaching method (collaborative learning on team-based projects.) Coalition attempts to achieve diversity goals involved some sensitivity training for faculty in addition to outreach and support efforts for students.

Phase 2: Model Testing

The second phase, testing the Institutionalization Process Model, began from the premise that institutionalization of ECSEL ideas and practices will occur as increasing numbers of faculty adopt the teaching methods and attitudes the coalition has promoted. Data from three sources were used to assess the relationships between regulative, normative, and cognitive indicators of institutionalization processes and faculty members' self-reported changes in practices and attitudes advocated by ECSEL. First, interviews with deans, chairs and principal investigators in Fall 1999 supplied information about number of years to ABET review, past and current funding levels for ECSEL courses, and which ECSEL courses were required for graduation. Second, course reports completed by local evaluators at each ECSEL campus in 1997-98 supplied information about the total number of engineering courses and ECSEL courses on each campus. The "ECSEL Faculty Survey," administered in Fall 1997, provided the third data source for these analyses. The survey asked faculty about their level of involvement with ECSEL, the frequency of their use of various teaching practices, their beliefs about student learning on their campuses, and their perceptions of support for teaching from their college colleagues and leaders. The survey also asked whether their approaches to teaching or their

sensitivity to the needs of underrepresented engineering students had changed since 1990, the year ECSEL began.

CSHE mailed the survey to a sample of 663 faculty members at the seven ECSEL institutions. Of that number, local evaluators identified 267 as having been involved with the coalition, and 396 as having no ECSEL involvement. There were a total of 1198 engineering faculty at the seven ECSEL schools. Surveys were sent to all faculty at the smaller schools, including CCNY, Howard, and Morgan State. Surveys were mailed to a random sample of 100 non-ECSEL faculty at the larger schools, including Penn State, and the Universities of Maryland and Washington. At the request of the institution, surveys were only mailed to faculty involved with ECSEL at MIT.The overall response rate was 44 percent, or 291 faculty. Information about gender, ethnicity, or department was not collected for this analysis. Consequently we are unable to evaluate the degree of response bias that may be present. Respondents who had been involved with the coalition (N = 162) were more likely to respond that those who had not (N = 112). Table 1 lists and defines the independent variables used in these analyses.

Four items assessed the dependent variable involving changes in curricular content,teaching methods, and sensitivity to the needs of diverse students. Faculty were asked to report whether there had been decreases, no change, or increases over the past seven years in their:

- Use of design projects in your undergraduate engineering courses,
- Use of group or team projects in your undergraduate courses,
- Sensitivity to the needs of women students,
- Sensitivity to the needs of underrepresented minority students,

Because only 1.1 percent or less of the responding faculty reported decreases in each of these areas, those responses were combined with the "no change" responses to set up a scale where 0 = "no change or decrease" and 1 = "increase."

Analytical Methods

Factor analyses were used to determine whether regulative, normative, and cognitive institutionalization indicators grouped into distinct dimensions. Logistic regression was used to assess the "net effect" (i.e., after controlling for all others variables in the model) of each institutionalization indicator on faculty members' teaching, sensitivity, and scholarship. Institutionalization process indicators were entered into the analyses in four sequential steps to assess whether adding an additional set of variables accounted for significant increases in the variance in the dependent variables. In each step, the model was assessed via the goodness of fit ratio (G^2/df), proportion of cases correctly predicted (PCP), and the χ^2 for the model. A particular logistic regression model is acceptable whenever the G^2/df ratio is less than 2.5[6]. PCP provides an overall indicator of the goodness-of-fit of the model. PCP values greater than .55 signify a good fit for the model. The model χ^2 assesses whether the independent variables (as a group) are significantly associated with the dependent variable. Regulative, Normative, and Cognitive indicators were entered on successive steps. ECSEL involvement was added separately on the fourth step due to its expected power in predicting the various changes
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Table 1. Variable Names, Type, Values and Data Source

