

論 文

# RATIONALITY OF HYPOTHESIS IN COLLEGE OF TECHNOLOGY IN JAPAN

*Can the fiftieth anniversary reform it to be capable of real engineering education?*

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From the point of view of the reformation of college of technology in Japan, the history of its establishment, the current statuses and the background were reviewed without hesitation to find the way out of the crucial problems included therein. Through the discussions on the reformation, some important points that the fiftieth anniversary should aim were presented; the improvement of the environment of engineering education, and the legal guarantee and promotion of the research work of the faculty are pressing needs for the reformation of college of technology in Japan. The fiftieth anniversary should be the good opportunity to abolish the old discussions on the college of technology and to promote the external evaluation.

**Key Words:** *college of technology, reformation, faculty, fiftieth anniversary*

## 1. INTRODUCTION

About fifty years have passed since the “College of Technology” in Japan was established in 1962. Today, many colleges of technology have been, however, reformed as the colleges aiming to the real fundamental engineering education system which will be capable of obliging the hope of many young students who have entered them just after graduation from the middle school (at age only fifteen!) aiming to become good and promising engineers in their future.

Many colleges of technology in Japan have been established extemporarily in mid 1960's; the time of high-growth economy of Japan after the World War II, according to the national need to ensure many young and able workers who were well-trained in the engineering field to many developing industries at the time of Japan. Consequently, the system of college of technology has involved many aspects similar to the vocational training school for young boys.

The college of technology, thereby, has involved many crucial problems from the point of view of

normal early engineering education system for young students, as discussed later in detail, just since the beginning of its establishment; it has neither the system satisfying standard level of high school education nor that of university, the facilities in education and research environment have been very poor and unsatisfactory for real advanced education system of engineering, the faculty has no duty to conduct the research work, the graduates can never be awarded the title of bachelor in engineering. Nowadays, due to the yearly remarkable decrease in the number of teenagers in Japan, it has become difficult year by year to collect the applicants up to the regular number of freshmen of college of technology.

Needless to say, today's mainstream of the advanced engineering education in many industrialized countries, including Japan, has shifted into the master course at the graduate school. Unless the advanced course is completed and strengthened, there will be no other way for today's college of technology to survive in Japan accordingly. How can we break these walls; many

crucial problems in the system of college of technology? What policy and stratagem should we have to find the way out of them?

In recent over two decades, although there have been many discussions and arguments to find the way out of the crucial problems involved in the college of technology in Japan, the discussions have never been opened widely to many people, and thereby the actual status of college of technology has not been known enough to many people even in the area of engineering education.

In my personal view, the policy itself of the establishment of college of technology aiming to supply many young workers who are well-trained in engineering area to industries; extempore five-years school of vocational training for young boys who have just graduated from middle school, has prevented the people from discussing openly the reformation and reconstruction of it.

Nevertheless, it seems to me in other way too. Namely, today's crucial problems may give some good chances for college of technology to survive in Japan through the dynamic reformation fifty years after the establishment, according to the need of normal fundamental engineering education for promising young students.

In this article, from the point of view described above, as a member of the faculties in college of technology, I would like to review the current status of college of technology in Japan, and discuss it without hesitation to find the way out of the crucial problems included therein.

## 2. CURRENT STATUSES AND THE BACKGROUND

It should be emphasized here again that the college of technology has been established as the improvised five-years school of vocational training for young boys who have just graduated from middle school, aiming to supply many young workers, well-trained in engineering area, to developing industries of Japan in mid 1960's.

Many fatal defects in the current system of college of technology have come from this history of establishment. By the school education law of

Japan, although one of the important objects of university education is to develop and enhance the ability of the students both in morality and application of their knowledge, the main object of the education in college of technology is just only to let the students obtain the ability of their future occupation.

Consequently, the policy of high-growth economy of Japan in mid 1960's had almost no hope on the graduates of college of technology to develop and enhance their abilities both in morality and application of their knowledge. Owing to the difference in the object of establishment between university and college of technology, the faculties of college of technology have no duty of research work, and there has been officially no system supporting their research work accordingly. The object and policy of the establishment of college of technology in Japan in mid 1960's has never been changed yet and continued as it is still now, which has thereby brought about some crucial problems in the education system as follows;

(1) The course of general education, where the ages of the students of the 1st~3rd years are the same as those in high school, does *Not* satisfy the standard of high school education in Japan. The number of faculties is very small, and thereby many *part-time teachers* engage in many classes of fundamental important subjects; Mathematics, Physics, Chemistry, Biology, English, Japanese Language, etc. Consequently, although the main object of college of technology is "Education", the education environment is considerably poor for advanced education system in engineering.

(2) The credit unit for the class hour in the college of technology is counted as only a half of that in University. It leads to very congested curriculum for students and also for teachers accordingly. Unreasonably, on the other hand, the "required subject" in college of technology does not mean the subject of which the students must get the credit unit, but that the students should only learn it at their classroom. Consequently, there is no final hindrance for the promotion and graduation of the students, even if they have failed to get the credit

units of the “required subjects” of the fundamental important areas; Mathematics, Physics, Chemistry, English, etc.

