

A Study of MET Programs in Korean Two-Year Colleges

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Abstract

Mechanical engineering programs are offered by 138 departments of 66 two-year colleges in Korea during the academic year 1998. The curricula of 71 ME programs by 58 departments of 37 colleges are collected and analyzed. The programs are classified to 7 areas: Mechanical Engineering Technology, Machine Design, Automotive Technology, Automation, Die and Mold Technology, CAD/CAM, and the others. In order to compare the characteristics of each program, all courses offered are arranged into 253 typical course codes, which are classified to 6 categories, 22 sub-categories, and 164 detailed ones. The comparison between the 10 most common courses, drawn separately from 7 areas, was made and each program was characterized by a suggested model curriculum composed of 27 courses.

I. Introduction

The current system of junior colleges in Korea was formed by Education Law in 1979 after several changes. Their mission is stated as “to train and educate middle level professionals for national industrial developments”. In 1979 there were 127 colleges with an enrollment of 78,455 students. In 1998 there are 158 colleges (143 private, and 15 public) with 801,681 students. There are 2,643 departments (1,021 technical, 138 mechanical related) in Korean junior colleges with 530 different kinds (213 technical, 44 mechanical related) [Table 1]¹. Junior colleges offer 2-year regular programs in technical areas, which require 80 credit hours for an associate degree. Nursing and some of the medical related programs require 3-year and 120 credit hours for a similar degree. Some short term, non-degree programs are offered regularly, but limitedly.

Table 1. Overview of Korean junior colleges (1998)

	Types of Department	Number of Departments	Annual Student Quota	Number of Faculties (1997)
Total	530	2,643	278,630	12,468
Technical	213	1,021	141,480	4,554
Mechanical	44	138	24,935	N/A

The purpose of the study is to understand the characteristics and problems of mechanical related majors in Korean junior colleges by analyzing various curricula, and to use the results for future developments.

II. Classification of Courses

Sixty-six colleges had 138 mechanical engineering related departments in 1998². Authors sent a request for curriculum data to 116 department heads of 65 colleges, and received from 58 departments of 37 colleges. Thirteen departments offered multi-major programs, so the total

number of different curricula under study was 71.

These 71 majors are classified to 7 areas: Mechanical Engineering Technology (MET), Mechanical Design (MD), Automotive Technology (AT), Automation (AU), Die and Mold Technology (D&M), CAD/CAM, and the others [Table 2].

Table 2. Mechanical related fields under study

Area	No. of Colleges	No. of Departments	Annual Student Quota	Remarks
Mechanical Engineering Technology (MET)	9	9	1,570	
Mechanical Design (MD)	13	13	2,050	
Automotive Technology (AT)	22	26	3,330	
Automation (AU)	8	8	760	
Die & Mold Technology (D&M)	4	4	340	
CAD/CAM	5	6	440	
Others	4	5	670	

The courses offered by departments under study are classified by 164 course codes since each department uses different course names for similar subjects. They are classified to six categories: General Education (I), Computer (II), Basic Courses (III), Applied Courses (IV), Specialized Courses (V), and the others (VI). They are further divided to 22 sub-categories as shown in Table 3. The authors design this classification, and others might come up with a different one. Categories II and III include most courses offered by many departments, and Category V includes ones by few specialized departments. Sub-categories V-D and V-E include concentration courses for a few specialized programs for ease of analysis and simplicity. Technical English and Technical Japanese taught by ME department faculties in addition to general education are classified to Category VI.

Table 3. Course classification codes

Category	Sub-category	Remarks
I. General Education	A. Languages	Korean, English, Japanese, etc.
	B. Liberal Arts and Social Sciences	History, Literature, Management, etc.
	C. Natural Sciences	Mathematics, Physics, etc.
	D. Physical Education, Services	
II. Computer	A. Computer in General	
	B. CAD/CAM	
III. Basic Courses	A. Design and Drafting	Graduation works included
	B. Manufacturing Processes	Field training included
	C. Experiments, Measurements	
	D. Basic Theory	Strength of Materials, Thermodynamics, Fluid Mechanics, Kinematics, Materials Science
IV. Applied Courses	A. Automation	Hydraulics and Pneumatics, PLC, Mechatronics, Fluid Machines
	B. Automotive Technology	Automotive Engineering, IC Engines
	C. Refrigeration, Air-conditioning	
	D. Die and Mold, Jig and Fixture	Design
	E. Electricity, Electronics	
	F. Factory Management	Factory Safety, Production Control, Quality Control
V. Specialized Courses	A. Mechanical Engineering, Design	Structural Analysis, Dynamics, Control Theory
	B. Die and Mold major	Fabrication
	C. Automotive major	Design, Test, Maintenance
	D. Major related courses	
	E. Machines, Automobiles	
VI. Others	A. Electives	For teaching profession

