Computer Aided Instruction in the Teaching of Architectural history in KFUPM: A Review of Current Experience and Future Challenges

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Abstract

Architecture as a sensual art is best understood by experiencing it. In teaching about the architecture of both extant and contemporary societies, however, it is not always possible or practical to have the opportunity of personal experience. In such situations, Instructional technology provides us with a variety of tools that can be used to enable some level of experience and, therefore, the understanding of such architectures. Computers are among the contemporary technologies that enable us to improve the ability of students to interact with and experience and understand the architecture of distant places or time. The paper reviews the experience of the King Fahd University of Petroleum and Minerals (KFUPM) in the use of computers for instruction in architectural history. The paper is essentially descriptive. It reviews history of architecture courses – their content and pedagogical issues, developments in computer-aided instruction, and describes the application of computers in teaching history in KFUPM. The challenges associated with the application are also presented. The paper concludes by providing some recommendations for departments and universities hoping to adopt computer aided instruction.

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Introduction

Advancements in information technology, which has resulted in increasing computer power, lower and declining cost of computers and ease of use, and the expansion of communication infrastructure has resulted in the widespread adoption of computers use in almost all spheres of human activity. Education is one of the spheres where computers are playing an expanding role and are increasingly looked upon as the instructional tool of the 21st century. The expansion in the adoption of computer is happening as the educational process also witnesses a paradigm shift. The educational process is moving from a teaching centered process to a learning centered one, which involves both students and teachers as active participators in the search for knowledge and the construction of meaning from it. Computers play a unique role in this paradigm

shift, offering unique benefits to the educational process. These benefits (Sheppard et al, 1998; Yang & chin, 1996) include: inherently better and more interactive instructional process, more cost effective delivery, richer and more diverse learning resources, possibility of extending the reach of education to a broader population, flexibility in the use of instructional material and improved student motivation. Computers are particularly noted for their motivational value, as their intrinsic features such as immediate feedback, animation, sound, active interaction, and individualization have a better motivational potential than any other media (Yang & Chin, 1996:25). Computer use in education is permeating all the levels of the educational process, and more particularly higher education, where almost all disciplines use computers in certain form in the instructional process.

In architecture, computers have featured prominently for a very long time as potential tools for use in the educational process. Emphasis in the exploration of this potential has concentrated, however, on use in design education (Schnarsky, 1979:380; Broadbent, 1973:299). This focus still endures and is evident in current debates on the relative merits of virtual design studios – e-telier, to the traditional design studios – ateliers (Laiserin, 2001:141). Increasingly, however, other courses in the architectural curriculum are beginning to benefit from the trend of the widespread expansion of computers use in education. History of architecture is one of the courses that stands to benefit immensely from the use of computer in its teaching. The very visual nature of the bulk of the content of architectural history courses and the need for enhanced interaction with the contents to support the objective of teaching history in the architecture education process makes the history courses very good candidates for the use of computer in their instruction.

In the King Fahd University of Petroleum and Minerals (KFUPM) we have adopted the use of computers as instructional tools in teaching some of our history courses. This paper reviews our experience in the teaching history of architecture courses using computer-aided instruction. The objective is to highlight potentials and difficulties arising from our experience. The paper is essentially descriptive, and starts with a review of history of architecture courses, exploring their content and pedagogical issues. Subsequently, a review of the use of computers in instruction is presented, highlighting instructional benefits, levels of utilization and requirements for effective utilization. The

last section presents our experience, describing the level of computer utilization in instruction, instructional benefits derived, future plans for utilization, and challenges and problems faced in the use of computers aided instruction.

History, Pedagogy, and the Education of an architect

Any history of architecture course is, more or less, a grand tour through different geographical locations and time periods. The main contents of the courses are buildings and other man-made objects. Architectural historians recapture "the true physical reality of things built, whether they have since been altered, damaged, or destroyed totally" (Kostof, 1995:3). By using materials that are both visual and literary in nature, historians try to go beyond the material reality of man-made objects to understand "what they are, how they came to be, and why they are the way they are" (Kostof, 1995:3). Architectural historians study buildings and other man-made objects in their physical context, trying to understand issues of form, space, enclosure, movement, materials and methods of construction, the impact of the physical context on buildings, and the ideas, notions, and principles that give form to the various buildings and objects. Historians also try to understand how contextual social, political, economic technological and other historical events shape the cultural processes that produce built forms as the material element of a culture. Thus in a basic way, history of architecture is the study of the cultural development of human civilization with architecture as the material embodiment of that civilization. Buildings and other material artifacts are studied in their place and time specific context, and in tune with the broader meanings ascribed to them by the societies in which they exist. The role of the architectural historian is to bring time and geography under control; sifting through different locations and historical periods, isolating relevant materials, arranging them into sequence, setting up relationship between objects in different times and places and generally trying to convey an understand of what these objects are, how they are used, the people who built them, and how they compare with objects in other locations. (Kostof, 1995:3).

