

Collaborative-learning design in rural areas: a mutual cooperation between an engineering education institution and industry

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ABSTRACT: A collaborative-learning design produced by engineering students in their collaboration with industry had a positive impact on both in rural areas. The design can also solve the engineering education problems experienced in those areas, including inadequate facilities for practice, low numbers of qualified teachers with up-to-date knowledge and students' lack of motivation for study. It is necessary that students be taught in full about both theory and practice. If not, these problems will become an insurmountable obstacle in making graduates ready for gaining employment in industry. This article's aim is to create a design of collaborative learning between an education institution and industry to develop and challenge students' competency, and instil in them good work habits that industry requires. The commitment of both, government support and parental involvement are highly instrumental in reaching the intended target of learning.

INTRODUCTION

Engineering education institutions have great responsibility for providing graduates with professional qualifications appropriate for industry in order for them to be prepared to compete and for jobs in the labour market [1] for the purpose of facilitating national economic development [2-4]. They stimulate the learning process in its collaboration with industry to explore growing trends in science and technology in the industrial world and to develop graduates' competency in the future [5][6]. Their collaboration with industry can help them to grasp the opportunity for their learning programme to be redesigned to make it more suitable for industrial needs through providing financial support [7], conducting field studies in industry, and establishing and developing an institution for engineering education [8]. This collaboration can also make it possible for both students and teachers to be actively and directly involved in real work and to have practical experience in industry [9].

In general, institutions in remote areas encounter considerable difficulties in accomplishing their academic purposes. Difficulties, such as inadequate facilities for practice, low numbers of qualified teachers with up-to-date knowledge, and students' lack of motivation for study have led educational practitioners to choose to establish a cooperative programme in order to overcome this problem.

Prigge stated that both the institution and industry can profit from this collaborative learning [10]. Through this collaboration, educational practitioners can solve the problems they face and enhance the quality of graduates of engineering education by which they can meet the requirements of industry, especially, local industry. Meanwhile, industry can easily recruit the skilled labour that it needs. This article intends to create a collaborative-learning design between engineering education and industry to develop students' competency and engender them with the good work habits that industry requires. Hopefully, the quality of future engineering education graduates will assist them in immediately finding jobs in industry.

DESIGN OF COLLABORATIVE LEARNING BETWEEN ENGINEERING EDUCATION AND INDUSTRY

Collaborative learning is one of the educational approaches involving intellectual efforts focusing on developing students' competency or practising their subjects to gain understanding, solutions or urgency of learning [11]. Collaborative learning describes a situation in which particular forms of interaction among people are expected to occur, which would trigger learning mechanisms to develop ways to increase the probability of interaction [12].

Collaborative learning in the Vygotskian tradition aims at social interaction either among students or between students and a teacher, and essentially assists students in advancing through the zone of proximal development [13]. While Brindley et al stated that collaborative learning aims to sharpen students' skill in critical thinking, making

knowledge and basic practice meaningful, encouraging deep reflection on learning subjects through applying them, and transforming learning into appropriate forms of graduates' competency [14].

An engineering education institution conducts this learning in collaboration with local industry to create stimulating learning environment that build up students' confidence about their competency to work in industry after they graduate [5]. This is undertaken to develop students' competency or practising their subjects to gain understanding, find solutions for learning through critical thinking, making knowledge and basic practice meaningful, and encouraging deep reflection on learning subjects within a zone of proximal development, including interaction either among students or between students and a teacher; students and industry; students, a teacher and industry. In addition, this will supply students and teachers with information and understanding about competency in an up-to-date way about up-to-date knowledge and the most recent technology [15]. The expectation is to transform learning into appropriate forms of graduates' competency. Figure 1 shows how this design is produced and who gets involved therein.

