

## COTINUED EFFORTS IN THE CREATION OF AN ACTIVE EDUCATION ENVIRONMENT IN NIT, GIFU COLLEGE

N. Ogawa<sup>\*,a</sup>, T. Tokoro<sup>b</sup>, A. Shimizu<sup>c</sup> and Y. Itoh<sup>d</sup>

<sup>a</sup> Department of Architecture, National Institute of Technology, Gifu College, Motosu-city, Japan

<sup>b</sup> Department of Electrical and Computer Engineering, National Institute of Technology, Gifu College, Motosu-city, Japan

<sup>c</sup> General Education, National Institute of Technology, Gifu College, Motosu-city, Japan

<sup>d</sup> President, National Institute of Technology, Gifu College, Motosu-city, Japan

\*ogawa@gifu-nct.ac.jp

### Abstract

Since 2001, with the help of the operating support fund from the Ministry of Education, Culture, Sports, Science and Technology (MEXT), our college has placed personal computers in the fourth-year classrooms, so that every student has exclusive use of a personal computer. However, in our fourth replacement of the entire system made last year, the fourth-year classrooms were reborn as classrooms where active education can be practiced. At the same time, the number of the seminar rooms of the Information Processing Center was increased from 3 to 5. Last year's activities related to the "Acceleration Program for Rebuilding of University Education (AP)" were to install equipment such as electronic blackboards primarily in the second and third-year classrooms, while promoting active education simultaneously in the second and third-year classes as well as in the first-year classes; equipment such as electronic blackboards was installed in the first-year classrooms two years ago. This year's activities are to install equipment such as electronic blackboards in the fourth and fifth-year classrooms, while promoting active education simultaneously in the classes of all years in all five departments.

In academic year 2015, we promoted active education mainly by making specific, elementary-level teaching materials, based on the items suggested by some senior graduates of our college working in Japanese industries. The teaching materials made from senior graduates' recommendations had a different focus from those of our teachers. Also, in our college, we are aiming that students will acquire the ability to describe matters related to engineering in English, while promoting the interactions between the teaching of technical English and that of the specialized subjects through active education. The activities of our college in visualizing our educational content are promoted by clearly showing the learning content of each student conducted outside the campus and developing a

database system which enables students to visually evaluate their degree of attainment. In academic year 2015, we developed a database system to visualize the learning content conducted outside the campus and started operations.

**Keywords:** *ICT-driven Education, Active Learning, Learning Environment, Creation of an Educational Environment, Educational Content, Learning Tools*

### Introduction

National Institute of Technology (NIT), Gifu College has been promoting an approach to practice ICT-driven education in all of the fourth-year classes by placing personal computers in the fourth-year classrooms of all five departments, so that every student can use one exclusively. Also, forming a consortium with more than 20 colleges and universities within Gifu prefecture, we have been practicing distance education using e-Learning under the credit transfer agreement. Moreover, we have been providing another consortium, which is run under the credit transfer agreement, with some e-Learning lectures. The consortium, which our college participated in when established, covers colleges, universities, graduate universities, the Open University of Japan in addition to NIT, Colleges.

As just described, for more than fifteen years, our college has created an educational and learning environment capable of utilizing ICT and supported students' voluntary learning. We applied for and successfully acquired the "Support Program for Contemporary Educational Needs (GP)" of MEXT in 2004, and its three-year major financial support helped build the foundation of the latter consortium as the "credit transfer project" using e-Learning. The project has successfully continued until today, and the number of NIT, Colleges which have participated in it has reached almost half of the total.

In 2014, MEXT inaugurated the AP with the aim of rapidly developing the projects of higher education institutions which have been successfully continued after the acquisition of "GP", etc. We applied for and

successfully acquired the AP in 2014, when it was inaugurated. Financially supported through the AP by MEXT, we are promoting a higher level of collegewide active education at an accelerating rate.

### Renewal of the Fourth-year Classrooms and the Seminar Rooms of the Information Processing Center

In our college, ICT-driven equipment of the fourth year classrooms of all five departments, which we mentioned in the Introduction, has been replaced every five years since it was first introduced. In the fourth replacement done last year, we changed each of the fourth-year classrooms of all five departments into a flexible classroom environment where active learning can be practiced by using tablet/notebook computers, connecting to classroom wireless LAN. Prior to that, the system of the fourth-year classrooms was the same as that of three seminar rooms of the Information Processing Center. See Lage, Platt, and Tandreghia (2000), Begmann & Sams (2012), Khan Academy (2006), and Bonwell & Eison (1991) for various AL methods.

