

Reformation of Engineering Education and Asian-Pacific Network

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Abstract

Recently, engineering work become very important for the leaders of the information society for the future knowledge in the 21st century and the goal of engineering education is to prepare people to practice engineering as a profession and also to spread technological literacy, increase student interest in technical careers through science and math education. The College of Engineering (COE) of Korea Maritime University (KMU) aims to be the center of both IT-related high industrial technology and the industries related to port, shipbuilding and the ocean. Especially COE focuses on the educational principles to contribute to the development of the country and the regional communities by educating specialists that have international competitiveness. With the need to expand international collaboration in terms of engineering work, it is proposed to initiate a new state of the Asian-Pacific body of engineering conference. To the extent possible the basic discussion was made to expose elements and supports as full-scale illustration of the engineering conference. The result is a body that evokes multi agreement and joint declaration among members.

Keywords: Engineering education, International collaboration, Asian-Pacific body, Engineering conference

1. Introduction

Engineering work is the activity of teaching, learning, and researching engineering and technology, at school, college and university levels, including engineering research institutes. Important response also comes from industries. As education and research in engineering are becoming more and more globalized, each institution makes every effort to meet the international standard. Most of institutions have young and competent faculties and researchers with flourishing enthusiasm on engineering teaching and research work, and also support facilities for high level of experiment and practice, language training abroad program and scholarships for students with ability, through various national projects such as the equipment and facility support project, the program of regional innovation and cultivation of brains, etc.

As per OECD STI Report (2006), the rates of employment in engineering and technology for Korea

in comparison with other OECD countries is very low, in terms of experts and technicians.

As the need of high quality engineers from the industrial sector has risen more than ever, the reformation of engineering education and a new accreditation system to this demand was made to provide the students qualified programs.

By introducing a professional accreditation system for engineering education depending on countries (e.g., ABEEK, ABET, JABEE), we also try to provide professionals with the background of engineering and technology based on the fine personality as well as good expertise needed in improvement of engineering education and in the industrial field. The capstone design project for juniors and seniors is another form of changes to the programs to cultivate engineering talent by offering technological thinking ability based on management mind as well as theoretical knowledge and practical technology.

Sharing learns in engineering work is gaining popularity within the variety of disciplinary focuses in many institutions in Asian and Pacific countries. So far, it obtained excellent results on the aspects of academic exchange, joint researches, student work exchanges, and sharing programs such as Double-

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Nation	Expert	Technician/Skilled	Total	Female Rates ('04)
Sweden	18.4	20.2	38.7	51.1
United States(2002)	15.8	16.9	32.7	56.8
France	12.6	17.9	30.4	47.0
Italy	10.1	19.6	29.7	46.3
EU15	12.5	15.5	28.1	48.3
United Kingdom	13.5	12.2	25.7	47.2
Korea	6.9	9.3	16.2	36.4
Japan	10.2	5.5	15.7	45.5

Sources : OECD Science, Technology and Industry (STI) Outlook 2006

[Fig. 1] Rates of employment in engineering and technology for OECD countries(%)

Degree Programs, etc. Based on the joint workshop and discussions between universities in Asian universities we had before, many universities including engineering colleges wanted to have a stronger collaboration network in engineering education and work, together with their regional strategic industrial researches. The network might be in a shape of the international conference among these institutions.

II. Changes of Engineering College in KMU

1. Background of engineering education

COE of KMU had been started from establishment of the Department of Marine Mechanical Engineering for education and study regarding shipbuilding- and port-related industry in 1980. After that, more departments of related industrial fields were included and the College of Science and Engineering was initiated by reforming process of the university in 1992. In March 2000, the new COE was started, combining the main engineering departments.

COE of KMU has young and competent faculties with flourishing enthusiasm on study and teaching, and also support facilities for high level of experiment and practice, language training abroad program and scholarships for students with ability, through various national projects such as the NEXT, the equipment and facility support project related to Information Technology, the NURI and BK21, the program of new university of regional innovation and cultivation of brains in Korea, ITRC, IT-E navigation, and GLOPEC projects, etc. As the need of high quality engineers from the industrial sector has risen more than ever, the reformation of engineering

education to this demand was made to provide the students qualified programs. By introducing ABEEK, COE also tries to provide professionals with the background of engineering and technology based on the fine personality as well as good expertise needed in improvement of engineering education and in the industrial field. The capstone design project for juniors and seniors is another form of changes to the programs to cultivate engineering talent by offering technological thinking ability based on management mind as well as theoretical knowledge and practical technology.