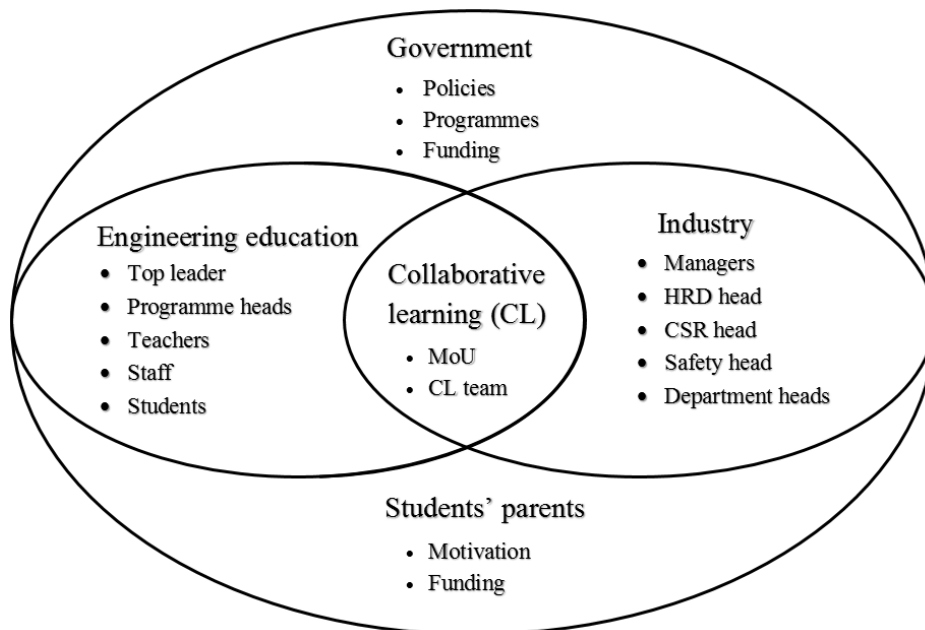


Figure 1: A collaborative-learning design between an engineering education institution and industry.

Figure 1 shows that this design of learning is not easy to apply. It involves an intricate process including the strong commitment that both education and industry have made and agreed on. The implementation of this learning design in practice involves the institution's leaders, heads of study programmes, teachers, other staff and the students. Herein, the leaders play a key role as decision and policy makers. The heads of the study programmes are responsible for coordinating the teachers of each programme to decide which type of student competency they want to acquire and challenge in the collaboration with industry; to choose academic advisors to accompany and monitor students during their teaching practice in industry; to arrange schedules of the collaborative learning; and to plan an education budget for implementing this collaborative learning.

Staff are in charge of administrative things related to learning. Students have to follow the rules of this programme. Meanwhile, managers of industry, human resource departments (HRD), the chief of corporate social responsibility (CSR), the head of the department of occupational safety and health, and heads of other departments are also involved in this collaboration.

Government and parental support is necessary to establish this collaborative programme. Government support can be for formulating policies on the provision of unrestricted access to education, allocating large sums of money with which to improve existing facilities for training and practical studies, improving the role of engineering education, enhancing graduates' quality, and boosting the professional careers of teachers and students [16].

Parents, meanwhile, can support the programme thorough motivating their children to participate in the learning under the procedure and providing them with financial support for living costs and transportation in that the location of the school is far enough to travel. Parental support has a decisive role in children's future competency and professional careers [17].

This learning is implemented through several steps, the first of which is to hold a meeting between heads of an engineering education institution and managers and heads of related departments of industry to reach agreement on the implementation of the collaborative programme. The results of the meeting must be written into a memorandum of understanding (MoU) between both sides to begin collaborative effective work in accordance with their roles in the learning [18].

The next step is to organise a collaborative learning team, including the heads of engineering education and heads of departments of industry related to various kinds of competency challenged in the learning. The team is responsible for the overall learning process, formulated in a design of collaborative learning, including preparation, implementation, reflection and development (as shown in Figure 2). The team members, especially those from the engineering education institution, must have had work experience in industry, so that all team members can easily come to a mutual understanding so as to begin every single step of the programmed process according to the team schedule.

