

# Promoting Motivation for Studying in Mechanical Engineering through Networking

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## 1. Introduction

Due to the recent advance in information technology, much concern has been focused on employing technologies such as networking and multi-media to make classes more exciting and attractive in university. On the background of utilizing the technology in the class, there is a recent trend recognized in universities which suggests that students are less willing to study hard due to the decrease in the number of 18-year-olds in the past decade in Japan which makes entering university much easier than before and produces many students not pursuing their own academic interests in the class. Then, various educational practices have been tried to make the class more attractive and students more eager to study with the aid of information technology [1,2,3].

Sponsored by JUCE (Japan Universities Association for Computer Education), which is responsible for supporting private universities with information facilities, devices and software for computer education, an educational practice has been conducted in the class of Finite Element Method (FEM) in the department of Mechanical Engineering at Kanagawa Institute of Technology (KAIT) to motivate students to have more interests and study on the subject by connecting the class with the design office of an automobile company and a laboratory related to FEM in other university, and giving short time lectures by the professionals outside class through network. Q & A was also conducted to give students chances to ask the lecturer directly about anything they have interests in through network. The practice in the subject was made thanks to the collaboration by the professionals to give students an impact to study. This paper is to describe the

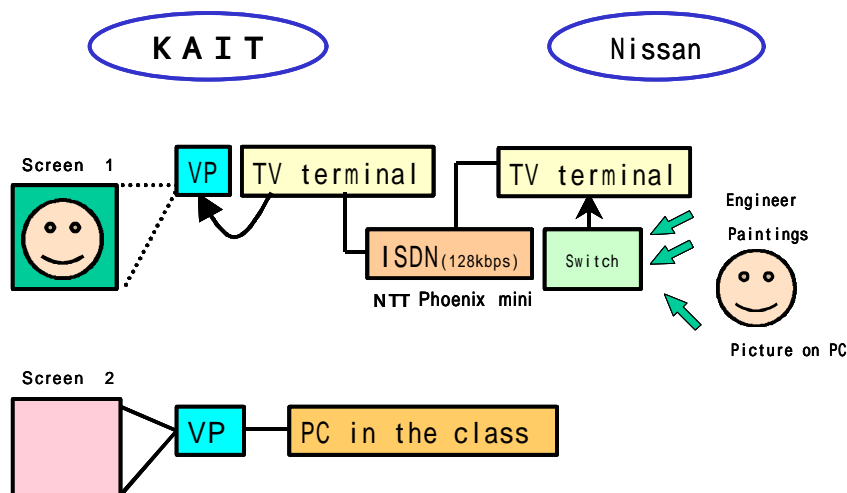


Fig.1 Device to connect the class with Nissan

detail of the practice and the effectiveness and problems of collaboration in the class by volunteers from industry and university.

## 2. Collaboration of professionals outside class

### 1) Short lecture by the engineer in the design office of an automobile company

Since the middle of the 1950s when FEM was presented at first for the structural analysis of the airplane, it has been used widely as an effective computational tool to design products in a wide range of industries including the aeronautic and automobile industries. From the importance of the subject applied to design products in various industries, it has been taught in the second term of the junior class in the department of Mechanical Engineering at KAIT. In the first class of the term, a short lecture as long as 25 minutes including 5 minutes Q & A was given through network by the engineer in the design office of the Technical Center (TC) at Nissan Motor Company (Nissan), where FEM has been used to design the variety of new cars. Fig.1 shows the overview of the communication device used for the practice to connect the class at KAIT and the design office at Nissan. Both sites, 15 km apart each other, were connected by a portable TV communication system commercially available within \$1,200 with two note-size terminals embedded with small cameras for each using a 128 kbps ISDN line. Two screens were used in the class, one for the picture sent from Nissan, and the other for the picture from the computer in the class. The picture from Nissan was switched among computational results by FEM on PC used to design various cars, an image of the engineer who gave the short-time lecture, and paintings shown by the engineer on hand. The picture and voice sent from Nissan were directly released on the screen through a video projector and an amplifier equipped in the class.

**Schedule of the class.** Table 1 shows a time schedule of the practice in the 90 minute class of Finite Element Method. At the beginning of the class, the history and present status of FEM applied to design various products in a wide range of industries are given by the professor using pictures shown on the screen from a computer in the class. Following the introduction of FEM to the students in the class, the professor called the engineer in the design office at Nissan asking to know about the current status of the automobile industry, and how FEM is used to design new cars in Nissan. The microphone was given to the engineer at Nissan.

