

# 1 Computer Literacy In Design Education

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*Many Schools of Architecture in Japan installed many computers in their class rooms, and have already begun courses for CAAD skill. But in many cases, few teachers make their efforts for this kind of education personally. Having limited staff prevents one from making the global program of design education by using computers.*

*On the other hand, only teaching how to use individual CAD/CG softwares in architectural and urban design is already out of date in education. Students will be expected to adapt themselves to the coming multi-media society. For example, many World Wide Web services were started commercially and the Internet has become very familiar within the last year. But I dare to say that a few people can enjoy Internet services actually in schools of Architecture and construction companies.*

*Students should be brought up to improve their ability of analysing, planning and designing by linking various software technologies efficiently in the world-wide network environment and using them at will. In future design education, we should teach that computers can be used not only as a presentation media of architectural form, but also as a simulation media of architectural and urban design from various points of view.*

*The University of Tsukuba was established about 25 years ago, and its system is different from the other universities in Japan. In comparison with other faculties of Architecture and Urban Planning, our Faculty is very multi-disciplinary, and ability of using computers has been regarded as the essential skill of foundation. In this paper, I will introduce how CAAD education is situated in our global program, and discuss the importance of computer literacy in architectural and urban design education.*

**KEYWORDS:** Computer Literacy, Design Education, CAD, Internet

## INTRODUCTION

In the 1990's, the new wave, that informationalization is shifted from an organization's level to its composed section's level, has progressed in our society. The workstations and personal computers are substituted for the main frame system, and the heterogeneous network for distributed computing environment has been familiar in which we can integrate individual computer systems of many sections in the organization. To succeed in constructing these environments, it is not only necessary to informationalize ourselves, but it is also necessary to secure an expert who has high ability to maintain the information system in the individual sections.

The informationalization of Japanese universities had also been performed by their computer centers who had maintained the main frame system, like IBM 3090, and the super mini computer, like VAX 8600. But currently, most of these centralized system have been abandoned, and information infrastructure has been equipped in their campus to construct the hierarchical network of workstations and personal computers installed at all schools, departments, and laboratories. Currently, they only serve the backbone network control and the highest level database.

Hierarchical computer network is never the new technology. In the 1980's, main-frame systems in the computer centers of the leading universities were already connected to each other, and we could use network services, such as telnet, ftp, e-mail, and news, to some extent. Why it is noticed today can be arranged into the following reasons. First, the internet has been able to be used commercially since 1993, and many companies began to participate in this academic network. Second, user friendly interfaces, such as X-Windows and MS-Windows, and attractive network navigation tools, such as Mosaic and Netscape, were developed and enable us to use previous network services visually and easily. Finally, cheap UNIX workstations and completion of information infrastructure enable us to construct internal sub-domains easily at each organization.

Worth of the computer network is in proportion to the number of computers which are connected. The internet has grown up enough within the few years to be able to browse world wide information much faster than any other information media, such as newspapers and televisions, as the disastrous Hansin earthquake revealed. Now we can surf the world wide network from the desk-top computers in every school rooms, only if we can manage our individual internet domain where it is registered.

In this hierarchical network environment, the information center only plays a role of mediation between external sites and internal domains, and every department or school is expected to be responsible for the management of their own network segments. This means that a department which does not have the ability to manage its domain will be left behind this international informationalization. Schools of engineering would have no problem with this requirement. How many schools of architecture and urban planning are actually managing their individual internet domains by themselves?

## 10 PRESENT CONDITION OF SCHOOLS

According to the report of AIJ(Architectural Institute of Japan), there are 128 schools of Architecture and Urban Planning among Japanese universities and colleges. In addition, many professional schools are also the alternative courses to study architectural and urban design. The report also explains that many of them installed a certain number of computers in their school rooms, and have already begun some design computing education. But, except some progressive schools, few teachers make their efforts for this kind of education personally. CAAD courses are generally separated from the global education program. Having few staff prevents one from making the global program of design education by using computers. Otherwise, using computers is still regarded as the specific knowledge which is not always necessary for architectural design education. Many World Wide Web services were started commercially and internet has become very familiar within the last one year as I mentioned before. But only a few under graduate students can enjoy these internet services actually in schools of architecture and urban design in our country at this moment.