History has always been a significant part of the training of architects. As early as during the Roman periods, Vitruvius recognized and advocated the need to include history as part of the education of an architect, pointing out that "let him be educated, skillful with the pencil, instructed in geometry, know much history, have followed the

philosophers with attention, …". He justifies the need for history's inclusion on the need by architects to understand and be able to explain ornaments employed in design (1960:3-9). History has been a part of architectural education, since formal training was introduced in the eighteenth century (Attoe, 1979:42), and it plays a very important role in the educational process. Architecture is by character, a normative profession. The focus of the architectural education process is to teach people how to solve design problems. History is a fundamental resource in teaching people how to solve design problems. History provides the architect under training with an integrated introduction to architecture in the process of historical creation. The student, in taking architectural history, is exposed to the riches of the past, put in order, illustrated and accounted for. He learns about the physical attributes of specific buildings, learns about when, how and why they came to be and the specific ideas and notions that give them form. By studying the different historical periods, he is introduced to a vast and varied wealth of information about buildings in the different periods and the factors and processes that have informed the evolution of the buildings. He is therefore exposed to a resource bank, which he could draw on to solve design problems and give shape to contemporary buildings. Commenting on history in this respect, Walter Gropius points out that "studies in the history of art and architecture, intellectual and analytical in character, make the student familiar with the conditions and reasons which have brought about the visual expressions of the different periods: i.e. the changes in philosophy, in politics, in means of production caused by new inventions. Such studies can verify principles found by the student through his own previous exercises" (quoted in Attoe, 1979:43).

Instructional methods used in teaching history play a fundamental role in the ability to achieve objectives sough in teaching history of architecture. History can generally be taught using one of two broad approaches: depictive treatment and interpretative treatment. In depictive treatment, the focus is on teaching history. History, in this respect is presented as a compendium of facts. This is a passive approach, which involves laying out the facts. In interpretative treatment, the focus is on interpretation of content. Emphasis here is not on just teaching history, but learning from history. We learn lessons from history that will serve as inputs into efforts to solve contemporary problems. This approach goes beyond just asking what, when and where, to actively inquiring about who, why and how. From an architectural perspective, the extended mode of inquiry inherent in the interpretative approach enables us to explore design

intentions and also seek meanings from the arrangement of monuments. The interpretative approach should ideally be the preferred one in teaching history of architecture.

Instructional tools also play an important role in the ability to achieve the objectives of teaching history of architecture. Learning the lessons required from history courses demands that students fully interact with the content and get a heightened experience of buildings and other objects that make up the main content of history of architecture courses. It is conventionally accepted that the best way to experience a building is to interact with it in its natural setting (Trachtenberg & Hyman, 1986; Kostof, 1995; Rasmussen, 1989). Le Corbusier describe this experience of architecture as "the foot that walks, the head that turns and the eyes that sees (quoted in Kostof, 1995:3). This is not always practical, however, because of the extant nature of some of the societies being studied and of practical limitations in resources. Conventionally, history instruction relies mainly on abstract formal representations in the form of plans, sections, models, and elevations to depict buildings (Trachtenberg & Hyman, 1986:42), supplemented with three-dimensional isometric and perspective drawings and photographs. The visual representations are made out into conventional teaching aids such as photographic slides, transparencies, posters, and video films, complemented by textbook materials.

There are certain inherent disadvantages associated with the use of the conventional instruction tools. Historical buildings can be very complicated and complex in their form and treatment. It is always very difficult to enable the understanding and experience of the buildings from abstract representations or the conventional tools used in instruction (Trachtenberg & Hyman, 1986:42). Most students, who are usually new initiates to the system of abstract architectural representation, find it very challenging to understand buildings from these representations. The representations are, therefore a poor substitute for experiencing the buildings and learning the lessons desired in studying history. Content sourcing and preparation of instructional material with the conventional tools is also very demanding, time consuming and expensive. Ready made materials in the form of slides and video films that address instructional needs are not commonly available. Slides have to be produced in a tedious and expensive process from books or from the photographic collection of the instructor. Access to the content

by students is usually restricted. The conventional tools encourage a transmission mode of instruction with students in such a process as passive receptors of knowledge rather than active participants in its exploration, understanding and the construction of meaning from it. It is because of these inherent weaknesses of the conventional methods that computers have been a welcomed addition in the teaching of history.

