

Integrated model of Industrial Practices (IP) program and Final Project Course (FPC) in Diploma 3 Study Program of Mechanical Engineering in Universitas Negeri Yogyakarta

Sudiyatno¹ and J Puspito¹

¹ Faculty of Engineering, Universitas Negeri Yogyakarta, Indonesia

E-mail: sudiyatno@uny.ac.id

Abstract. The paper presents the integrated model of industrial practice program and final project course as a solution to shorten the time consumed in doing Diploma 3 in Mechanical Engineering. The model was implemented in UPT Logam Yogyakarta, where four D3 students did their IP Program. Along the students doing the program, they designed a machine as the final project. Through an intensive supervision by their industrial supervisor and lecturer, the machine was finished in 4,5 mounts. It is reduced almost 50% of the time needed to do the project in regular way. The result of the study suggested that at the beginning of sem IV (January-April), can be started from registration-briefing-correspondence with industries. In May-June, student's choice - assigning a letter of assignment to the supervisor and determining the location of the IP Program. IP Program should be in line with its concentration. In July-August IP Program implementation, students work on the final project at the industries and the supervisor interacts with the FPC supervisor. End of August IP Program report can be completed first. Sem V (Sep-Dec) students continue to make project work in the industry. Sem VI (Jan-July) writing FPC report and doing FPC Examination.

1. Introduction

The Faculty of Engineering of UNY has set one of the important and urgent academic agendas to accelerate graduation or shorten the study period of undergraduate (S1) and D3 study programs. The Dean of the Faculty of Engineering revealed that in 2017 the average study period of undergraduate students was still above 9 semesters or 4.5 years. Furthermore, the average study period of D3 students was around 7 semesters or nearly four years. Though according to the curriculum, D3 study period is six semesters or three years. Furthermore, it was revealed that the main factors causing the delay in the period of study both S1 and D3 students were delays in completing the Final Task Course (thesis) for S1 students and Final Project Course (FPC) for D3 students. Generally, both S1 and D3 students are able to take all theoretical courses on time. The average time of undergraduate students in take thesis at the Faculty of Engineering is 8,59 months and the average time of D3 students in finish FPC in the Faculty of Engineering for 9,30 months.

There have been quite a lot of efforts done both by the Faculties and Departments to overcome this problem. For undergraduate students, the Department and Study Program provide themes that can be used as FPC titles, so students are expected to be able to prepare research proposals as soon as possible. For D3 students, the Department and Study Program especially in the Department of Mechanical



Engineering Education have facilitated through lecturing activities designing and supplying types of technological works that can be used as FPC materials, so that students are expected to quickly work on and complete the FPC.

However, until now these efforts have not been significant in reducing the duration of study for D3 students. Some of the causes are first, the limitations of the machines and equipment available in the workshops, because the Department prioritizes the use of lectures, students who are taking their FPC are forced to spend an additional budget. Second, the limited financial ability of FPC students, so that it clearly slows down the FPC work process. Third, there is no adequate systemic support so students can get FPC material and facilities to make it happen faster. To be able to shorten the graduation of this D3 Study Program student and increase the effectiveness of the IP program, the Faculty of Engineering is in need of good and ongoing collaboration with the local industry especially as one of the most strategic partners. There have been quite a number of pioneering collaborations with various industries through the signing of an agreement in the form of a memorandum of understanding (MOU), but unfortunately there is not enough follow-up to now.

There are at least two big advantages, if this synergistic cooperation with the local industry is realized. First, students will find it easy to find a good industry that is relevant to their concentration of expertise, and can carry out PIs on time. Therefore, there can be an increase in the quality of the implementation of the IP Program which leads to an increase in the quality of graduates especially the D3 Study Program. Second, the industry can show and direct students to plan various forms of technological work that can be used as FPC and the industry can also provide machinery and equipment facilities for students to do PA, so that students can quickly do and complete FPC. To deal with problems that result in delayed IP implementation and work on FPC assignments, which results in delayed study completion, a new model of cohesiveness is needed between the IP Program and FPC assignments. First, there is a system that facilitates students to carry out IP program easily, precisely time and according to the concentration of expertise. The limited capacity of the industry in accepting student participant. Second, there needs to be synergy between the Department and industry so that the mentoring process is effective both during the industry and on campus after students have completed the IP.

The main problem faced by students in implementing FPC is that students first have difficulty in determining contents of FPC. Second, because generally students come from the middle to lower economic community, they have a limited financial ability to do the final project. Third, there are limitations to the machinery and equipment available in the workshops, so that in the Department of Mechanical Engineering Education, students are forced to only be able to do FPC once per week on Saturday only. Whereas, several main problems faced by students in implementing the IP Program include: 1) there is no system that facilitates students to carry out IP easily, on time and in accordance with the concentration of their expertise; 2) limited capacity of relevant industries in accepting student students; 3) ineffectiveness of the mentoring process both in industry and on campus after students have completed the IP Program, and 4) students are forced to run IP far outside the territory of the Province of D. I. Yogyakarta, so that it is burdensome for students especially from the financial side.