This kind of phenomenon tends to be found in the traditional schools. Conservative teachers often have their educational policy that designing ability is only improved with hand drawing skill, and resist introducing design computing education formally. On the other hand the number of students who have their own computers at home has increased rapidly the last few years. They prefer to perform their design works using CAD and CG applications. As a result, illiterate teachers can't evaluate student's works properly, since they have no idea that what we can do and can't do by current computer applications. Actually, a photo-realistic CG presentation often charms more than traditional one, and discussion is not direct to evaluate design itself. Ignorance of information technology prevents architectural schools from improving educational programs.

In addition, at the traditional schools, they have already used many workstations and personal computers for individual research activity. There are many information resources in these schools. But these computers were introduced individually and often managed by a graduate student's voluntary service. There are no teachers or committees in the faculty who are responsible for the informationalization about whole school. At the newly established schools, they install the latest equipment at a time. But there are no experts who have the knowledge about managing the system installed by traders. These systems are often managed perfunctorily, and students are sometimes subject to restriction of using the system free.

The informationalization of organizations was already finished in 1980's, and popularization of personal computers has also accelerated the informationalization of individual persons in 1990's. Now the informationalization of sections is left behind, and many schools of architecture and urban planning in Japan have not prepared enough to begin what is called computer literacy education yet.

## **20 COMPUTER LITERACY FOR UNDER GRADUATE**

Last decade, we have taught how to use particular CAD/CG applications for architectural and urban design only for students who were interested in information technology. But this type of instruction has already been the out of date education. Now, computers are not specific tools for graphical presentation nor numerical calculation. Computers have grown to be the essential media for studying and working. We can use them for documentation, communication, simulation, presentation, and so on. Computer literacy is required not only for particular students, but also all of us who have to live through the coming multi-media society. From the view of computer literacy, using CAD/CG is merely an extended skill of using computers.

However, the aim of computer literacy education at universities is not to accustom students to computer operation. It is to bring up them to improve their ability of analyzing, planning, and designing by linking various software technologies efficiently and using them at will. Type-writing and command learning can be the basic skill, and from this point of view, using computer is not knowledge but skill. But the critical knowledge may be to distinguish the characteristics of basic data representations stored in computers, such as text, bitmap, and vectors, and to be able to express their idea and design by handling these digital media and technologies. Then we should teach that computers can be used not only as a presentation media of architectural form, but also as a simulation media of architectural and urban design from various points of view. Finally, they should be able to use them by themselves to improve their design performance throughout their designing activity.

How to communicate in the current world-wide network computing environment becomes another important part of computer literacy. Not only is digital information copied and changed much more easily than analog information, but also digital information is transferred from one site to another in a moment. Using the internet environment, students could receive information from all over the world and also send theirs whenever they like. For example, World-Wide Web servers of foreign schools become the important information source for students who hope to study abroad.

In addition, Architectural and Urban Design is essentially a collaborative process in which many people should participate, and there is a possibility that fusion of computing technology and telecommunication technology could realize the architectural design process in a new dimension which is different from what we are accustomed to. Currently, educational projects of collaborative design works in the network environment between some progressive schools are known as "Virtual Design Studio",

and the revolution of communication by computers causes the removal of walls between schools and countries.

Manners of using computers and networks which are not mentioned in the text books are sometimes more important knowledge than any other knowledge and skill of using computers and their applications practically. When we use isolated computers, we need not be worried about troubling other persons. But, having connected them to the network, we have to obey the tacit rules of the network environment. Innocent students sometimes turn off the workstation when its console is hanged. Leaving a lot of e-mail in the public spooling directory for a long time rarely causes the mail receiving error. Large ftp in a day time is also the out of manner. In addition, respecting registration and copyright of original information and design is another important manner of using computers and networks. It is very easy to duplicate design information of other persons from all over the world, and there are no differences between the original and the copy. Computer technology has been developed on the assumption that the human nature is virtuous, and they never do something wrong. We have to instruct students to distinguish between right and wrong in this virtual world.

However, we should not force students to use computers for everything, but instead leave them to select suitable media according to their talents and jobs. There are many alternatives, and the computer is never the ultimate media. Traditional media, such as hand drawings and craft models, still have many advantage especially in design and presentation. Students should be educated not to be computer kids, but to be architectural and urban designers or researchers.