2. Start of engineering education

KMU was established in 1945 as a national university for the purpose of contributing to the maritime and industrial development of Korea. KMU has played a vital role in the nation's growth through providing high-quality maritime professionals. Beyond the practical education for deck officers and engineers, new courses had established in 1980 such as ship mechanical engineering, shipping management, and maritime law, followed by naval architecture, electronics and communication in 1982. COE was established in 1992 and most of COE departments were established between 1992 and 1995. In KMU, traditionally, students were trained on the training ship and machine shop for practical training for shipping company or ship building company and these became a strong background for the industrial and ocean plant engineers, comparing with other universities in Korea. Great effort is placed on insuring that all undergraduate ABEEK requirements are fulfilled even though some courses are still preparing for entering to the program, since 2003.

3. Goal of COE and progress

The published mission of COE is to provide high quality education, research and service to its constituents. COE expanded this into a series of objectives, and honed these objectives into a set of program outcomes anticipated. The specific mission statement goals of COE are to:

- 1) Creative technical expert: training technical experts to put into practice creatively by engineering education such as experiments and planning training, based on the basic technology.

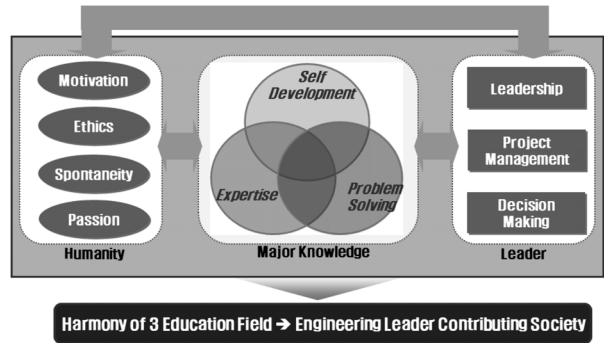


[Fig. 2] Adaptation of mission to the education program

- 2) Leading technical expert: cultivating leading technical experts as leaders with special technology and shipbuilding industry including the work for the ocean.
 - 3) Active training expert: educating technical experts that work diligently and sincerely with the responsibility for the country and the community in behalf of development of oneself and the group.
- This mission is adapted to the education program as shown in [Fig. 1].

In order to foster inter- and multi-disciplinary works of the highest quality in basic research, COE had established several research institutes and centers. These aim to advance technology transfer and training through the integration of research, information exchange, teaching, and practice: Research Institute of Industrial Technology, Korea Maritime Equipment Research Institute, Innovation Center for Engineering Education, Shipping Port and Logistics Center, Training Center of Semiconductor Batch Processing, Electric Wave Dark Room, Business Incubator Center, Information Technology Research Center, and Global Ocean Plant Engineering Center, etc.

After enhancing the relations with industries and adoption of group research system, COE aimed to develop education programs and technologies to cope with a harsh research environment by introducing own rich human resources to the various field. Various engineering based national projects were granted successfully such as BK21, NURI, NEXT, ITRC, IT-E Navigation, and GLOPEC, etc. Faculties had



[Fig. 3] Education background for engineering leader

shown tremendous efforts on these projects. The COE program is also committed to a process of continuous improvement. The information used for program improvement comes from a variety of sources. They particularly were included in programs for practical engineer: engineering english class for global leadership by native speakers, capstone design competition/awards in the COE to encourage students' participation (either unique teams or multi-major group teams), a system for academic advisor, and mentoring program by seniors and experts from industries. The most important thing for these programs is to train engineering students through creative engineering education for the future as shown in [Fig. 3].

III. General Ideas

In order to foster inter- and multi-disciplinary works of the highest quality in engineering research, advanced technology transfer and training through the integration of research, information exchange, teaching, and practice are necessary. The mission of the international conference is to share experiences and discuss on high quality education, research and service to own constituents. The conference also fulfills its mission by providing a valuable communication link among institutions and promotes participations that support student activities. It directs many of its efforts at providing for open and ongoing dialogues among these groups.

The necessary body for this Asia and Pacific conference is the board of directors. This body aims to contribute to the smooth operation of the International conference on engineering work and education and the promotion of exchanges of students

and researches among Asian and Pacific universities. Great effort is necessary to place on insuring that all participants invite most of all engineering fields to this annual conference even though some courses are still preparing for entering to this body. The conference will be held annually with the change of location (different university and/or country). There remain many things to discuss such as the location and name of headquarters, the name for board of director and the conference, etc. I believe that the following points should be discussed to achieve the goal of the conference.

- 1) To administer various matters related to the conference (supervising various matters related to the conference such as selecting the location, issues, contents, sessions, operational ways and etc.)
- 2) To establish and enforce ways to develop the conference
- 3) To pick out and intervene in the international joint researches, program and technology exchange, and etc.
- 4) To open student session among member
- 5) To manage member institutions and to admit new member institutions
- 6) To carry out publicity activities
- 7) To carry out other necessary matters to achieve the goal of the conference

Membership may be applied by the institution that supports its establishment goal through submitting a form and needs to obtain the approval of the board of directors.

