

PROGRAMS DEVELOPMENT AIMING AT INTERFACING DIFFERENT ENGINEERING DISCIPLINES

With eleven bachelor departments and seven diplomas, the Faculty of Engineering, Diponegoro University is experiencing individualism of departments in offering trainings and short courses for external community. In order to interface departments or labs for not being a stand alone system, the Faculty has initiated a Center of Continuing Engineering Education. This Center, on the Faculty level, will act as organizer and try to be a facilitating institution for interfacing departments and labs within the Faculty. For initial step the Center will develop data base of staffs, departments' and labs' competencies. Also to collect information what trainings and short courses that have been done by individual department or lab and those done collaboratively.

I. Background and Situation

This year the Faculty of Engineering Diponegoro University is celebrating its 50 years of its establishment when the Civil Engineering Department was the first officially open for the enrollment of students. Now resulting from the dynamic of demand and the continuous development in the engineering field and discipline the Faculty has eleven undergraduate departments or sometimes referred also as study programs. These eleven departments will be used as the basis of discussion and for the simplicity of discussion they are to be taken as eleven disciplines in the Faculty. This is important since even the Faculty has many labs and studios to which every staff belongs to, the areas of discipline regarded here as the starting issue are limited to the existing departments. Then we have eleven (in broad sense) engineering disciplines as listed in Table 1 with the year of their opening and number of academic staffs. The number of staff shown is only for bachelor level staffs not to include diploma's teaching staffs.

Table 1: List of Departments

No.	Name of Department (Bachelor level)	Year of Establishment	Number of Academic Staff
1	Civil Engineering	1958	60
2	Architecture	1962	42
3	Chemical Engineering	1965	42
4	Mechanical Engineering	1983	34
5	Electrical Engineering	1983	37
6	Urban and Regional Planning	1992	45
7	Industrial Engineering	1998	22
8	Environmental Engineering	1998	20
9	Ship Building Engineering	2002	12
10	Geology Engineering	2004	11
11	Geodetic Engineering	2004	8

The situation shown is firstly related to the different ages of the departments. The problem with this difference is that departments or study programs did not start from the same point of time meaning that they are not growing together to give the sense of togetherness. The staffs from newer departments are mostly younger generation from those longer established departments. They hardly know each other in the sense of discipline acquaintance yet to mention that they are not familiar personally. Sometimes it is worse to note that staff from one department does not really know what other disciplines' can do in terms of skill or competency. How are they supposed to cooperate when they hardly know each other?

Moreover there are very few common activities in the faculty, not necessarily academic, that are intentionally targeting staffs to work together. These very few activities and programs are mostly non-academic such as organizing committee setup for anniversary or graduation. It is teamwork and they get more familiar interpersonally but not in the sense of academic teamwork. This is also happening to students. Within existing mechanism of enrollment and curricula, students of certain study program will begin and finish their study practically only with the same group or class.

Problems arisen from this situation are that mono discipline is not good enough to solve complex challenges in the society. Furthermore as the Dean of the Faculty of Engineering University of Toronto says that innovation often occurs at the interface of disciplines, where knowledge overlaps and interconnects. Engineering Faculty should be a center of intellectual fusion, offering opportunities to exchange ideas with colleagues in other engineering disciplines. And when it is related to students and graduates, they are lack of understanding of others which is actually this experience of team working is needed when they are facing real and big circumstances in the society.

Following table is to show that there are 61 labs or studios altogether in the Faculty of Engineering. This is not to complicate the situation but to bring forward the fact that those labs or studios are practically operating or functioning independently or to say precisely individually which reinforces the challenges of cooperation. Even they belong to departments it is very rarely they organize or conduct collaborative programs. There is very minimal search for "value added" through collaborative actions.

Table 2: List of Labs in the Faculty of Engineering

NO.	NAME OF LAB	DEPARTMENT
1	Soil Mechanics	CIVIL ENGINEERING
2	Hydraulic	
3	Materials & Construction	
4	Transportation	
5	Computing	
6	Geodetic	
7	Building Technology & Structure	ARCHITECTURE
8	Architecture Design	
9	Architecture History & Theory	
10	City & Residential Design	
11	Graphic Design	
12	Basic Chemical Engineering 1	CHEMICAL ENGINEERING
13	Basic Chemical Engineering 2	
14	Separation Technology	
15	Bioprocess	