(3) Owing to the lack of the scholarship satisfying the graduation level of high school in the important areas, many students of the 4th and 5th years cannot keep up with their classes in fundamental engineering education of the university level; Mathematics, Physics, English, etc. Average level of the scholarship of students of the 4th and 5th years is considerably lower than that of the 3rd year students of high school who aim to pass the entrance examination of university and study science and engineering. Today, although many graduates of college of technology have been widely accepted for admission as the 3rd year students of many universities, many of them cannot keep up with the classes in the university.

(4) Students have no aim to pass the entrance examination of university in their daily lives, and they have no duty to get the credit units of the “required subjects”. Many students cannot feel the necessity of studying and mastering the fundamental subjects of many classes accordingly. From the point of view that the authentic advanced engineering education system should aim to train the students who will be capable of engaging in jobs in many areas in their future, and of becoming the leader in their work group, the system of college of technology may have fatal problems since the establishment, because authentic engineers need to be capable of appropriate and correct “decision making” in many cases in their jobs.

(5) Faculties of college of technology have no duty to engage in the research work, and there has been officially no system supporting their research work accordingly. As a matter of course, not a few faculties who have long career in college of technology have abandoned the research work finally, which has led to the obvious decrease in their education activity also.

These are the characteristic aspects that can be observed commonly in many colleges of technology in Japan, but the people even in the

areas of engineering and advanced education know them little. It is due to the fact that the system of college of technology has been closed on the peculiar course far from the normal education system of Japan. For about fifty years since the establishment, this closed system, which is little known to people, has prevented the reformation and reconstruction for the development of college of technology. From the point of view of the current status of college of technology, the certification by JABEE (Japan Accreditation Board for Engineering Education) may be unreasonable, because many parts in the current system of college of technology are far from the standard of the accreditation by JABEE.

It should be noted here that the future position of the graduates of college of technology in many working areas; companies, public offices, etc., is, in fact, not good for their high competence in their work. It, however, has been as same as that in the time of establishment in mid 1960’s, because the educational background still weighs greatly in Japanese society. The number of the graduates of college of technology in a year is very smaller than that of the university and the graduate school in engineering. Today’s many working areas in engineering, in particular the research and development division in many companies and public institutes, require the staffs who have been well-trained in engineering and also obtained the degrees of bachelor and master in engineering. Many of intellectual people in Japan including teachers of middle and high schools have, of course, already known this disadvantageous future of the graduates of college of technology since the establishment fifty years ago.

The unreasonable disadvantage in the future of the graduates has brought about many serious troubles for the students in many colleges of technology in the early 1970’s, which were the reasonable protest of many students at that time. There was, however, no other way for teaches and staffs except to tell the students to leave the college if they don’t agree with the object of the

establishment of college of technology.

The hypothesis; the graduates of college of technology will be acceptable in their future as the promising professional engineers in many industries, had *No* rationality at all, and had been just only a fantasy since the establishment. In fact, in my personal view, there are no teachers and staffs of the college of technology who hope their son or daughter to enter the college of technology, if they had experienced the normal advanced education in the university.

Owing to the marked decrease in the number of teenager in Japan, and to the increase in the interdisciplinary areas of engineering, today's Japanese universities in engineering have faced their reformation to become attractive and outstanding. Reorganization and unification of many departments in similar engineering areas have been, thereby, reasonable mainstream. On the contrary, the departments in the college of technology have been subdivided into many branches according to the administrative guidance of education of Japan government.

College of technology has involved some crucial inconsistencies since the establishment. If it aims the extempore five-years school of vocational training for young boys who have just graduated from middle school, the establishments of the university of technology and the graduate school in Nagaoka and Toyohashi, which connect to the college of technology, would have no rationale. The establishment of the advanced course in the college of technology also would have no rationale. On the other hand, if college of technology aims the advanced school of engineering for young boys, it cannot account for the aforementioned many fatal defects in the current system.

In addition, there is no legal ground for the current advanced course in the college of technology because it cannot satisfy legally the standard accreditation level of university, and the faculties who have no duty of research work engage in the education of university level, although the faculties of university have the duty of research

work by the school education law of Japan.

These many fatal defects in the current status of college of technology have brought about much discouragement of new (and young) teachers who have excellent career in various areas of engineering. As a matter of course, many of the new teachers become eager to search and apply to another faculty position shortly after their arrival at the college of technology.

Whatever the current legal assignment in Japan is, today no one may have the objection to the opinion that the college of technology has already finished the duty, and thereby should be reformed and reconstructed as a normal and real advanced school in engineering. The college of technology has already been left behind the mainstream of advanced engineering education system, and it has been very difficult year by year to collect the freshmen up to the regular number due to the obvious decrease in the number of teenagers in Japan.

The choice of abrogation of college of technology due to the finish of its social duty, of course, may be one of the reasonable policies in the future programs of the advanced engineering education in Japan. It should be emphasized, however, that the college of technology has greatly contributed to the fundamental engineering education for many young boys who have no chances to enter the university due to the economical status of their family since the establishment in mid 1960's.