III. Characteristics of ME Curricula

Kang³ suggests the roles of Korean junior colleges as follows: 1) to produce middle level professionals for industries, 2) to offer services to local society and popularization of higher education, 3) to provide adult education, and 4) to prepare their graduates for transfer to 4-year universities. The government emphasizes the first. When the role of training industry expert is emphasized, the curriculum is constructed to increase the passing rates of national technical qualification testing.

The analysis shows the number of courses, credit hours and class hours are uniformly distributed to four semesters. Required courses are offered mostly during the first year and comprised of more in-class lectures than experiments or hand-on practices, because most of the courses in this period are general education.

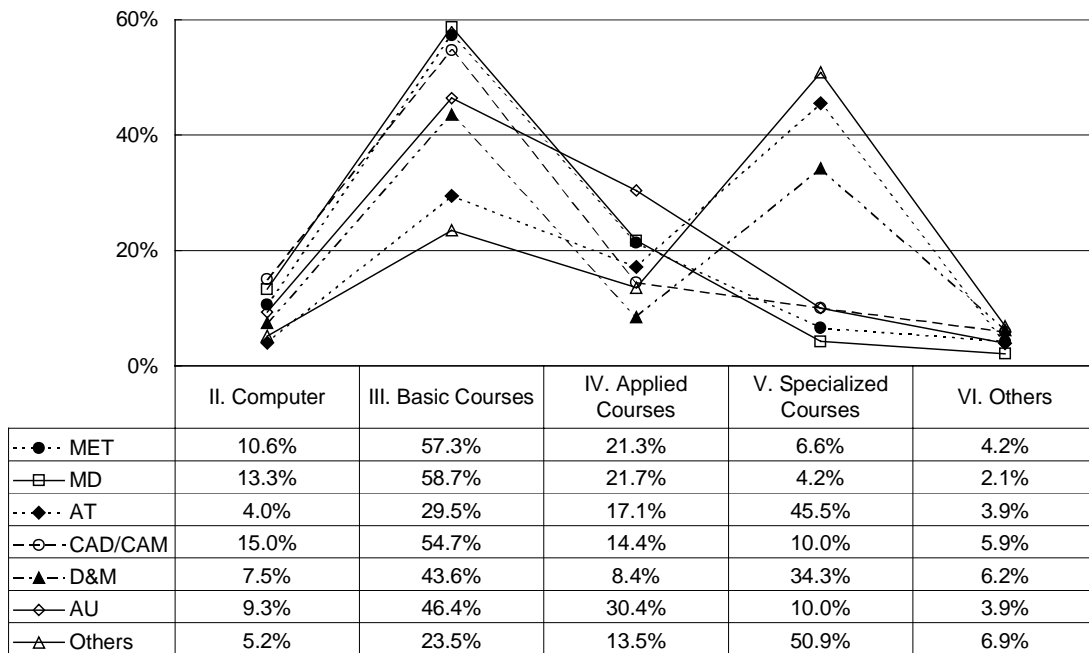


Figure 1. Distribution of major course credits for each category

Figure 1 shows the percentage distribution of credit hours of major courses (excluding general education) for 5 categories and 7 areas. More specialized courses are offered in specialized areas such as Automotive Technology, Die and Mold Technology and the others. The ratio for the basic courses is high for Mechanical Engineering Technology, Mechanical Design, and CAD/CAM in order to give the students better chances to transfer to 4-year universities after graduation or to prepare them for national technical qualification testing which is managed by the Korea Manpower Agency. It shows that courses are closely related to the qualification tests, because both junior colleges and the Korea Manpower Agency have similar purpose to produce proper workforce needed by national industries. The test grade for 2-year college graduates had changed its name from Class-2 Engineer to Industrial Engineer and the number of mechanical engineering related certificates increased from 19 to 31 in 1999⁴.