Computer Assisted Instruction

Education is in the process of witnessing a paradigm shift, from a teaching centered approach to learning centered one (Piccinin, 2001; Morin 2000). The learning centered approach looks at knowledge increasingly as a valorized commodity. The role of the educational process is to enable people acquire skills that can be marketed. Computers are an integral part of this paradigm shift, as technology, particularly information technology is increasingly integrated into the educational process and looked at as an element in the valorization of knowledge. In education, computers play a fundamental role in both instruction and the learning process. Information technology plays a significant role as an aid to instruction in the development and presentation of course contents. The use of information technology offers wider and richer sources of content material and easier ways of manipulating, packaging and presenting the material. The Internet presents a vast opportunity for sourcing both free and paid for content for architectural history courses. With the computer, it is also easier to source materials from textbooks, by scanning and manipulating them, making them ready for inclusion as content. Using programs such as Microsoft PowerPoint and Director, it is both easier to package a presentation, as well as include more advanced instructional tools such as digital video and 3-dimensional simulations for more enhance experience of contents. Even basic photographs when used in computer presentation can be presented in a larger number, in a crisp and clear form with commentaries than when slide projectors are used.

Computers also enhance the learning process in very unique ways. The use of the computers means that democratic and asynchronous access to course material can be extended to all students. This gives the students opportunity to interact with the content in new ways and also to adapt the learning process to their individual learning skills or habit. Students also have the opportunity to explore new and additional sources, in the process contributing not only to making meaning out of the content provided, but also

contributing to the development of the course content. The use of information technology also reinforces the skills of the student in the technology, improving their marketability after graduation.

There are wide variations in the levels of the application of computers in instruction. In general, application could be broadly classified into basic and advanced applications. Basic application simply utilizes the computer as a tool to enhance traditional ways of teaching. Advance application stretches the use of the technology in teaching by incorporating its advanced capabilities. The basic uses of information technology includes: content sourcing and development – involving the use of technology to source for content or to manipulate the content into a form ready for inclusion in a presentation; content presentation and instruction – involving packaging the content into a presentation and incorporating an instructional mode into the presentation; and enabling access to the content so that students can at their own time further explore and interact with the content. Advances uses of technology in instruction includes: the incorporation of enhanced experiential tools such as digital video, 3-dimensional simulations and animations, virtual reality projections into presentations; the use of advanced asynchronous delivery systems such as partial or full web-based course packages using internet explorer or internet delivery packages such as WebCT or Blackboard for all facets of course delivery within a bounded geographical space; and distance education which is asynchronous in both time and space. Web-based and distance education use of the computer may incorporate such resources as content portals, search engines, electronic libraries and discussion forums.

The use of information technology or computers in instruction has stringent requirements that must be met to guarantee the potential for success. These requirements are highlighted in Table 1.

Table 1: Requirements for the effective implementation of Computer Aided Instruction

Item	Requirement
Infrastructure	Adequate information technology infrastructure and resources is a fundamental requirement for using computer-aided instruction. Resources include reliable networks, connection to the internet, availability of wired classrooms and instructional support tools, and universal access to information technology resources.
Support for course Development	Course development for computer-aided instruction requires certain basic skills, is time consuming and demands considerable effort. Faculty support in the form of summer contracts, lower teaching jobs, recognition of efforts in content development and financial compensation are critical in encouraging faculty to employ the new technology in teaching. Training and technical support are also basic requirements.
Technical support	Technical support is critical to any attempt to introduce computer-aided instruction. Technical support has to go beyond centralized structures for supporting overall organizational strategies to 'just-in-time' decentralized support for immediately addressing problems that arise at the point of instruction.
University Policy	The availability of a university policy is an important precondition for promoting computer-aided instruction. Such policies have to address the issues of training, start up grant and support for course development, technical support, develop a system of assessment and feedback and provide forum for communication between users of computer aided instruction.