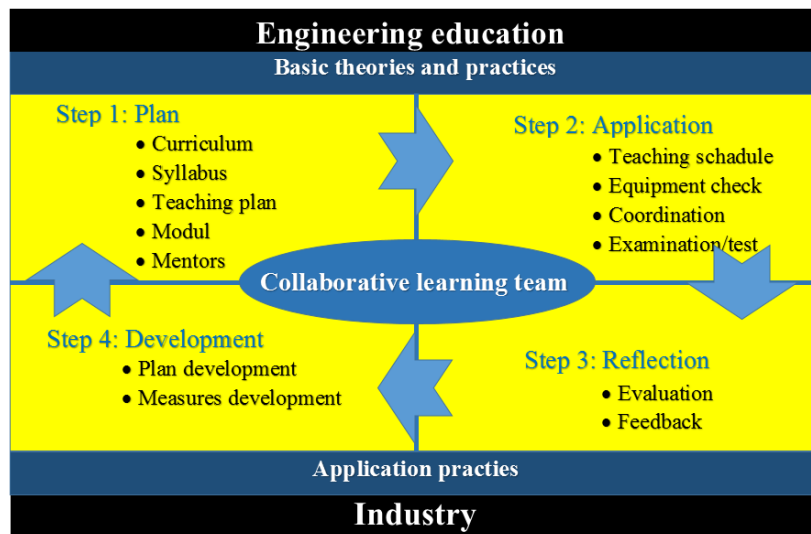


Figure 2: The creating process of collaborative learning between engineering education and industry.

Furthermore, the steps in the process of creating the collaborative learning between engineering education institutions and industry shown above can be explained as follows:

Step 1: Planning

The first step is performed by achieving a favourable balance between the curricula, syllabi and teaching plans of an engineering education institution and competencies that will be developed in industry. Accordingly, the relevance of theories and basic practices taught in engineering education to practical application in industry must be established. Subsequently, the team needs to make a handbook of each lesson according to the curricula, syllabi and teaching plans, for this is useful in improving the performance of trainees [19]. The handbook should contain basic theories, job-sheets of basic practice, job-sheets of practical application and a test or examination.

Every job-sheet, in connection with the availability of equipment, media and practical procedures, must be evaluated to ensure that it is in accordance with rules of the industry. After the contents of the handbook have been agreed on, the team should choose technical mentors and advisors from the institution and industry and, then, set up the schedule of the implementation of the learning systematically, in order to ensure that the implementation will not clash with the existing schedule of operation of the industry.

Step 2: Application

In this step, the team ensures that teaching schedules can be applied to all levels of industry - i.e. the chief executive officer, heads of departments and operational staff - so that the purpose of the learning can be achieved completely [20]. Also, the team has to check the availability of equipment and material needed for teaching practices. For this purpose, close coordination is highly essential, because understanding the overall procedure can avoid misunderstanding in the team during the process of application. Afterwards, a test should be taken before and after the learning in industry. While written tests are conducted before teaching practices to measure the comprehension of basic theories, practice tests are administered to measure the understanding gained about the practice.

The assessment of the final result is based not only on the result of written and practice tests, but also on behavioural aspects of trainees during the learning, because behaviour is closely related to labours' professional competencies, such as knowledge, critical thinking, disciplinary actions, technological skills, ability to learn fast, keen vision and deep understanding of culture [21]. These components are necessary for preparing future working competencies of the graduates of engineering education institutions.

Step 3: Reflection

This step consists of evaluations and feedback. The evaluation is made to assess planning and application of the learning done in cooperative work by the collaborative learning team. The evaluation is aimed at measuring

the accomplishment of learning outcomes and results with which to give feedback for improved future learning application [22]. Feedback can form recommendations for developing what has to be done.

Step 4: Development

Development is stimulated in planning and the measurements of assessment of the learning application. It is based on the recommendations from the reflection step. The expense of development may be the responsibility of institutions of engineering education or of the industry CSR. All steps of the learning process must be written down as the result of the programme and presented orally through evaluations made by both the institution and industry. All of these steps should be taken to offer a good understanding of the development and improvement of better learning processes in the future.

This article's conclusion is that collaborative-learning design between engineering education institutions and industry is vitally important in improving the quality of graduates and human resources in engineering education. Those institutions desperately need to stimulate organisational industrial innovation in leadership, administration, student affairs, curricula and teaching, enhancement of teachers' professionalism, resource development and campus to show a total commitment to the development of their learning programme [8].

It is also important to maintain effectiveness and efficiency of the application of the collaboration, so that any possible obstacle can be easily overcome [23] through forming teaching groups in industry consisting of four or five students [24], making the learning and teaching process more interesting [25], using more practical methods effective enough to increase the efficiency of learning, and integrating all subjects and basic practices taught on campus into practical applications needed in industry. To serve all of these purposes, engineering education institutions have to establish intense and continuous communication with industry.

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