### 30 COMPUTER LITERACY FOR GRADUATES

Computer literacy which is required of graduate students should be higher than that for undergraduates. It is also different among schools and research aspects. Some students want to improve their artistic sense of architectural design, and some want to get Ph.D. in their future. In any case, they are expected to meet with good results for their design and research activities, and computers can be a good tools to amplify their idea. In fact, computers have already become essential tools for their works.

We can say that research trends of almost all academic fields have been affected by computing technology since computers were available to use for extensive research activities. Once we can reduce both natural and artificial phenomena to mathematical models, we can analyze and simulate them under different conditions over again. Not only in physics and chemistry, but also in economics and politics, we need to find out mathematical or logical relations between parameters we notice, and computers are also useful for these deductions. Researches into design have also dealt with the mathematical or logical models of design process and decision making, and many models have also been devised to optimize design performance. This type of research style has required us to learn computer programming.

Now, there are prepared many useful application softwares, and programming knowledge seems to be no longer a requirement for using computers to optimize design and perform research. Using pre-prepared applications is easier than making domain specific programs by ourselves. But too much dependence on a particular application software causes application oriented design and research. We sometimes found a student whose perspective of design and research is totally bounded by what can be done by the particular application, and he is not aware of it. Easy operation of computers prevent him to study the basis of domains.

For example, there are many good spreadsheet applications which include functions of statistical analysis. We can make statistical tables and graphs without remembering complicated commands. Students who have poor knowledge about statistics always calculate a regression line without checking conditions of data, such as outliers and scatter diagrams. Even if they meet with a wrong result, they can't find it and write their reports and papers according to this wrong analysis. In actual architectural projects, we usually require a mass volume (cage) which satisfies restrictions of overshadowing according to the Japanese building standard law before beginning architectural design. The application softwares have also developed to produce it automatically, which represent not the optimum but one answer. There may be many alternative volumes. Students who have poor knowledge about the characteristics of these kind of applications always follow a particular answer blindly. They struggle to put this design in this volume and never consider alternatives.

Computer language education is still very important especially for graduates who study design science. Popularization of computers have brought many papers presented in Japanese conferences about architectural computing. But generally speaking, many of them only report the trials of particular commercial applications. In these papers, authors never present original ideas of architectural computing, nor actually make their own computer programs to confirm it. They are devoted to the particular application, and the purpose and the meaning of researches are totally inverted. Designing is producing information of social artifacts. Researching is also producing knowledge of designing. Computer literacy of graduate students should be their ability to use computers for their original aspects of architectural design and design science.

#### **40 EDUCATIONAL PROGRAM IN TSUKUBA**

The University of Tsukuba is the national university, and was established in 1973. Tsukuba city is located at the north side of the Kanto district, and one hour drive from the center of Tokyo. Tsukuba city has developed as the national research area. More than 60 percent of national research centers are gathered in this area, and people from all over the world are working and studying. The University of Tsukuba is the core facility at this city, and has the biggest campus in Japan. It is more than 4 km from south end to north end, and 1 km from east to west.

The characteristic of the university is that faculties are organized inter-disciplinary, in comparison with other universities where they are classified traditionally. Colleges are organized from another perspective which does not always reflect faculties clustering, and urban and regional planning major is classified into the college of policy and planning science; we recently changed the official name of our college in English reflected by variety of specialties. There are three major courses in this college, they are, the social and economic planning major, the management science and engineering major, and the urban and regional planning major. Students can decide their majors when they promote to junior. Freshmen and sophomores have to complete various courses about policy and planning subjects, and design courses which are familiar at traditional architectural schools are prepared for junior and senior who promote to the urban and regional planning major.

On the other hand, the ability of using computers has been regarded as the essential skill from its foundation. Our educational program concerned with information science is fairly different from one of general architectural and urban design schools mainly concerned with CAD training. Reflecting the variety of major courses, it covers a wide field from computer programming to specific information technologies. In this meaning, we can say that computer literacy education precedes CAD education in our school. For example, all freshman of our school have to buy his personal computer when he is

matriculated, and many courses are provided on the assumption that they have their own computers. First, they are given their personal account for the information systems in our school which consists of many UNIX workstations, PCs, and Macintoshes, and expected to be accustomed to this environment. This type of computer literacy education is already familiar at the proceeding schools of information science, but still not so much at schools of architectural and urban design.