Variable	Type of Variable	Values	Data Source
Regulative Indicators			
• ABET (years to review)	Item	Range = 1-4 Mean = 2.8	Administrator Interviews
• Operating Budget (% of course support from institutional funds)	Item	Range = 1-3[a] Mean = 2.5	Administrator Interviews
• Curricular requirement (ECSEL courses required as % of total courses)	Item	Range = 1-3[b] Mean = 1.6	Administrator Interviews & Course reports
• Faculty Rank	Item	Range = 1-4[c] Mean = 3.16	Faculty Survey
Normative Indicator			
• Support for Teaching Scale	Scale items include: 1) my college of engineering's administration supports teaching, 2) sufficient incentives are given for teaching in my college, 3) my university's administration supports teaching, 4) faculty in my college support teaching, 5) teaching is appropriately weighted in the promotion & tenure process in my college, 6) my department chairperson supports teaching	Range = 1-4[d] Mean = 2.68 S.D. = .62 Alpha = .87	Faculty Survey
Cognitive Indicators			
• Beliefs (about student learning in own college)	Scale items: 1) graduates of my college understand the design process, 2) graduates of my college can apply the design process, 3) students in my college learn teamwork, 4) graduates of my college understand how groups work, 5) graduates of my college are well-prepared for the engineering work force	Range = 1-4[d] Mean = 3.05 S.D. = .48 Alpha = .85	Faculty Survey
• Use computers in teaching	Scale items: Use of 1) computational tools or software, 2) computer-aided or machine-aided instruction	Range = 1-3[e] Mean = 2.16 S.D. = .61 Alpha = .60	Faculty Survey
• Use student-centered teaching practices	Scale items: Use of 1) student presentations, 2) student evaluations of other students' work, 3) term/ research papers, 4) multiple drafts of written work	Range = 1-3[e] Mean = 1.96 S.D. = .54 Alpha = .73	Faculty Survey
• ECSEL involvement	Item	0=no, 1=yes Mean = .60	Faculty Survey

[a] 1 = low (67-75%), 2 = medium (80-81.1%), 3 = high (89.2-95%)
[b] 1 = low (0.9-2.2%), 2 = medium (3.1-3.6%), 3 = high (7.7-14.9%)
[c] 1 = instructor, 2 = assistant professor, 3 = associate professor, 4 = full professor
[d] 1 = strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree
[e] 1 = never, 2 = sometimes, 3 = often

Tables 2 and 3 report the results of the best fitting model for each dependent variable. The logistic regression coefficients identify those institutionalization indicators that, net of all the other variables, are significantly associated with increases in the use of design projects, group projects, and sensitivity to the needs of women or minority students. The Delta-P statistic reflects the incremental change in the dependent/outcome variable (e.g., change in use of design) due to a unit-change on the measurement scale of the independent variable (e.g., use of student-centered teaching practices).

Findings

Increased Use of Design Projects: Sixty-three percent of all survey respondents indicated that they had increased their use of design projects in their undergraduate classes between 1990 and 1997. The net effect of the institutionalization indicators on changes in use of design in undergraduate teaching is shown in Table 2. Use of student-centered teaching practices (p<.001) and ECSEL involvement practices (p<0.10) both affected the likelihood that a faculty members had increased their use of design projects. Every one-unit increase (on a 1-3 scale) in the use of student-centered teaching practices increased the likelihood of that faculty were using more design projects by 21 percent. Faculty involved in ECSEL were 13 percent more likely than those not involved to have increased their use of design projects in undergraduate classes. This model correctly predicted nearly 68 percent of the cases.

Table 3. Predictors of Increased Use of Design Projects and of Group Projects
(scale ranges in parentheses)

Variables	Increased Use of Design Projects		Increased Use of Group Projects	
	Beta	Delta-P	*Beta*	Delta-P
Regulative Indicators				
Years to ABET review (1-4)	.24		-.25	
Operating budget (1-3)	-.51		.58	
Curricular requirements (1-3)	-.01		.53*	.11
Faculty rank (1-4)	.14		-.12	
Normative Indicators				
Perceived support for teaching (1-4)	-.17			
Cognitive Indicators				
Beliefs about student learning (1-4)	.47		.50	
Computer-aided teaching practices (1-3)	-.05		-.09	
Student-centered teaching practices (1-3)	1.16****	.21	.80**	.16
ECSEL Involvement (0-1)	.60*	.13	.86***	.17
N	212		214	
Probability	.63		.64	
G^2	246.10		240.53	
df	203		205	
G^2/df	1.21		1.12	
PCP	67.9%		76.6%	
χ^2 , df	26.90, 9***		27.04, 9****	
* p<0.10, **p<.05, ***p<.01, ****p<.001				

