DEVELOPING CAAD TEACHING STRATEGY, ENHANCING COURSE OF INSTRUCTION

An Alternative for Shaping Quality of Architectural Education

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Abstract. This paper discusses teaching method and how to manage CAAD courses, where limited resources are existed in an educational institution. Potential of integrating CAAD with other course works are explored in order to have more efficient teaching process for both group of courses. Course coordination and digital design databases for course works become the main focus of this educational research.

1. Introduction

This ongoing research is part of long-term research in constructing a suitable format of computer implementation in architectural education at the Department of Architecture University of North Sumatra (USU), Indonesia. At the first stage the Department has implemented a sequence of computation courses consisting of two required courses and two elective courses for undergraduate level, and another two elective courses for graduate level. The establishment of these sequential computation courses was merely considering emerging requirements of architectural graduates both in regional and in global context that put skill in Computer Aided Architectural Design (CAAD) as one of the basic competencies. On the other hand lack of consideration of local situation and resources has led to various problems in maintaining the CAAD courses, not to speak creating an ideal architectural education itself that still needs continuing revision. Some of the most crucial problems are establishing and managing CAAD courses are still considered as an expensive investment, and the background of computation knowledge among incoming students indicates a very wide gap
(Satwiko, 2001; Mintorogo, 2001; Kosasih, 2001). Meanwhile methods, patterns and course materials employed in implementing CAAD courses are mostly referred to architectural educational institution from overseas that are developed based on more settled context and resources. Facing this limitation, which is mainly concerning technical matters, the Department directs all of its potentials towards optimizing its resources. Strategy in teaching CAAD courses shouldn’t be focused only on supplying student with computation skill but also on empowering course substances as part of attempts in learning other courses in architectural education as a whole. Research outcome is expected to be useful for every architectural educational institution with similar context to that of the University of North Sumatra (USU) in its effort to face globalization challenges concerning the Information Technology (IT) issues and limited educational resources to support those attempts.

Considering those problems, the research has taken following issues as the objectives for this stage of this long-term research in digital design education:

1. To formulate a local based format of computation courses in architectural education, considering IT relevant problems and limitation on local resources
2. To identify the extent of computer usage in non-computation courses in order to increase teaching quality
3. To identify the format of digital databases of architectural objects compatible with all format of coursework as prototype for further development

2. Positioning CAAD in Facing Limited Resources in Architectural Education

The existence of CAAD as part of taught subject in modern architectural education is still being debated. Discourses on this subject depart from a lot of attempts in positioning or more precisely in putting it back on its truly domain, design (as a process). Discussing CAAD meant speaking merely about architectural presentation or documents production has been left behind for quite long time. Nowadays research on architectural computation has been focused more on its role in facilitating process in early design stages. But this fact should be true at settled school of architecture located mostly in so-called developed countries. Even in this context CAAD has developed further utilizing whether a process can be said as design or not (Wiszniewski et al., 1999). Meanwhile a reverse fact occurs on the other side of the world where a rather obscure situation of CAAD position in architectural education might be found easily. Institution such as USU has to face dilemma between generating tremendous efforts in following global educational technology
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progress on one hand and empowering all of its resources to cover a lot of gap in order to perform an ideal university.

Developing computation in educational program for such institution needs strategic thinking, including CAAD courses in the architecture department. Although a high demand for graduates with adequate skill and knowledge of these subjects is consistently growing up, the department still faces a continuous trouble to meet it. Hardware, software and facilities to support the operation of these courses are still considered as sophisticated tools that bring expensive costs. It is pity that very few ideas have been discussed on this subject so far concerning its implementation strategy in a situation where there are very limited access to support a successful integration of CAAD into architectural education. Furthermore strategic thinking for maintaining that course, identifying substances and materials, implementing tools and teaching strategies becomes very urgent. Among such strategies, teaching method that attempt to place CAAD teaching in order to have the best result such as adopting methods in teaching language will be a valuable input to be adopted (Cheng, 1998). Implementing CAAD doesn’t mean merely talking about technical matters. Seeking potential starting point in creating a more contextual CAAD courses will be more relevant. Realizing that complexity in Computer Aided Design (CAD) doesn’t imply only on complexity of projects to be modeled becomes something essential, such as complexity of CAD itself regarding its role whether in industrial or educational setting (Chase and Murty, 1999).