IV. Functions of the Board of Directors

Body for the conference is the board of directors, which consists of one representative recommended from each member institution. The presiding officer is elected by the members of the board of directors. The board of directors decides the following matters.

- 1) Revision of the operational provisions for the conference
- 2) Admission of the new member institution
- 3) Selection of the location to hold the conference
- 4) Issues, contents, sessions, and operational ways of the next conference
- 5) Other important matters related to the works and operation of the conference

The board of directors opens its session with a majority of the board members. However, if a board member who cannot attend the session entrusts the duty by mail (including E-mail), it is regarded as an attendance. The agenda is passed by a majority vote among the board members present. In case of a tie, the presiding officer shall decide the issue. The board of directors is convened at least once a year by the presiding officer. A documentary resolution may replace a board of directors meeting. There are many committees, which the board of directors directs, such as planning, program, publication, and local committees. A series of documents include meeting agendas and minutes, member lists, budgets, conference programs and proceedings, committee lists, memoranda, program schedules, and registration lists, etc.

V. Preparations for the Future

1. Preparations of KMU

COE will prepare for the future by the following operations to attain the objectives referred to in article 2.2.

- 1) Enhancing the relations with industries frequently.
- 2) Modifying the format of the capstone design to emphasize teamwork, communication skills, and consult from companies.
- 3) Initiating engineering internships and field works.
- 4) Developing research based postgraduate train programs.
- 5) Increasing number of papers in journals
- 6) Transferring research activities & technology and exchange to the industries.
- 7) Authorizing faculties to get grants from government or private companies

All these are prepared by two main bodies in COE such as the COE Development Strategy Committee and the Industry-Academy Cooperation Committee. Initiation of the special courses for Samsung Electric Co. workers by the faculties of COE through several discussions and meetings and active participation throughout the year are a good example for the above. Joint research works supported by COE overcomes the barrier of majors. Discussions for preparation of the international conference in engineering and technology among Asian universities are going on with

Japan, China, Hongkong, Vietnam, Australia, Singapore, and Malay, etc. Major contents were agreed and summary on the discussions will be appeared soon.

2. Other preparations

There are many other matters for organization of the conference, such as an executive office to handle works and necessary staffs that might be needed, fee from the member institutions, contributions, subsidy, registration on the conference and etc. from the universities, central or local government, autonomous entities, institutions, industries and etc., together with agreement and joint declaration. We should cooperate in discussing how to seek the conference's substantiality by maintaining consistency in its contents and operation, and how to maintain and develop its establishment goal. We know that it is necessary to have a standing organization to carry out various tasks related to the conference, including management of its member institutions, establishment of its development methods, intervention of student participation program and scale of the conference, and common issues, etc.

Open discussion supported by every institution overcomes the barrier of majors. Discussions for preparation of the international conference in engineering work and education among Asian and Pacific universities are going on with Japan, China, Hongkong, Vietnam, Singapore, Malay, Australia, and New Zealand, etc. Major contents were agreed and I believe the summary on the discussions will be appeared soon.

VI. Conclusion

In order to give young students and faculties a firm belief and the vision as the engineering collaboration among institutions in Asian and Pacific countries for the future in the coming century and to promote the internal and external position of the university, let's do our best to cooperate with each other and keep strong connections in terms of engineering education and work. Discussions and share at the Asian and Pacific conference on engineering work with our eagerness will improve the present and future of the society. After enhancing the relations through the international engineering conference, we can move our steps forward to compete with the



[Fig. 4] Proposal for international network

world standard and to cope with a harsh research environment by introducing own rich human resources to the various field.

References

- Douglas, J., Iverson, E., and Kalyandurg, C. (2004). *Engineering in the K-12 classroom: An analysis of current practices and guidelines for the future*, American Society for Engineering Education, WA, DC.
- Dym, C. L., Agogino, A. M, Eris, O., Frey, D. D., and Leifer, L. J. (2005), "Engineering Design Thinking, Teaching, and Learning", *Journal of Engineering Education* 94 (1): 103-120.
- Wankat, P. C. and Oreovicz, F. S. (1993), *Teaching Engineering*, McGraw-Hill New York.
- Lee, J. W. (2009), *Reformation of Engineering Education in KMU*, The 1st Asia Conference for Engineering Education 2009, Busan, Korea.
- Lee, J. W. (2009), *Asian-Pacific International Cooperation in Engineering Work*, The Fourth International Symposium: Development of the Global Double Degree Program, 2009, Tokushima, Japan.
- OECD STI (2006), *OECD Science, Technology and Industry Outlook 2006*.

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