Increased Use of Group Projects: Sixty-four percent of the survey respondents indicated that they had increased their use of group projects in their undergraduate classes between 1990 and 1997. The net effect of each institutionalization process indicator on the likelihood of increased use of group projects as determined by logistic regression is also summarized in Table 2. Net of all other indicators, the proportion of ECSEL courses required for graduation ($p<0.10$), use of student-centered teaching practices ($p<.05$), and ECSEL involvement ($p<.01$) predicted increased faculty use of group projects. ECSEL involvement had a large and strong impact. Faculty involved with ECSEL were 17 percent more likely to have increased their use of group projects than faculty not involved with ECSEL. Use of student-centered teaching practices also had a strong impact. For every one-unit increase (on a 1-3 scale) in the use of student-centered teaching practices, faculty members (regardless of any ECSEL involvement) were 16 percent more likely to use group projects in their undergraduate classes. Although ECSEL courses as a percent of those required for graduation was significant at $p < 0.10$ confidence level, the impact of this variable was equivocal. Increased use of group projects was most likely among faculty who worked at schools where the ECSEL courses required for graduation as a percent of total engineering courses were in the medium range (between three and four percent). Nevertheless, this model is especially strong, predicting correctly 76.6 percent of the cases.

Increased Sensitivity to the Needs of Women Students: Fifty percent of the faculty indicated their sensitivity to the needs of women students had increased over the previous seven years. Cognitive institutionalization indicators were not significant, and their inclusion reduced the goodness-of-fit of data of the model. The best fitting model for the net effect of each predictor of increased sensitivity to the needs of women students (which included only regulative and normative indicators) is shown in Table 3. The only indicator significantly associated with increased sensitivity to the needs of women students was perceived support for teaching ($p<01$). Every one-unit increase (on a 1-4 scale) in faculty members' perceptions that their colleagues and administrators supported teaching was associated with a 16 percent increase in the likelihood that faculty had become more sensitive to women students' needs. This model correctly predicted nearly 60 percent of the cases.

Increased Sensitivity to the Needs of Underrepresented Minority Students: Fifty percent of the faculty respondents indicated their sensitivity to the needs of underrepresented minority students had increased since 1990. As with the model for sensitivity to women students' needs, the inclusion of the cognitive institutionalization indicators reduced the goodness-of-fit between the data and the minority students' needs model. The best-fitting model, which includes only regulative and normative indicators, is presented in Table 3. The only indicator significantly associated with increased sensitivity to the needs of minority students was perceived support for teaching ($p<.01$). Every one-unit increase (on a 1-4 scale) in faculty members' perceptions that their colleagues and administrators supported teaching was associated with a 16 percent increase in the likelihood that faculty had become more sensitive to minority students' needs. This model correctly predicted nearly 60 percent of the cases.

Table 3. Predictors of Increased Sensitivity to Needs of Women, Minority Students
(scale ranges in parentheses)

Variables	Increased Sensitivity to Women's Needs		Increased Sensitivity to Minorities' Needs	
	Beta	Delta-P	*Beta*	Delta-P
Regulative Indicators				
Years to ABET review (1-4)	-.11		.02	
Operating budget (1-3)	.26		.09	
Curricular requirements (1-3)	.12		.07	
Faculty rank (1-4)	.16		.1	
Normative Indicators				
Perceived support for teaching (1-4)	.66***	.16	.66***	.16
Cognitive Indicators				
Beliefs about student learning (1-4)	--		--	
Computer-aided teaching practices (1-3)	--		--	
Student-centered teaching practices (1-3)	--		--	
ECSEL Involvement (0-1)	--	--	--	--
N	213		212	
Probability	.50		.50	
G^2	283.28		283.51	
df	208		207	
G^2/df	1.36		1.37	
PCP	59.6%		59.9%	
χ^2, df	11.21, 5***		9.71, 5*	
* p<0.10, **p<.05, ***p<.01, ****p<.001				

Discussion and Conclusions

The findings indicate that, even after controlling for ECSEL involvement, cognitive institutionalization indicators have a stronger influence than regulative or normative indicators on increases in faculty acceptance of teaching practices inherent in ECSEL's design goal. The use of student-centered teaching practices and ECSEL involvement were the only consistent and unambiguously significant predictors of changes in curricular content (design), and pedagogical method (use of group projects). Despite the Coalition's goal of increasing the diversity of engineering graduates, however, ECSEL involvement was unrelated to changes in faculty members' self-reported sensitivity to the needs of women or minority students. The normative institutionalization indicator of perceived support for teaching was the only significant predictor of changes in sensitivity to the needs of women students and minority students.