The formulation of the problems solved through this research activity are: the form or model of cohesiveness between the IP and FPC Program that supports efforts to accelerate the study period of students of Mechanical Engineering D3 Study Program; 2) characteristics of local industry are feasible and conducive to implementing an integrated IP Program model for D3 students of the Department of Mechanical Engineering Education; 3) the effective guidance mechanism for organizing the integrated model between IP and FPC Programs in the Department of Mechanical Engineering Education and the local industry where the IP Program is being implemented.

2. Method

2.1. Industrial practice (IP) program

Term of IP program is taken from the definition of the term internship as a supervised discipline-related work experience involving an intentional experiential learning strategy, an emphasis on professional

development, performance assessment, and reflection and acknowledgment [1]. Thus IP Program is a series of activities that provide supervised and deliberate work experience in learning experience strategies that emphasize the development of professional abilities, performance appraisal, reflection and recognition. Thus the IP is a connecting bridge between the world of campus and the world of work. Based on the above understanding, the IP program involves at least three parties, namely practicing students, universities and industries. Students practiced are those who are learning through real work experience. Industry is a party that is processing learning to form professional abilities in students themselves. Higher education is a party that prepares students to practice with the provision of knowledge and skills relevant to the demands of the professional world (work). All three parties are responsible for the proportion of their duties, so that the objectives of the IP Program are successful.

The students have to develop academic abilities, based on the knowledge and skills they have become professional abilities, namely working in accordance with the demands of achieving standards. Therefore, during conducting activities in industry, students are entitled to get guidance and assessment in order to get recognition that they have reached a certain professional degree. Professionalism is the main goal of learning while in the industry. Professionalism is a demand that must be fulfilled by every college graduate in his field of expertise. A professional workforce has a number of identities that reflect the expertise possessed. Eliot and Turns [2] define professional identity as individual identification of the tasks, responsibilities and knowledge related to a professional role.

The growth of professional attitudes and behavior is influenced by an educational background which can be distinguished in four stages [3]. First, the anticipatory stage is characterized by an ideal understanding of the professional role as a result of interactions with the media and other people. Second, the formal stage a person experiences through the formal education process regarding the knowledge and skills needed to fulfill the demands of his professional role. Third, the informal stage is when someone studies the expectations that are not delivered related to a professional role. Expectations that are not conveyed can be fulfilled through informal interactions with peers or when participating in industrial activities (internships), co-ops, or social / voluntary activities. Fourth, the personal stage where someone internalizes their roles and expectations related to their professional attitudes and skills. Most graduates have not reached this degree at the time of graduation, they only get it when they are in the world of work (real world). In practice, internship (in Indonesia is generally referred to as field work practice. In the field of engineering often referred to as industrial practice) can be done by students in two forms, namely part time (part time internship) or full time (full time internship).

Based on the FT UNY Student Industrial Practices Manual in 2009 [4], the IP program is a compulsory curricular program for all UNY Faculty of Engineering students. The implementation uses a block system, where students follow IP for 7-8 weeks or equivalent to 256 hours continuously in the industry. Therefore students usually take time during the transition from the even semester to the odd shift (July-August). There are two objectives of this IP program, namely general objectives and special objectives. The general aim of the IP program is that: 1) students get the opportunity to add insight directly about the application of science and technology in industry, 2) students can learn about field problems related to their area of expertise, 3) students can learn skills / skills with demands industrial standards, and 4) students can learn aspects of knowledge and skills in the field of entrepreneurship. The specific objectives at the end of the IP program to be achieved are: 1) students can explain industrial management and workforce competencies required by the industry where the IP is implemented, 2) students are involved in the production or service process, 3) students can find a case that can used as study material that requires in-depth analysis, and 4) for IP entrepreneur participants, students get material to make proposals to establish an independent business.

Some of the main activities that must be carried out by IP participating students include: 1) facing and consulting to IP supervisors in their respective departments before departure, 2) reporting themselves to the industry to start implementing PI, 3) facing and consulting with supervisors in partner industries, 4) carry out IP activities according to the rules and schedules determined by industry, 5) at the end of IP activities, students complete administrative matters related to assessment, and 6) compile reports on IP implementation with the guidance of lecturers. As the final step in the series of IP

implementation, students must undergo the final IP test based on the report they have made. This test must be carried out no later than four months after the IP is completed, if it is not implemented then the student must repeat the implementation of the PI.

2. 2. Final project course (FPC)

One of the requirements to graduate in D-III Mechanical Engineering, students are required to make Project Work as FPC with intensive guidance by lecturers. The work of Technology created by students is then tested by a designated team of lecturers to assess the machine as a whole, including functional tests and machine performance tests. The Technology Work Examination is packaged in the "Examination and Engineering Product D3 Student Mechanical Engineering Product".

In addition to academic purposes, through examinations and product exhibition, this activity is also as a mean of publication to the wider communities for the products of applied technology produced by D3 students in Mechanical Engineering. It is hoped that this activity can facilitate the people who need special technology to help their daily activities as well as for production activities in their businesses. The Examination and Product of Technology Products which are usually held in the Faculty of Engineering, this time are a little different because they were held at GOR UNY as a series of activities in the 53rd Anniversary agenda of UNY. Thus, the public is expected to be able to access and obtain information about Project Works produced by students more broadly. The Student Project Works produced this year were a Centrifugal Casting Machine, a Gas Motor Injection Converter and a Gas Cutting Pipes Machine [5].