Figure 2 compares between the questions of 12 Class-2 Engineer and 17 Industrial Engineer tests that mechanical engineering related junior college graduates usually take, and the distribution of credit hours for all 7 areas under study or by four areas of MET, MD, AU, and CAD/CAM. The importance of applied engineering has increased since the title changed in 1999. This trend reflects the changes in the need of the industries, and the proper curriculum developments in junior colleges are also required to satisfy it.

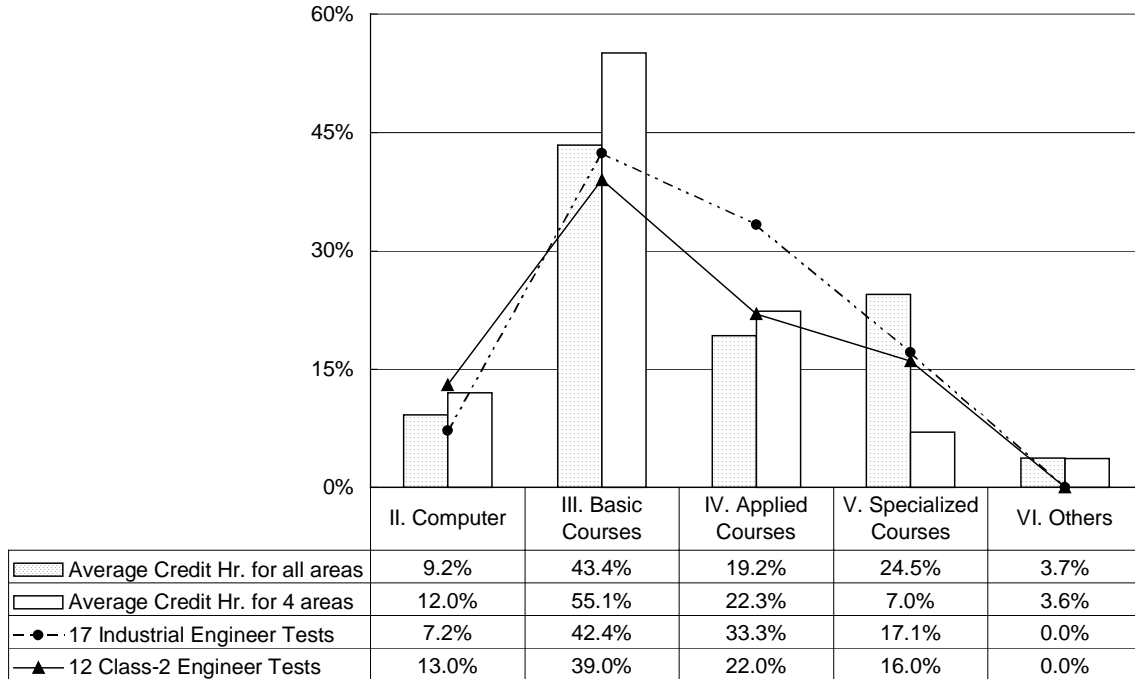


Figure 2. Questionnaire trends in National Technical Qualification Testing for mechanical engineering fields

Figure 3 compares the courses offered and the national technical qualification testing problems based on sub-category course codes. The weights of IV-B (Automotive Technology), IV-D (Die and Mold, Jig and Fixture), and V-A (Mechanical Technology and Design) are high for the Class-2 Engineer qualification tests since many materials are integrated in a single course with the same name by colleges. The courses for Industrial Engineer qualification testing represent two or three courses in colleges since 1999, and the weights are well matched. This means that technical qualification now requires an overall technical understanding rather than the knowledge of some specific courses as before. A relatively high discrepancy in specialized sub-category V-C (Automobile Technology) results from the requirements for the knowledge of the basic courses. Sub-category IV-E (Electrical and Electronic Engineering) in applied engineering has gained its importance as automation and mechatronics in mechanical industries became important.