Sources: Day, 2000; Sheppard et al, 1998; Hagner 2000

The Teaching of History in KFUPM

The Architecture curriculum at KFUPM has three history courses and two theory courses. The first history course covers the period from Prehistory to Early Christian and Byzantine periods, the second one covers the period from Romanesque to post modernism and the third course deals with Islamic Architecture. The first theory course covers architectural thinking from the Greek period to end of the nineteenth century, while the second course covers the period from the 19th century to the postmodern period. This paper relates to experience gathered in the teaching of the first two history

courses. History is taught in the curriculum to support design education. The choice of computer as a tool of instruction was initially motivated by the need for a convenient means of collecting, modifying, organizing, packaging and presenting the courses. Soon, however, the potentials of the computer for enhancing access and interaction with content, and for enabling a higher level of content experience became evident and so became the motivation for further development. Computers have been used to teach history courses for the last seven semesters, and within that period the level of application of computer aided instruction has transcended the basic level into more advanced uses. We have used the computer as an invaluable tool in sourcing a large volume of instructional materials available from the Internet. Materials sourced have included Two and three-dimensional representations, pictures, and digital models of buildings. The computer has also enabled us to expand our collection of instructional materials through the scanning and manipulation of images from textbooks, journals and other printed sources. This has enriched our content and given us the liberty of choice when presenting any civilization. We have also been able to package instructional presentations for individual civilizations, incorporating both textual and graphic material, and in some cases three-dimensional models and animations. These presentation packages have been placed on the university wide area network through our college local area network ensuring that students have access to the contents and the freedom to explore and interact with these contents at their own time. We have made the process of incorporating three-dimensional digital images and animations into the presentations a continuous one, including them in presentations as they become available. We have also evolved a system of encouraging active student participation in exploring and understanding content through arranging forums in which groups of students search for information on individual buildings and present it to the class in a discussion format. Discussions in the forums concentrate on deducing architectural lessons from the presentation.

Currently we are trying to expand our use of the computer in instruction into further advanced uses. We are planning to start a library of digital audio-visual materials comprising digital video, three-dimensional models and animation, and virtual reality renderings of settings for all the civilizations for use in instruction. This is in line with the plans of the department to establish a virtual reality laboratory. We are also in the process of converting the courses into web-based courses using the WebCT platform.

This will allow us to make course material and course evaluation package on-line, and allow students to interact with it at their own time with immediate feedback and access to an enhanced digital library. This will free the class time to discussing important architectural lessons from the presentations and also to comparing architectural developments and thinking between the different periods.

Our use of computers in instruction has been supported by the extensive investment in information technology infrastructure in KFUPM. The university has a wide area network comprising several college networks and the network of affiliated organs of the university. The wide area network supports Internet access, e-mail and file transfer protocols. All members of the university, both staff and student, have access to the network, and in addition, all faculty members have connections in their offices. In almost all the colleges, there are wired classrooms equipped with network computers, digital projectors and screen for academic uses and their numbers are increasing. Colleges and departments are also supported by computer laboratories, to which students have full access.

The use of computer in instructions in KFUPM has not been without its challenges, however. Part of these challenges relates to the characteristics of our students. Many of our students come with limited history and language skills and so are not ready at the point of entry for an exploratory and depictive treatment of architectural history inherent in the use of computer aided instruction. In a recent survey of one of the classes at the beginning of the first semester (2001/2002 session), 36% of all the students had never taken a history course, and 89% of the class had not studied societies other than Islamic societies. Sixty two percent of the class rated their language skills as average or below average. Many of the students also have a fundament shyness of working with each other in groups, so that discussion forums in which groups of students are suppose to explore the material further and make presentations, sometimes produces less than expected results. Retention is also another major problems with the students. While interaction and understanding of content is very high at the moment of instructional contact or discussions, long-term retention appears to low, with students unable to recall important concepts about contents six to eight weeks after presentations. The architecture curriculum in KFUPM also appears to be a factor in the challenges we face in using computers in history instruction. Our history and theory courses starts at the

moment of entry into the Department, and continue for five semesters. At the point of entry most students are not familiar with abstract forms of architectural presentations and so sometimes find it hard to follow history presentations. The coverage of courses are also very wide, covering at least seven civilizations on the average, making it difficult for a more interpretative treatment of history. The separation of the history and theory courses contributes in encouraging depictive treatment and so limits the advantages of a more engaged instructional use of computers for an interpretative treatment of history. This situation probably contributes to an overload in instruction and to the transient nature of content retention that we have noticed.