In the course of "information basis" for freshman, they are taught how to use e-mail, news, web browsers and to connect their personal computers to the university network. Basis of Pascal programming are also taught in this course. Every instruction is provided from the database server, and students also have to send their reports by e-mail. In the course of "information processing" for sophomores, classes about advanced Pascal programming, statistic analysis(SPSS), WWW/HTML, CAD/CG/GIS, and so on are prepared as elective subjects. Figure 1 shows students' works in the CAD class for the

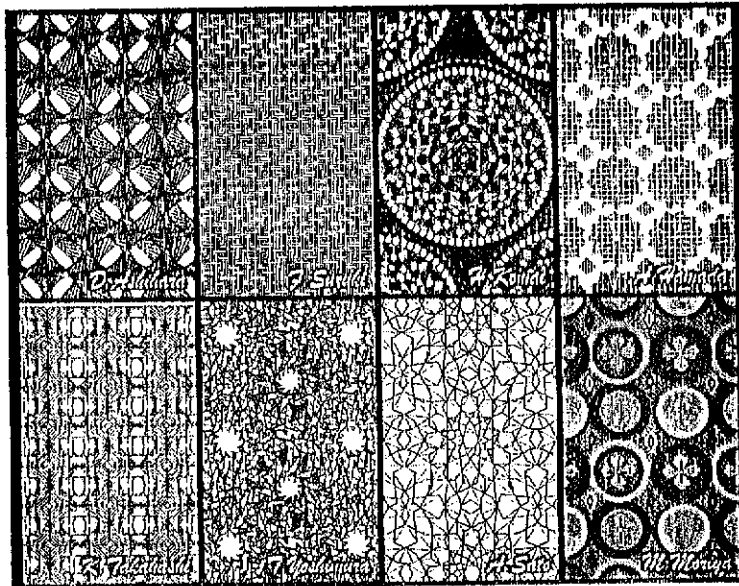


Fig. 1. Design Patterns using 2D-CAD

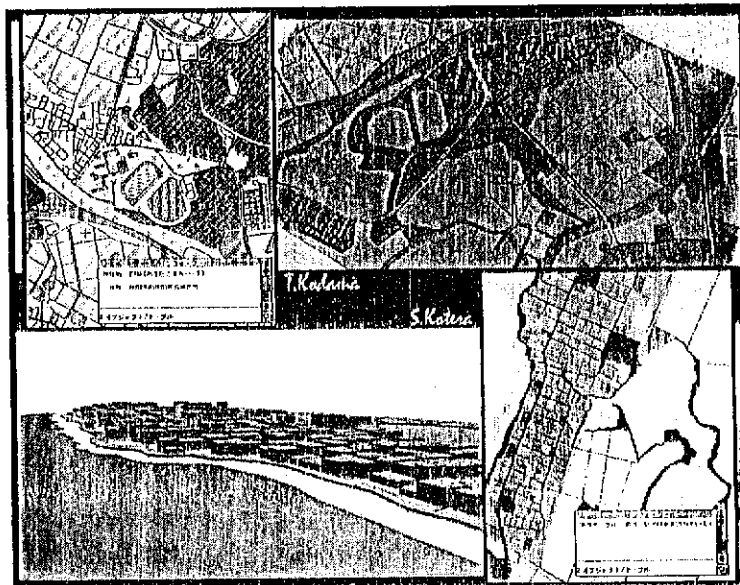


Fig. 2. Digital Mapping and 3D Modeling

first subject which is the same as that we had presented in the traditional hand drafting class. Students had never presented these precise patterns from the beginning before we introduced the CAD class for design and drafting skill. They can manage the software for their creativity. Figure 2 also shows their works for another subject about the digital mapping and the urban modeling. Throughout these subjects, we expect students to have various experiences in using computers for architectural and urban design. In the course of "urban design" for seniors, they have to perform a particular urban design project only using digital media. Figure 3 is the sequence of the video presentation by the students group about the skyscraper project at Tokyo water front area. Since they have already had critical knowledge about how to use computers enough, they could make these design and graphics within one month, even if they used the video editing application for the first time.