Table 4 is the result of 10 most common courses in each major area. They are chosen based on the number of departments/concentrations, the number of courses offered, credit hours, and class hours. They are different for each major area because emphasis in each area is different. However, it must be noticed that 5 to 8 courses are included in all of the 4 bases stated above. Strength of Materials, Manufacturing Processes Practice and Machine Element Design are

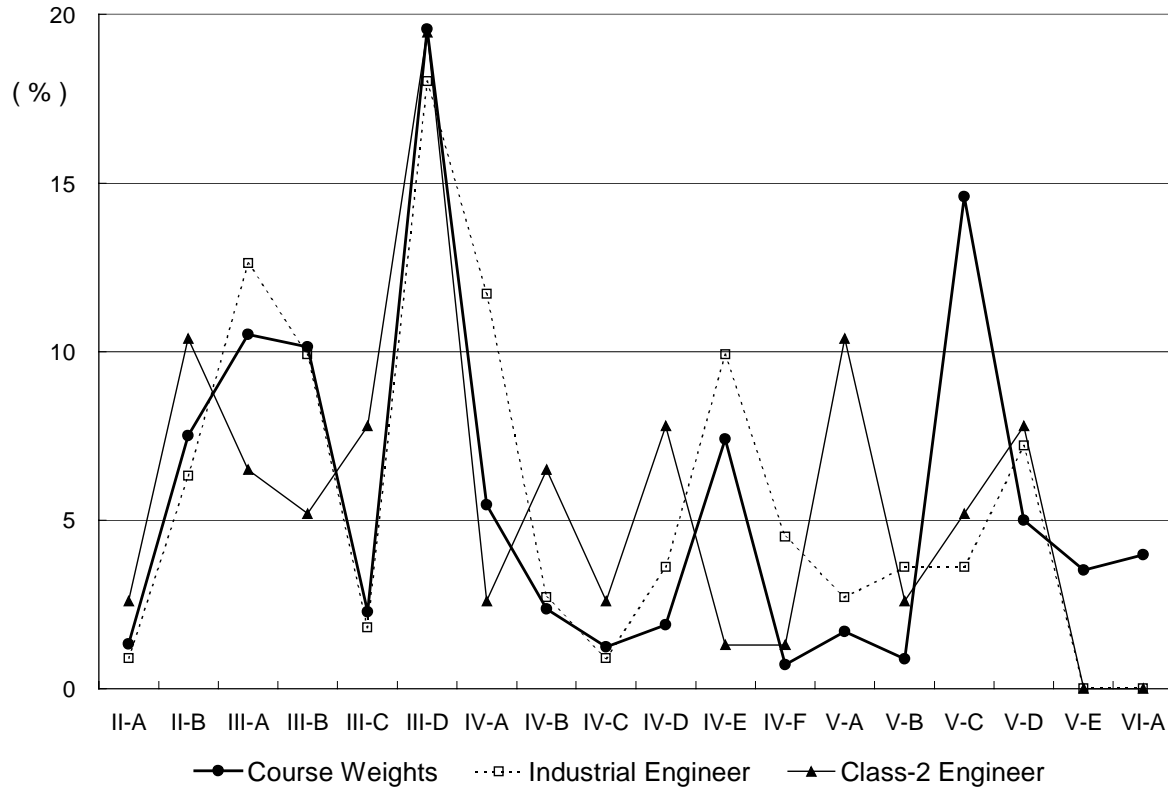


Figure 3. Comparison of course weights in each sub-category and National Technical Qualification Testing problems

Table 4. Ten most common courses in each major area

	MET	MD	AT	AU	D&M	CAD /CAM	Others	Remark ^{#2}
Field Training	○ ¹	○▲	○	○▲	○	○	○	7
Fluid Mechanics	○▲□●	○▲□●	○▲□●	○▲□	□	○▲□●	○▲□●	7
Strength of Materials	○▲□●	○▲□●	○▲□●	○▲□●	○▲□●	○▲□●	○▲□●	7
Basic CAD	○▲□●	▲□●		○▲□●	○●	○▲□●	○▲□●	6
Manufacturing Processes Lab.	○▲□●	○▲□●		○▲□●	○▲□●	○▲□●	○▲□●	6
Design of Machine Elements	○▲□●	○▲□●		○▲□●	○▲□●	○▲□●	○▲□●	6
Thermodynamics	○▲□●	○▲□●	○▲□●	○▲□		○▲□●	□	6
Manufacturing Processes	○▲□●	○▲□●		○▲□●		○▲□●	○	5
CAM		□●		●		○▲□●	●	4
Mechanical Engineering Lab.	●			●		▲●	●	4
Design Practice	●	▲●			▲□●	▲□●		4
Material Science	○	○▲□			○▲□	○□		4
Drafting Basics	▲□●	●			●		●	4
Course for Teaching Profession	▲□		▲□					2
Introduction to Computer					○▲□●		▲	2
Kind of courses	14	14	12	13	14	12	14	
No. of courses offered	68	71	90	69	52	56	60	

Notes: 1. Symbols represent the most common courses as follows:

○ in the numbers of departments/concentrations

▲ in the frequency of the course offered

□ in the number of credit hours

● in class hours per week

2. The number of areas that offer the course

3. There are 19 additional courses that are offered by one area only.

regarded important in all major areas except Automotive Technology.