The problem of inadequate resources and infrastructure is also major problem in our use of computers for instruction. While students have full access to all computer resources and networks in the academic area, the same is not true in their place of residences. This limits the concept of universal and asynchronous access and the ability of students to explore and interact with content at their time and convenience. The amount of wired classrooms in colleges, though increasing, is still inadequate to support the widespread use of computers in instruction. In our own college, using computers in instructions means having to book for such wired classes during lecture time. If, however, two people want to use such spaces at the same time then a conflict arises. The use of non-wired classroom means going through a complicated process of downloading presentations to mobile computers and setting up projection systems in the non-wired classrooms; a tedious process considering that class contacts last for only fifty minutes.

The limited level of institutional support for the use of computer-aided instruction by faculty is also a disincentive to its use. In KFUM, we have an Academic Development Center, which is charged with pursuing the goal of improved level of instruction in the university. The Center has performed excellently in organizing seminars and workshops on instruction and also in licensing computer aided instruction platforms for use in teaching. This level of support is, however, inadequate, as it does not incorporate provisions for encouraging faculty to change to computer-aided instruction. Content development for computer-aided instruction is very tedious and time consuming. It also requires a certain level of computer proficiency. Except institutional encouragement are given in the form of release time for content development, compensation packages and the provision of necessary resources and recognition, there will be a disincentive to

incorporating the computer in education. In our own case, not only is support not adequate, but in some instances also, we have had to invest personal resources to acquire tools such as scanners and CD writers to support our use of computers in instruction. This serves as a disincentive to faculty willing to experiment with computer aided instruction. It is in the aspect of technical support that we, however, face our greatest challenge and problem. The use of computers entails all kinds of problems. Common problems that we face include network failure, problems in file transfers and in connectivity between computers, problems of projectors and projection computers, virus attacks and computer crashes. While major problems are well handled by our Information Technology Center, we lack critical 'just-in-time' support by qualified personnel at the point of instruction. This has meant that we sometimes have had to grapple with technical problems during lecture periods, making the use of the computer a frustrating endeavor. In many cases, such problems have forced us to change mode of instruction or to seek for other short-term alternatives.

Summary and Conclusion

The paper presents the experience of KFUPM in the use of computer-aided instruction in the teaching of architectural history. A history of architecture course is more or less a grand tour through different historical periods and geographical locations. The main contents of history courses are buildings and the main objectives in learning history are to understand the buildings and how and why they came to be at the particular time and place. Instructional methods and tools seek to reinforce the ability to achieve the objectives of teaching history by ensuring a more engaged experience of contents. Computers are playing an expanding role in education because of the advantages they offer in terms of both instruction and learning. Computers can be used in instruction in various ways and certain requirements have to be met for the effective utilization of computers in instruction.

In KFUPM, we have adopted computer-aided instruction in teaching history of architecture. Our use of the computer in instruction has moved beyond basic application, which sought to use computers in place of conventional instructional tools, to the use of more enhanced visualization tools and to cooperative learning and student engagement in content exploration. Our future plans include the compilation of a library of digital audiovisual materials of all major historical buildings and sites. We are also

trying to transform the courses into online courses using the WebCT platform. Problems associated with our use of computer-aided instructions were highlighted. Despite the problems, however, our general assessment of the application of computers in instruction is positive. Benefits have included wider access to sources and richer contents, improved packaging and presentation, ability to include enhanced graphics, improved access to content by student, and support for different learning habits. In general we would say that computer aided instructions can potentially improve the teaching and learning of history of architecture and related courses, and foresee a trend of its expansion as the tool of choice in instruction.

In conclusion, it is worth reiterating that the adoption of the computer as a tool of instruction has to be balanced by the need to address the requirements for effective utilization. Investments in infrastructure, in content development and in faculty support for changing to computer-based instruction are critical to a successful adoption regime. Universities can best guarantee success by ensuring that they have the necessary policies to guide the transfer to a computer-based instruction. For university faculty, the creation of content for computer-aided instruction is one of the most challenging aspects of using the computer in instruction. Paradoxically, it is also an opportunity waiting to be exploited. Academic faculty, who engage in the active creation of content, can in the final analysis also turn it into a commodity and market such contents. In history as well as in many other courses that we teach, there is a large, salient demand for ready-made instructional materials. It is our duty to appraise this potential and rise up to the challenge of exploiting it.

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