Table 1 Time schedule of the practice through network

Item	Time (minutes)	Speaker
History of FEM Status of FEM in various industries	30	Professor
Introduction of TC Status of FEM in Nissan Examples of the application	20	Engineer
Q & A	5	Students and Engineer
Message	3	Engineer

A clear picture and voice were sent from the desk of the engineer. Including a brief introduction of TC where he works (Fig.2, 3), he gave a lecture as long as 20 minutes in a clear and gentle voice on the screen in the class about the current status of FEM applied to the design of new cars at Nissan,



Fig. 2 Technical Center of Nissan



Fig.3 CAE/CAD room in Nissan

and practical examples of finite element static and dynamic analyses to design various cars including animation of modes shape and car-crash analysis through the network. Then, a 5 minutes Q & A followed between students in the class and the engineer in the design office. Finally the engineer sent an impressive message to students to encourage them to study hard if they are interested in designing good cars to be accepted in society and the natural environment in future. Fig.4 and 5 show the scene in the class where the practice was made, and the communication between a student who asked a question and the engineer who answered to it, respectively.

## 2) Short lecture from a prominent professor at Tamagawa University

In the last class after having learned about the theoretical aspect of FEM, the numerical method, designing and programming a two dimensional FEM structural analysis program, and the analyses of simple problems by the program they developed themselves, the class was connected with a laboratory at Tamagawa University, which is 20 km away from the class, and a short lecture was given by a prominent professor about the current status of research works on finite element fluid dynamics. An interesting picture of the animation of analysis results was released on the screen in

Fig.4 Class



Fig.5 Q & A

the class, and applications to solve fluid and thermal problems were discussed clearly in the lecture to develop student interest in the research works. Then, 5minutes of Q & A followed through network.

### **3. Evaluation of the educational practice through network**

#### **1) Device and Facility used for the class**

Although a handy and inexpensive TV communication system was used in the practice, the picture sent from the design office was clear and smooth enough to help understand computational results by FEM as a whole on the wide screen under the clear and adequate explanation by the lecturer.

#### **2) Student reaction**

There are some students sleeping in the class usually, as the class is just after lunch, however,

as the picture from Nissan or Tamagawa University was shown on the screen with a clear voice, almost all of the students concentrated on the lecture from the professional outside the class, and were very eager to join the class. Actually, in Q & A, a large number of students raised hands to ask the lecturer on the screen. Lecturers who contributed for the class were very surprised at the eagerness of the students through the picture sent from the class. It was successful to give students some impact to have interest and motivation to study FEM, because students could learn that the technology has been used in a routine manner to design new cars to be accepted in society and the natural environment, and various research works related to FEM have been made.

#### **4. Reviews and proposals**

(1) The portable TV communication system used in the practice does not have enough quality of resolution and brightness of picture projected on the screen when used in a big class with more than sixty students. Further development of the quality of the communication system is required to use in the normal class as private universities in Japan have.

(2) Thinking about the collaboration of distinguished people at any places in the universities and companies for the class, the Internet is the most convenient and inexpensive way. It is urgently requested to build a high-speed and inexpensive communication network by Internet to send clear pictures with voices smoothly to any sites available.

(3) The development of an education kit to communicate with people in any places by Internet and to connect with video-projector and loud speaker in the class is important. Then, various people with rich experiences in society can contribute with short lectures through network for the class not only in higher education as university, but also in elementary and secondary education where children are said to be less motivated to learn than before, because they are those who were raised in an affluent era. Students know that various experienced people in companies, universities and society contribute for them to be highly motivated to learn and take interests in the way they learn, and they are really powerful supporters of students who are responsible for society in the next generation.

(4) The most important thing in getting collaboration of professionals in universities, companies and society is a pool of experienced persons including retired people who are willing to contribute to classes through short-time lectures about 20 minutes from any place : the office, laboratory, and home when they are free. Such distinguished people can contribute easily through network in the way they can for the class to encourage students to have interest and to study intently.

#### **5. Concluding remarks**

By using network and multi-media devices and facilities, an educational practice has been conducted in a class of mechanical engineering. The collaboration by the engineer in the design office at an automobile company and the professor at another university outside the class were brought into the normal class through network. Students seemed to be so impressed to know that the subject they study is used to design products they have interests in and there are various research works related to the subject, and to have kind and warm-hearted messages directly from distinguished professionals to encourage them to study. The practice was successful from the viewpoint of motivating students to have academic interests and to study hard. The collaboration

from distinguished professionals through network using multi-media devices made the class really fresh, exciting and fun.

Based on the experience of the practice, some proposals were given related to building the infrastructure of high-speed and inexpensive communication network to make possible a short lecture by experienced people through the Internet easily for the class in various educational levels of school, and to arranging a pool of experienced persons including retired people to contribute to give a short lecture of experiences for the class through network from any place. As the country develops, students used to learn in a better educational environment than before. However, when it comes to education, what is so interesting is that a better educational environment doesn't always mean better students develop. To develop good students for the next generation's society, the collaboration of various experienced people for the class through network is considered to play an important role because it will make the class not only exciting and fun, but also motivate students to study intently.

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