The number of departments/concentration and the number of courses are given in Figure 4. Fifty-five percent of 71 concentrations offer 25 to 29 major courses, and the average number of courses offered in a major field is 26.5. The average course compositions are obtained by selecting top 27 courses in each major area. It shows that the Automotive Technology programs offer more practical courses than other areas, which emphasize basic courses such as Mechanics. Fifty-one percent of 51 departments/concentrations, of which information on general education courses are analyzed, offer 7 to 9 general education courses and the average is 7.8.

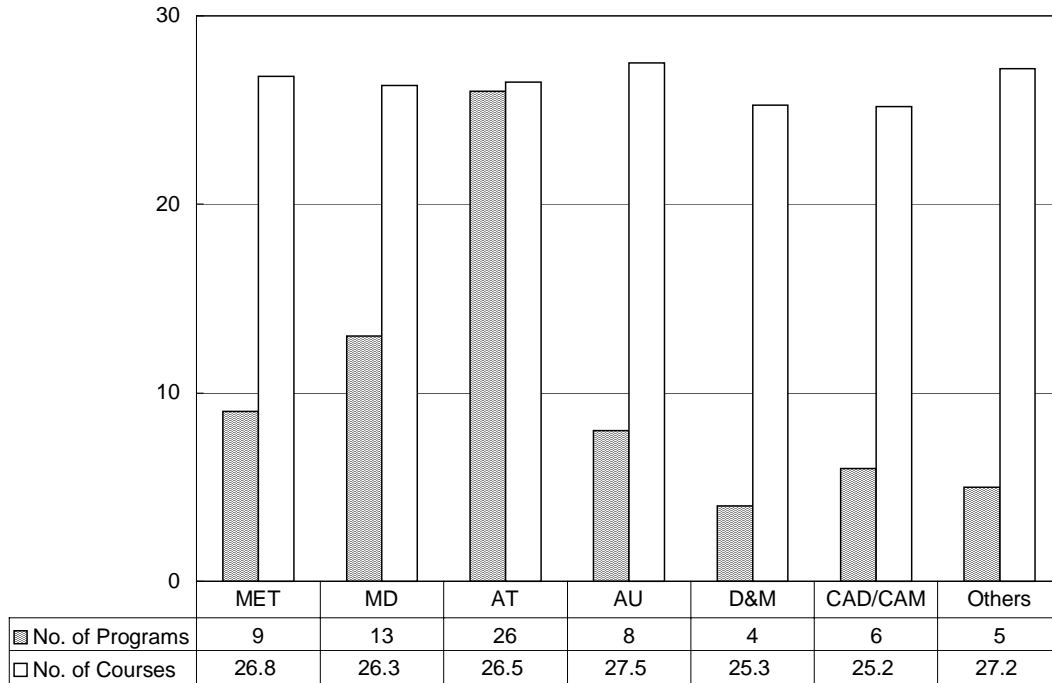


Figure 4. Average number of departments and courses in each area

The average number of credit hours, obtained by dividing the total credit hours by the number of courses, lies between 2.0 and 2.3 depending on the area. This means that the courses are offered for 2 credits in junior colleges while for 3 in most 4-year universities. More than half of the departments requires less than 30 % of their major courses as compulsory for graduation. Twelve departments/concentrations specify only Field Training or none as the required courses, and only 6 departments/concentrations specify more than 50 percent of major courses as a requirement for an associate degree. Generally the programs in the Automotive Technology area specify more courses as a requirement. Specialized departments/concentrations specify fewer courses as a requirement and offers many courses as common for several programs. The average ratio of practice to lecture hours is 1.13.