Positioning CAAD courses among sequences of other courses in an architectural education with very limited resources becomes something that needs creativity. The ideas of putting CAAD back in design domain and that creativity depends much on local context become very relevant (Gero and Sosa, 2002). It is in this creativity framework that this educational research should be reviewed. The Department of Architecture USU has taken policy to develop its educational program by empowering all potential aspects which one of them is by integrating its academic resources as part of efficiency at one side and increasing quality at another one.

Apart from limitation in managing CAAD courses, actually the department has faced many more handicaps in running most courses as a whole and integrated teaching system. Course materials, such as case study databases, student’s works archives, tutorials, were scattered around indicating lack of coordination. Meanwhile digital courses don’t have any standard for modeling projects each term.

3. Computer in the Curriculum

CAAD courses in most of architectural education institution in Indonesia are still considered as supplementary courses mainly playing its role to
support architectural design courses (Tim Kurikulum PSA-USU, 2000; Kosasih, 2001; Mintorogo, 2001). Objective of these courses are more directed towards supplying students with adequate skill of computer in architectural design. This is very contradictory with the development of CAAD courses at schools where technical matters aren’t considered as determinant factors in managing the curriculum. Even authorization in basic computer literacy shouldn’t become a standard objective. On the contrary computer courses have opened alternative models for a more IT-based curriculum in architectural education (Mark et al., 2001).

When limited resources are considered significant restrictions, integrating CAAD into curriculum can’t only based by truly following trends in architectural education. Essential factors in order to have an ideal CAAD teaching should be investigated and implemented carefully. Stratifying CAAD teaching into a series of particular levels is a must. This may be implemented by leveling the courses according to the objective competency (Mark et al. 2001; Cheng 1998). The approaches in managing courses concerning three significant aspects: access, instruction and application, are very crucial to be reviewed against the local limitation. Each instructor should be able to identify which, where and when all aspects or each one of them playing as determinant factor for his/her course (Juroszek, 1999).

At the Department of Architecture USU, there are two required courses and two elective CAAD courses. The two required courses, Introduction to Computation in Architecture and Computer Aided Design (CAD) in Architecture, are placed on the first and fourth semester consecutively among an eight-semester curriculum leading to Bachelor of Science in Architecture degree. The two elective courses are offered in two last semester as option for those who have deep interests in developing their skills in digital design in architecture.

The two required CAAD courses on undergraduate level, Introduction to Computation in Architecture and CAAD, are two sequential courses. The lower level course is a prerequisite of the upper level one. As part of the research, syllabus, teaching method and course works for both courses have significant revision. The introduction course has been modified in order to enable students using computer creatively as part of utilizing his/her design skill from basics. Simple modeling program is the best option for this purpose, such as basic VRML (Virtual Reality Modeling Language). The CAAD course is focused in training student to achieve the standard level of mastering the most common CAAD application program in professional sector either in local or regional context. For both courses, skills in utilizing web-based presentation become standard for presentation format and this is consistently developed while working on course works for other non-computation course.
Previous research conducted by Hamid and Defriza (2001) has integrated its research works with a number of courses, which its course works have potential to be collaborated due to similar contents and technical works. The research, which utilized spatial information system under urban planning and design topics, has led to a model of coordination system between computer courses, non-computer courses and research works as well (Hamid, 2002). Table 1 describes the nature of their relationship.

TABLE 1. Integrating research works into CAAD courses by stratifying course works according to level of complexity of the computer works; after Hamid, 2002.