When the faculty survey was conducted in 1997-98, faculty who had ever been involved in ECSEL in any way comprised about 22% of the total number of engineering faculty at the seven schools. Because the number of faculty involved in ECSEL was relatively small, institutionalization of ECSEL reforms required diffusion of the Coalition's goals and practices to faculty who have never been involved in the Coalition. Thus, the most important influences on change are those that remain significant even after controlling for ECSEL involvement. These are the "levers" that administrators and faculty reform leaders might pull in order to

spread the reforms to other faculty, especially as external funding for any specific reform effort comes to an end.

Even when controlling for ECSEL involvement, the use of student-centered teaching practices predicted increased use of design and group projects in the classroom. This finding may reflect the cumulative effect of various reform efforts on changes in curriculum and faculty teaching practices. Even as ECSEL has endeavored to restore teaching the art and practice of design to the engineering curriculum, other forces for reform on ECSEL campuses (e.g., ABET, industry, and deans' agendas) have also advocated teaching practices that focus more on student engagement in learning than on faculty performance. As faculty accept the proposition that it is worth the extra time needed to engage in such student-centered teaching practices as allowing students to evaluate each others' work, engage in research, and give presentations in class, those faculty may also be more likely to assign complex design projects and group projects. Experience at some ECSEL schools suggests that one way to encourage such acceptance on the part of somewhat reluctant faculty is to encourage (if not assign) them to teach redesigned courses that require innovative teaching practices. Arranging for such a faculty member to work with a colleague who has already taught that course using active and collaborative methods may be another way to help the "newer" faculty member ease into a course that relies on innovative teaching methods. Once faculty attempt reformed practices, they are likely to try them again, even if they were not successful the first time[7].

Irrespective of ECSEL involvement, faculty members' perceptions that their administrators and colleagues support teaching in general predicted increased sensitivity to the needs of women and of underrepresented minority students. This finding suggests that administrators' and faculty leaders' efforts to promote effective teaching and learning are noticed by faculty, and those efforts may well have positive benefits for underrepresented students. Such efforts are likely to benefit all students as more faculty respond to normative pressures to take teaching seriously.

A possible explanation for why normative and cognitive institutionalization processes had more impact on diffusion of reforms than regulative institutionalization processes may lie in the degree to which the institutionalization process directly affects individual faculty. Accreditation, budget, and curricular requirements each involve a limited number of faculty. On each campus, for example, a small core group of faculty and administrators have responsibility for ensuring compliance with new ABET accreditation standards. Most other faculty may only be aware of changes in ABET standards if they have been asked to respond to new assessment efforts. The few faculty likely to be aware that some courses are not fully funded from the operating budget are probably those who teach such courses, and they may be wondering if they will still be teaching the course after external funding ends. Indeed, even those faculty teaching ECSEL-supported courses may be unaware of ECSEL's backing. Similarly, most faculty—even at schools that received ECSEL funding—may know whether a given course number and title is required for the purpose of advising students, but not know if the course includes design content, group projects, or was ever considered an "ECSEL course." How a course is actually taught, as well as what is taught, moreover, may vary across instructors.

Normative indicators affect faculty more than regulative indicators. Socialization as well as institutionalization theories would suggest that faculty members would be quite likely to be influenced by their perceptions of the beliefs and behaviors of their peers. Given their professional status and tradition of independence, faculty may be a bit less likely to be influenced by their perceptions of the beliefs and behaviors of their administrators. Most current faculty were socialized to their profession during a period when research was valued over teaching even more than it is now. Furthermore the tradition for faculty autonomy in the classroom is especially strong. Therefore some faculty, even at schools that received ECSEL funding, may be at best dimly aware of their colleagues' and administrators' involvement in the coalition's reform efforts. More faculty, however, are likely to be aware of the extent to which their colleagues and their administrators support teaching in general, and this institutionalization process indicator did influence increased sensitivity to the needs of women and minority students.

Cognitive institutionalization process involve faculty members' own beliefs and behaviors, so have a direct effect on changes in teaching methods, sensitivity, and scholarship of teaching. It is perhaps no surprise that involvement in ECSEL is associated with changes that were promoted by the coalition. When considering institutionalization of ECSEL reforms after the funding ends, however, predictors of changes made by faculty who were not involved are even more important. Regardless of their ECSEL involvement, the faculty members' use of student-centered teaching practices predicted several changes promoted by the coalition. This suggests that institutionalization by diffusion depends on factors that directly engage faculty rather than on factors that affect the formal or informal structures surrounding them.

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