We expected, however, that the change of the fourth-year classrooms into a flexible classroom environment for practicing active learning by using tablet/notebook computers would make it almost impossible to practice programming/CAD. Before that, the students were learning them by using high-specification desktop computers with high memory capacity, high-speed arithmetic processing capacity and advanced drawing performance which were installed in the fourth-year classrooms. In order to deal with this situation, in this replacement we increased the number of the seminar rooms of the Information Processing Center from 3 to 5. (Figure 1)

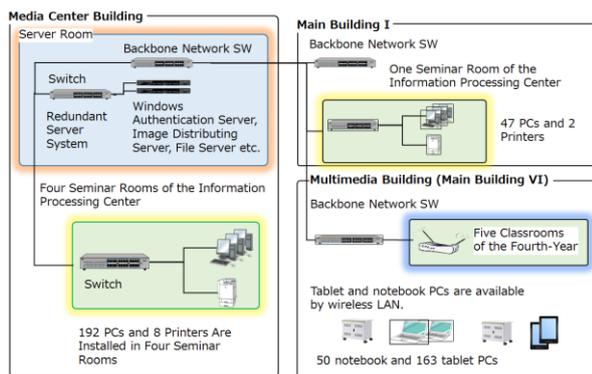


Figure 1 The whole image of the seminar rooms of the Information Processing Center and related facilities after the replacement

Through the replacement of the Information Processing Center the following were introduced and distributed into 5 seminar rooms: 242 Client PCs (DELL: OptiPlex 3020 SFF), 4 Servers (DELL: PowerEdge R430), 1 NAS (Dell Storage NX3230), 10 Printers (Canon Laser Beam Printer Satera LBP8710), 5 Document Cameras (EPSON: ELPDC12)

### Establishment of an Educational Environment through the AP Project

The AP, now having five different themes, is an open-type project which MEXT inaugurated with the purpose of promoting the educational reform of Japanese higher education institutions at an accelerating rate. Theme I of the AP is “the practice of active learning”, Theme II is “the visualization of the learning outcomes”, and our successfully adopted project covers both Theme I and II. Now, entering the third year since our AP project started, our college is planning to install electronic blackboards in all classrooms from the first to the fifth year which will realize interactive function between teachers and students through a wireless LAN.

The above-mentioned system was introduced into the 5 classrooms of the first year two years ago, into 10 classrooms of the second and third years last year, and will be introduced into 10 classrooms of the fourth and fifth years this year.

The introduction of ICT-driven equipment into all classrooms of all the five departments will create a practical educational environment where students’ voluntary, active learning will be promoted.

Our college is utilizing two different kinds of LMS: Moodle, which we independently introduced as LMS, and Blackboard, which the head office of NIT, Japan is providing for nationwide NIT, Colleges. Each of them is suitable for the above-described educational environment and is useful for promoting active learning.

### Teaching Materials Made from Senior Graduates’ Viewpoint

We refer to old-time graduates of our college as NIT senior graduates (NITsg). They have long contributed to the development of Japanese manufacturing industries, and have an understanding of what is expected of human resources NIT, Colleges have provided to the industrial world. Therefore, they are invaluable to our college, having an idea of the needs and seeds of technological education in Japan. The cooperation between old-time graduates and the field of education is the task imposed on NIT, Colleges today.

We are making teaching materials in cooperation with NITsg, while incorporating their suggestions about what students should learn. The suggested 45 subjects were categorized into the introductory, intermediate and advanced levels. (Table 1)

Table 1 The List of Teaching Materials Made Based on Subjects Highly Recommended by Corporate Engineers (Progress of Making Teaching Materials as of July 7, 2016)

No	Subject	AL Content	Introductory	Intermediate	Advanced	The Presence of Cooperation with Graduates
Liberal Arts						
1	Pollution Issues and Contemporary History	○	○	○	○	○
2	History, Politics and Economics, Law	○	○		○	×
3	The Constitution of Japan	○	○			○
4	Modern History of Neighboring Countries	○	○			○
5	Chinese Classics	○	○	○	○	×
6	How to Write Numbers in Japanese	○	○	○	○	○
7	Social Ethics	○	○	○		○
8	Engineering English	○	○	○		○
9	Writing Skills in Japanese	○	○	○	○	○
Natural Science						
1	Moment of Inertia	○	○	○		×
2	Standard Deviation	○	○	○		×
3	Scatter Diagram and Regression Analysis	○	○	○		×
4	3D Printer	○	○			
5	IT Engineer Examinations	○	○	○	○	×
6	Arithmetic Mean and Geometric Mean	○	○			
7	Examples of How to Utilize Numerical Integral	○	○			
8	Linear Planning	○	○			○
9	yard, pound	○	○			○
10	Physical Meaning of Correlation Coefficient	○	○	○		
11	Orthogonality between Longitudinal Wave/ Transverse Wave and Function	○	○			
12	Human Error	○	○			
13	Multiple Classification Analysis	○	○			○
14	Design of Experiments	○	○			○
15	5S	○	○			

The 45 subjects shown in Table 1, which were highly recommended by corporate engineers, are used for developing the learning support content in consideration of a link with the Model Core Curriculum provided by NIT, Japan. However, some parts of the content do not completely conform to some class subjects of our college curriculum. On the basis that they will be used