Details of this education can be browsed in our World-Wide Web server (<http://www.sk.tsukuba.ac.jp/>) which is officially managed by the internal committee. The server also provides the digital syllabus, workshops information, and job hunting for students. In our college, there are more than 80 full-time teachers, and many teachers also provide themes about their individual research on the web, shown in Figure 4. These kinds of information seem to be good instructions for undergraduate students to select a teacher as the director for their graduation theses and design projects shown. Some seniors make simulation programs for the graduation theses to prove their ideas, and others make detailed 3D models for the design projects to receive their diploma. Figure 5 shows the final presentations of their design projects.

On the other hand, in the graduate school of our university, students are graduated from various colleges and universities. Therefore, there is so much difference in computer literacy between domestic students and students from others. As I mentioned before, students from others also have fragmentary skills about individual computer applications throughout their under graduate study, but do not organize them as their information literacy. Now, even at the graduate school, we have to prepare some education about computer literacy which is the same level for under graduates. Individual teachers also instruct their students.

## 50 CONCLUSION

In a mass media society, information only flows from the privileged producers to the general public consumers. We needed to invest our huge capital in producing information media. These technologies are differentiated and specialized, and an individual person could never make use of them. In the multi media society, information flows to mutual directions, and every one can be a producer and a consumer. Downsizing of computers enables us to handle the information media personally with only a single machine. Architectural and Urban Design is also the works to produce the specifications of design information, which have been expressed on various media. The mass media society is composed of apprentices vertically, whereas the multi-media society is composed of collaborators horizontally. Architectural and urban design will change to be the collaborative process horizontally connected all over the world, that is "network".

Now, facility of computer network has preceded. But human network is much more important than computer network. We can never enjoy the internet enough without human communication. Even real time oral communication may be difficult between different languages, we will be able to find the important knowledge of how to use this technology frontier only from this international communication. I expect CAADRIA to be a good association where Asian people can communicate beyond the difference of cultures and languages.





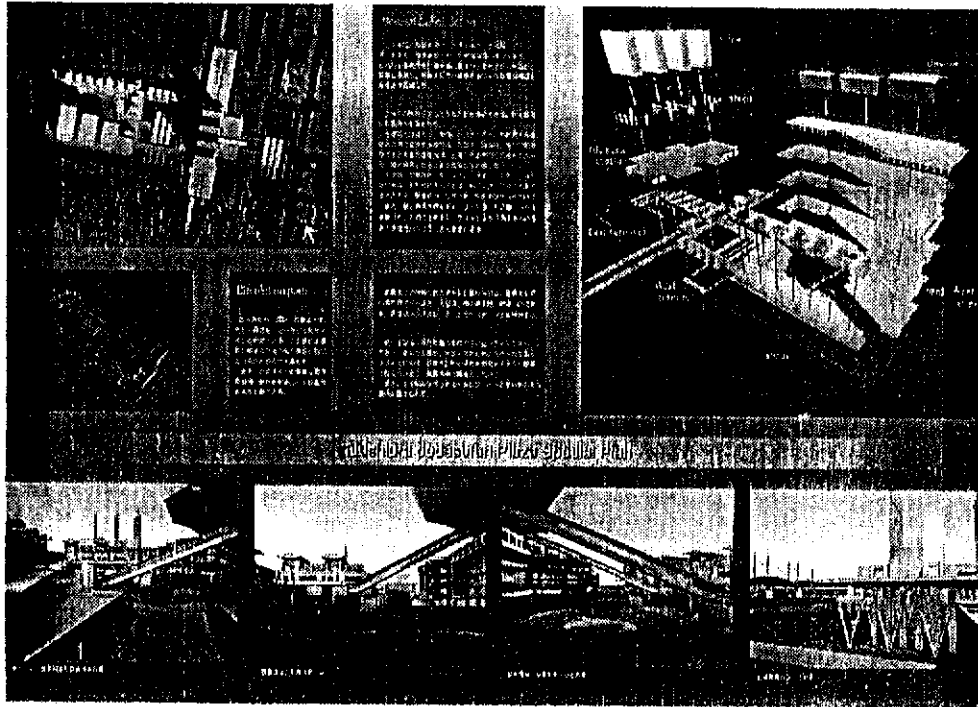


Fig.5. Design Project for diploma

Finally, I would like to acknowledge the students, Kiichiro Komatsu, and Yumiko Aoki, to complete this paper.

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