16	Industrial Microbiology	
17	New Material & Catalysis	
18	Food Processing & Engineering	
19	Waste Treatment	
20	Instrumentation	
21	Process Computation	
22	Chemical Engineering 1 : Process	
23	Chemical Engineering 2 : Operation	
24	Production Processes	
25	CNC / CAD-CAM	
26	Fundamental Engine Phenomenon	MECHANICAL ENGINEERING
27	Performances	
28	Physical Metallurgy	
29	Mechatronics & Automation	
30	Computing	
31	Energy Conversion	ELECTRICAL ENGINEERING
32	Computer	
33	Signal & Telecommunication	
34	Electronics	
35	Automated Control	URBAN & REGIONAL PLANNING ENGINEERING
36	Urban Development	
37	Regional Planning & Environment Management	
38	Urban & Regional Physical Space Planning	
39	Planning Computation & Geomatics	INDUSTRIAL ENGINEERING
40	Ergonomics & Work Design	
41	Production System	
42	Industrial Statistics & System Optimation	
43	Decision Support System	ENVIRONMENTAL ENGINEERING
44	Entrepreneurship & Management Studio	
45	Environment	
46	Computer	
47	Workshop	SHIP BUILDING ENGINEERING
48	Ship Design Studio	
49	Ship Construction	
50	Ship Design Computer	
51	Ship Welding	
52	Ship Engine	
53	Ship Electricity	
54	Ship Docking & Maintenance	GEOLOGY ENGINEERING
55	Geotechnics, Geothermal, & Geophysics	
56	Geodynamics, Hydrogeology & Planning	
57	Sediments, Oil Geology, & Geochemistry	
58	Paleontology, Photo geology, & Geoptic	GEODETTIC ENGINEERING
59	Measurement & Mapping	
60	Photogrammetric	
61	Computer & SIG	

II. Programs Development

Realizing the benefit of interaction between different disciplines, the Faculty is trying to develop programs and activities systematically not only for short term but also longer term planning to support this mission. One mission for example i.e. in order to get individual departments not being a stand alone system, the Faculty has initiated an entity that is the Center of Continuing Engineering Education. This Center, at the Faculty level, will try to be a facilitating institution for interfacing disciplines (that is departments or study programs and labs) within the Faculty. For initial step the Center will develop data base of staffs, departments and labs competencies. Also to collect information what trainings and short courses that have been done by individual department or lab and those done collaboratively. Potential existing joint programs are to be improved and formalized by the Center. The Center will act as organizer of the programs on providing initial funding, promotion until conducting the program and evaluation. This scheme will not apply to all programs within the Faculty but to exclude those especially for the time being conducted by individual department or lab.

Another effort is clustering the disciplines in the faculty into several clusters which are close to each other in terms of competency and potentially to create joint research projects. To stimulate these clusters to prepare proposals of joint research, this year the Center will provide funding taken from student's enrollment fees. This kind of research funding never existed in previous years. The scheme is competitive and one important condition applied is that the proposal must be submitted by at least two disciplines and will be given more plus points if the projects will involve students and even better if the students are coming from several disciplines or study programs. This year proposals submitted are at least eleven proposals (equal the number of clusters in the Faculty) and then to be selected and granted funding to only 6 until 8 research projects. Here is important to be noted that involving more than one discipline means that the research team consists of staffs coming from more than one department.

These disciplines' clusters are simultaneously encouraged to prepare training projects or short courses that will be facilitated by the Center for publication and promotion. This kind of proposed training programs and short courses is not limited to be submitted by those clusters which are already existed but is open to any proposing team in the Faculty as long as fulfilling one among other important requirements of facilitation i.e. submitted by at least two disciplines. Selected programs of training and short course are preferred to be offered periodically at least every year. Subjects or contents of these joint programs are aimed more to public as the mission of continuing education is kept mainly for those outside the university.

As it has been mentioned before, students need to be acquainted to other disciplines to build understanding of others and to explore along their process of study the opportunities of team work. One specific need of soft skills faced these days by graduates when they are being interviewed or starting their career is teamwork skill. The effort of diffusing students into personal familiarity and academic interactions as the pre-requirement for teamwork must be made systemic and even embedded in the curriculum. One solution is to develop common academic activities of students which much better be clearly embedded in the curricula of departments. This is done by designing that some credits of one department must be stated to be taken from other departments. Taking credits from outside of own department or study program is known as credit transfer system. This system can take two forms. One is creating common classes of same basic subjects that most disciplines will take. One class will consist of several departments' students. For now these common classes in the Faculty of Engineering are for subjects mostly in the early semesters.

Another scheme is providing opportunities to students to take subjects from any other institutions most probably the same discipline anywhere they like. This is sometimes called exchange students. And for the Faculty of Engineering Diponegoro University exchange students with overseas institutions are preferred. This is usually very important to show mutual recognition of each other quality of partnering institution. Sending students to overseas should also mean of being able receiving overseas students.

III. Conclusion

Many departments or disciplines in the Faculty should be seen as strength not weakness. But to gain strength and benefit of synergism among those varied disciplines or departments, programs and activities must be intentionally planned and designed. To plan and design these joint programs an entity should be given responsibility of this mission. The Center of Continuing Engineering Education at the Faculty level will be given this assignment. Joint research and joint training and joint short courses are those programs to be given incentives when they really more competitive than other proposals.

To develop programs that will help students to interact at least within the Faculty, students from several departments should be put in the same class of common subjects. Credit transfer system which is supposed to be taken outside oneself department soon to be applied to give experience and exposure of other academic culture and at the same time to probably gain minor competence.

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