As an example of the implementation of integrated model of IP Program and FPC in 2015 which was done UPT Logam Yogyakarta, there was a machine produced as shown in Figure 1. This machine was done by four students of D3 Mechanical Engineering. The time needed to produce this machine was about 4,5 mounts. So it reduced nearly 50% from the average of regular FPC.



Figure 1. Sieve Machine of Waste of Aluminium Casting

3. Result and Discussion

3.1. Model of integrated model of IP program and Final Project Course (FPC)

Model of an integrated IP Program-FPC has been conducted, and it was found that IP Program -FPC can be integrated and the PI results obtained are of higher quality with faster time. This integrated PI-PA, so that from the beginning it can be carried out as well as possible and its sustainability is guaranteed, its quality must be guaranteed within a quality assurance framework. The tools that need to be prepared for this are valid Flow Charts and supporting documents required. The integrated IP Program -FPC Flow Chart contains when it starts and when it ends and what tools are needed. The

results of the study related to time, IP Program can be done at the beginning of sem IV (January-April), can be started from registration-briefing-correspondence with industry. In May-June, student's choice - assigning a letter of assignment to the supervisor and determining the location of the IP Program. IP Program is in line with its concentration. July-August IP Program implementation, students work on the final project at the industrial location-PI supervisor interacts with the FPC supervisor so that the two go together. End of August IP Program report completed first. Sem V (Sep-Dec) students continue to make project work in the industry. Sem VI (Jan-July) writing FPC report and doing FPC Examination.

3.2. Suggestion from industries

What is expected by the industry for IP Program students is that they come to the industry not like empty bottles, but are expected to have a proposal to make tools / machines that are ready to be done in the industry, which tools are in accordance with the needs of relevant industry stakeholders. In order to make proposals made by students according to their needs, an initial survey is needed to identify the needs of stake holders. In this case the industry provides a solution, namely: two months before students are deployed to the industry, it is expected that students come to the industry first, in order to observe and survey the initial requirements of the equipment / machine. The industry will also invite students to the built industry, so students can know firsthand the problems faced by the built industry.

3.3. Suggestion from IP program manager

This integrated IP Program -FPC is very likely to be implemented and has the potential to accelerate the graduation of D3 Mechanical Engineering students. Therefore institutionally it is necessary to make a special pattern for this integrated IP Program -FPC, outside the pattern that has been implemented so far. The special pattern is so that sustainability is ensured, later on it needs to be stated in the PI Guidelines issued by the Faculty of Engineering. To improve student competency, the implementation of the final project making is required to be carried out in the industry occupied by the PI students concerned. This greatly adds to the competencies of students that cannot be obtained on campus, namely the competence of work attitudes with nuances of real industry which requires students to learn to work under pressure (deadline).

3.4. Suggestion from PI students

In general, students are ready to undergo an integrated IP Program -FPC. In terms of the time and cost of integrated IP Program -FPC very beneficial for students, the reason is that not much lecture time is wasted on non-academic matters and the cost of material procurement for the final project is reduced because it has been borne by the industry occupied. However, there is a suggestion from students that is related to the IP Program -FPC supervisor lecturer should be done by the same lecturer and competent in their field. During this time, according to students, the manager of IP Program -FPC in appointing supervisory lecturers has more applied the principle of equalization or in other words the principle of professionalism has been overlooked.

4. Conclusion

To accelerate the study period can be done by implementing the integrated IP Program and FPC. For this reason, it is necessary to make a special guidance book for implementing the integrated IP Program and Final Project Course. The book must at least contain: (1) A holistic objective of industrial practice; (2) Eligible implementation instructions; (3) Good supervision, monitoring and evaluation. As an implication, it must also prepare eligible industriess and data tools / or machinery that can be reached by students to carry out the integrated IP Program and the Final Project Course. To find out more about the advantages and disadvantages of the integrated IP program and the Final Project Course, it is necessary to carry out further research by involving other departments within the FT UNY.

5. References

- [1] Eliot, M & Turns, J 2011 Constructing professional portfolios: Sense-making and professional identity development for engineering undergraduates. *Journal of Engineering Education* Vol. 100. No. 4. Pp. 630-654 Proquest Research Library
- [2] O'Neill, N 2010 Internship as a high-impact practice: Some reflections on Quality Peer Review. 12. 4. Pp 4-8. Proquest Research Library
- [3] Henry, J.S, Rehwaldt, S.S. & Vineyard, G.M 2001 Congruency between student interns and worksite supervisors regarding critical elements of an internship experience. *Information Technology, Learning and Performance Journal* Vo. 19. No. 1. Pp. 31-41 Proquest Research Library
- [4] Tim Praktik Industri 2009 *Pedoman praktik industri mahasiswa fakultas teknik UNY* Yogyakarta: Fakultas Teknik UNY