The ratios of the number of courses included in the 27 courses given in Table 4 to the total number of courses offered are shown in Figure 5. It is obtained separately on the total programs, Automotive Technology programs, and the rest. It shows that the programs in the Automotive Technology area are different from the rest. The number in abscissa is arbitrarily given to each program and the departments/concentrations with number 1–26 belong to the Automotive

Technology area. Fifty-eight-point-eight percent of major courses as a whole and 71.1 percent in the Automotive Technology area are included in the 27 most common courses.

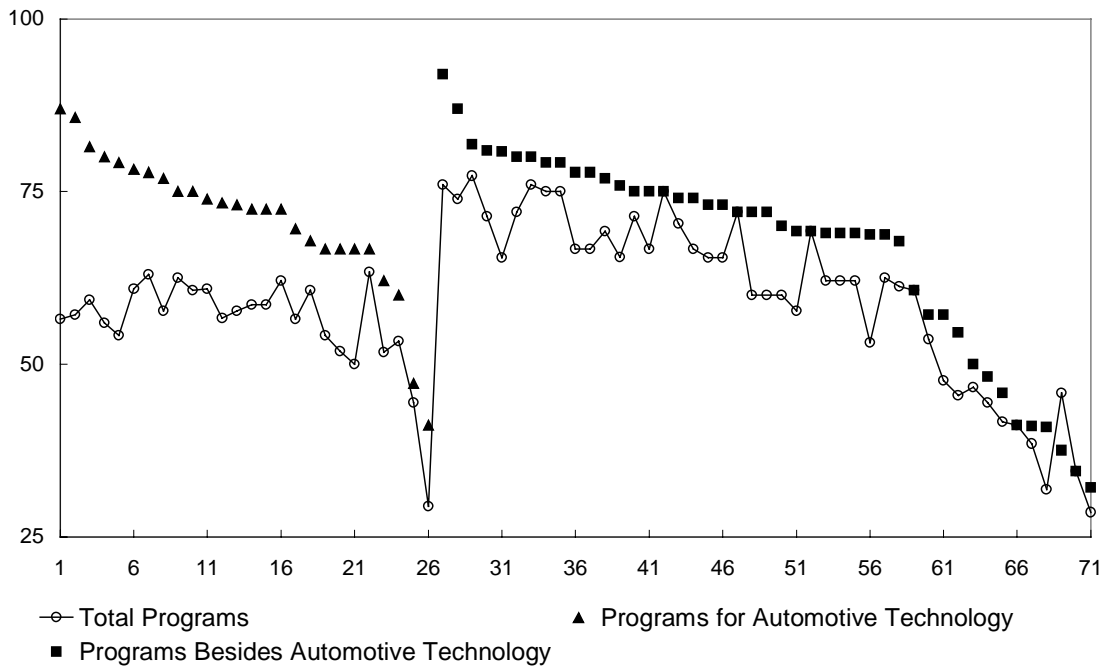


Figure 5. Ratio of the courses offered which are in the common courses

Table 5 shows the number of programs with discrepancy ratios from the average in major courses obtained in this study. It shows that 21 out of 26 programs (81 %) in the Automotive Technology area and 24 out of 45 programs (53 %) in the other areas have a discrepancy ratio less than 10 %.

Table 5. Number of programs with discrepancy ratio from the average common courses.

Discrepancy ratio	Automotive Technology	Other than Automotive Technology	As a Whole
With 15 % and above	3 (26)	11 (45)	13 (71)
With 10 – 15 %	2 (23)	10 (34)	12 (58)
With 5 – 10 %	7 (21)	12 (24)	14 (46)
With less than 5 %	14 (14)	12 (12)	32 (32)

IV. Summary and Conclusion

From the analysis of 71 mechanical engineering related programs in 37 two-year colleges in Korea, following conclusions have been derived:

1. A model curriculum with 27 major courses is suggested, and the characteristics of curriculum in 7 areas are analyzed by comparing with its model. The course classification codes suggested in this study can be used for curriculum development and/or revision.
2. It is found that approximately 60 % of the courses are common regardless of colleges or departments.

3. Of the 7 areas, the Automotive Technology programs emphasize specialized courses and have different characteristics from the other programs, especially from the conventional MET programs.

4. This study was done on the mechanical related programs only. A similar study may be needed in other areas. Further studies are also needed on the role of general education courses in vocational education of technical colleges. Also a study of vocational education in colleges abroad is needed to develop various programs such as degree and non-degree and short term programs in Korea.

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