### **3. HOW SHOULD IT BE REFORMED?**

In recent over a decade, almost all colleges of technology have invited the applicants openly for a new position of faculty who has a Ph.D. degree in science or engineering as the minimum requirement. Namely, today's college of technology has requested all applicants to have the sufficient research career before their employment. Owing to the obvious increase in the research activity of the faculty of today's college of technology, almost all faculties have Ph.D. degree, and they are to be

qualified every five years to maintain the faculty position in the advanced course of college of technology.

Thus, It seems to me that today's college of technology has been reformed and reconstructed to become the real advanced school of engineering, and to be capable of obliging the hope of many young students. Today's society, fifty years since the establishment, may give the college of technology a good chance to be reformed and reconstructed.

The first, it should be emphasized here that the old object and policy of the establishment of college of technology of fifty years ago should be abolished officially. The number of graduates of college of technology who aim to enter the university as the 3rd year students has increased year by year, and today's almost all departments in science and engineering of the university in Japan accept them warmly. As the result of it, the number of the graduates of college of technology who could successfully get Ph.D. degree in science and engineering has increased year by year.

Consequently, the old object and policy of the establishment of the college of technology; the improvised five-years school of vocational training for young boys who have just graduated from middle school, has already lost the rationality. The fantasy in the old object and policy of the college of technology; "extempore vocational training school for able young boys" or "complete education for promising young boys as future gentle engineers" should be abandoned officially. No one has believed them since the establishment fifty years ago.

The main and important points for the drastic reformation and improvement of the college of technology are, in my personal view, as follows;

(1) The education process in the division of general education for the 1st~3rd years students should be completed to satisfy the standard of high school education, so that the students can never be separated from the education process of the students in high school. The education process in college of technology should never be exceptional among

the usual education system for young boys of the same age.

(2) The education of college of technology should be divided into two steps; high school and university levels. The student's free choice of variable courses should be admitted legally after their completion of the third year course; getting a job, entering the university or continuing the study in the college of technology. This has been counseled strongly by many professionals in education, and proved by the fact that about 20~30% of new students (freshmen) usually disappear at the graduation ceremony five years later.

For obtaining the social authorization as a real advanced school of engineering through the reformation, the college of technology should change into the school of which the young graduates have no disadvantage in many areas; companies, public offices, universities, etc. The college of technology should concentrate on the fundamental education, so that all young graduates can get the scholarship satisfying the graduation level of high school in many important areas of engineering; Mathematics, Physics, Chemistry, English, etc., and all applicants can successfully enter the university as the 3rd year students passing the entrance examination. Today's social background is entirely different from that of fifty years ago, the establishment of college of technology.

For the faculty in college of technology, the academic environment has been very poor to sustain their research activity still now since the establishment. All faculties have, however, engaged in enthusiastic engineering education and research work even in such the disadvantageous environment. Such the enthusiasm has been needed for the faculty of college of technology.

Needless to say, for the original and active work in education, the principle on the research methodology must have been established in the faculty itself. Consequently, in the current status

of the environment (education and research) of college of technology, the very careful screening on the employment of new faculty is needed.

I would like to emphasize again here that the old object and policy of the establishment of college of technology of fifty years ago should be abolished officially. The improvement of the environment for engineering education, and the legal guarantee and promotion of the research work of the faculty are pressing needs for the reformation of college of technology in Japan.

We should remember that the main principle of engineering education for young students is to bring up them as “professional for finding the problem“ rather than “professional for solving the problem”. Education in college of technology should never be degraded to vocational training.

#### 4. WHAT SHOULD THE 50<sup>th</sup> ANNIVERSARY AIM?

Although the reformation and reconstruction of the universities and the graduate schools have been important subjects for their survival due to the marked decrease in the number of young students in Japan, in particular, in the recent two decades, the college of technology has been left behind the mainstream of them still now since the establishment fifty years ago. It is, however, well-known fact that the current status and the crucial problems of the college of technology are attributable to the administrative guidance by the former ministry of education of Japan government for many years since the establishment.

In my previous article, the history and the current status of college of technology in Japan have been described in detail without hesitation, and one of the reformation programs for the survival has been proposed<sup>1)</sup>. The discussions in the article have attracted many favorable comments from many faculties of university and college of technology, and the presidents also.

Consequently, many people in the area of today’s advanced education in Japan have already ascertained the kernel of the problems included in the college of technology. The fiftieth anniversary

should be the good opportunity to abolish the old discussions on the education of college of technology; “*extempore vocational training school for able young boys*” or “*complete education for promising young boys as future gentle engineers*”.

Today, it has been very difficult year by year to collect the applicants up to the regular number of freshmen of college of technology. The main attractive points of college of technology for many young boys and their parents may be the easy path to enter the university as the 3rd year student, and the complete education in the advanced course.

Needless to say, today’s college of technology needs an external evaluation on the current status and the future program by many people in various areas; local society, high schools, universities, colleges, industries, etc. The fiftieth anniversary should be the good opportunity for the promotion of the external evaluation also.

#### REFERENCE

- 1) Ishida, H.: Today’s Problems in the College of Technology of Japan, *Engineering Education*, Japan Association of Engineering Education, Vol.43, No.3, pp.24-28, 1995.

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