16	FMEA/FTA	○	○			
17	PLC/programmable controller	○	○	○	○	
Practical Mechanics						
1	JIS Material Mark	○	○			○
2	How to Write Formula of Thermodynamics	○	○			
3	Law of Thermodynamics	○	○			
4	Energy in Thermodynamics	○	○			
5	Heat Calculation	○	○			○
6	Diagrammatic Drawing Used in Thermodynamics	○	○			
Electronics						
1	Feedback Control	○	○	○		○
2	Operational Amplifier	○	○	○		○
3	Vector Control of Three-Phase Induction Motor	○	○	○		×
4	The Basis of the Finite Element Method	○	○	○		×
5	Time Constant	○	○	○	○	○
6	On-the-Spot Design Chart with a Nomograph	○	○	○	○	○
7	Phase Delay (Velocity) and Group Delay (Velocity)	○	○	○		○
8	Characteristic Impedance	○	○			×
Environment						
1	Processing Test of the Activated Sludge Method and Measurement of Water Quality Management Items	○	○	○		○
2	How to Proceed with Soil Contamination Countermeasures	○	○	○	○	○
3	The Membrane Isolation Activated Sludge Method	○	○	○	○	○
4	Harmful Chemical Substances Contained in Materials	○	○			×
5	Industrial Activity/Daily Life and Environmental Issues ( Various Environmental Cleanup Technologies)		○			

as study-support content when students learn the challenges corporate engineers tackle, we intend to promote development of the teaching materials.

We plan to use the teaching materials we make in specific classes and also in various related classes. In addition to these, we are going to provide them as autonomous learning materials for students who prepare for life after graduation. Moreover, we are promoting

the making of the materials with a view to using them at “School for Fostering Core Human Resources”, a recurrent education for mid-level engineers in the community

### Visualization of Learning outside the Formal Curriculum

Aiming at establishing a system of visualizing students’ learning activities performed outside the formal curriculum based on a points system, we discussed what kind of student activities are to be evaluated in all the departments of our college. Then, we selected the items to which the “practical engineering points” are to be given and determined the details. As a result, when students perform learning activities outside the formal curriculum, the activities started to be evaluated just like learning activities in the formal curriculum according to the rules of the respective department. So, we made up a system with a database with the purpose of visualizing these activities.

When implementing a database, we made it possible to work under a versatile environment and separate the database and the website. The program was written with PHP and JavaScript, the operating software for the server was Cent OS, Linux-based OS, web management software was Apache, and the database management system was MySQL. When implementing them, we separated data and appearance by using the different programs for connecting to the database and in the display area. By doing this, it will be easier to transfer the database into a different management system in future.

Users access the database through a web browser. The website of the system was designed to authenticate the students and the faculty with the campus authentication server in order to protect against unauthorized access. The acquisition of username after authentication made it possible to create a page specifically for the faculty.

We performed operation verification of the system in a test server for campus use only and compared the students’ acquisition conditions of points collected so

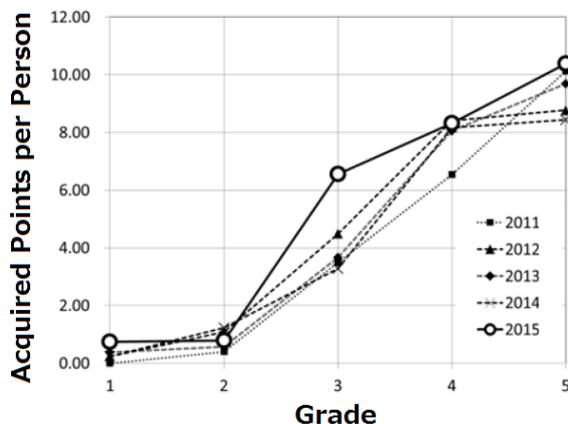


Figure 2 Changes in Acquired Points per Person for Each Academic Year, see NIT, Gifu College (2016)

far in the Department of Electrical and Computer Engineering, with those of the same department collected in a server on a trial basis, in terms of acquired, average points per person. As a result, it turned out that the acquired points, among others, of the third year students had increased. (Figure 2) Every year, the number of points registered in the third year is very high in the department, for the number of accumulated points at the time of the third year decides on the course students take in the fourth and fifth years. Even so, the increase in the academic year 2015 when the system was introduced was especially conspicuous.

### Conclusions

In the modern era of expanding globalization, not only natural resources but also knowledge, technologies and human resources have already become borderless. While providing education to produce human resources with social competencies for survival who are capable of responding to the wave of globalization in future, NIT, Colleges are expected to provide education to contribute to local communities. In this project, we have established education systems to evaluate learning activities outside the formal curriculum, cultivate students’ autonomy and initiative through development of teaching materials supported by NITsg with work experience, and develop students’ innovative spirit through practice of active learning.

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