<table>
<thead>
<tr>
<th>Programs in Urban Spatial Development Project</th>
<th>Sequence of IT Courses</th>
<th>Typical computer works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey: collecting, compiling and updating databases</td>
<td>Non IT courses</td>
<td>Digital data entry (text, graphics, images)</td>
</tr>
<tr>
<td>Developing and updating presentation</td>
<td>Introduction to Computation in Architecture</td>
<td>Digital Architectural Presentation (web presentation, etc.)</td>
</tr>
<tr>
<td>Developing and updating digital model</td>
<td>CAAD</td>
<td>Digital modeling</td>
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<tr>
<td>Developing and updating digital model and design database</td>
<td>Advanced Digital Modeling</td>
<td>Advanced digital modeling, animation</td>
</tr>
<tr>
<td>Developing and evaluating IT system implementation</td>
<td>Information Technology in Planning and Design (previously IT and Architecture)</td>
<td>Conceptualization of IT implementation</td>
</tr>
</tbody>
</table>

4. Integrating Computer Works into Other Courses

Research is conducted by integrating it simultaneously with teaching activities in several courses during two consecutive semesters: 2nd semester academic year 2001/2002 and 1st semester academic year 2002/2003. Totally, there are ten courses included with various degrees of computer works. Researches on CAAD courses are developed based on the results of regular course evaluation, which is held prior to the beginning of the research. Researches on non-computation courses are done based on the performance of CAAD course in previous semester. It is projected to be finished at the end of year 2002.

Researches on non-computation courses are divided into three categories, according to typical role of computation works for learning
process in each course. Categorization doesn’t indicate level of complexity or
skills in computation, at least not yet for this stage.

Category A, computation for understanding principle of architecture,
represents role of computation in developing sense of spatial exploration on
students. Two courses belong to this category are: Communication in
Architecture and Design Basics. Potentials of VRML are explored for these
basic level courses. Category B, computation for design process, represents
role of computation in supporting students in utilizing their design skill for
studio works. Two advanced design studio courses are involved in this
category: Architectural Design V and Introduction to Urban Design. CAAD
application program has the main role in this category. Category C,
computation for description purposes, represents role of computation in
supporting the abstraction of theoretical courses through digital visualization.
There are two courses involved in this category for this research: one
representing history and theory courses and another one representing
technology courses. Good information of student performances in
computation courses along with their segmentation plays significant role in
order to get the best of computation works for courses belong to this
category.

To enrich significance and linkage of CAAD course and non-
computation courses, while at the same time get the course projects closer to
local context, all projects to be modeled have to be coordinated. For instance,
a digital modeling project as part of Advanced Digital Modeling course has
taken a case that can be used as course materials in Introduction to Urban
Design course and Basic Design course (Figure 1 and 2).
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Figure 1. Digital model of Esplanade in Medan, where most of historical buildings surrounded this open space, developed as digital model in Advanced Digital Modeling course, and projected to be explored in Urban Design course.

Figure 2. Historical building model, which its original building located on one side of the Esplanade (dotted circle on Figure 1), has been completed as digital model for Advanced Digital Modeling course (left), and its derivative model (right) to be explored in building anatomy subject as part of Basic Design course.

Whole presentation is set up in web-based presentation. Figure 3 illustrates a model of web-based presentation format that has been implemented in a research where traditional architecture topics are discussed and explored in digital format (Hamid and Lubis, 2002). As Ehrhardt and Gross (2000) specified the power of web site that its ability to integrate animations, panoramic images, sound, and virtual reality, web sites can provide a strong sense of place, richer than text and photographs.
This website presentation strategy is utilized in the framework that whole computation works are projected to be integrated in a digital database that will be continually developed for future references. Since this digital database is expected to be one of major teaching resources, web-based database becomes a preference method. This considers existing resources at the University of North Sumatra, including a relatively wide Internet access for most of the academic community. The format itself is being conducted through course works in advanced CAAD course.

5. Proposed Course Coordination Model and Databases

Two main issues emerge during various events in integrating course works of CAAD with subjects or topics of other courses. To be effective and to have the maximum results of this method, course coordination and digital databases format should be identified in early process. Instructors of courses involved should talk about format and content of digital modeling project before each academic term begins, and should evaluate the result at the end of the term. Besides intensive communication should also maintained during the effective term (Figure 4).

![Diagram of Course Coordination Model and Databases](image-url)
Digital design database is an integrated part with the digital design development itself. It is a logical consequence of rapid information technology progress that becomes its main supportive element (Mitchell and McCullough, 1995). As part of design issues, building digital design databases needs creative strategy in order to have an optimum result. According to Gero and Sosa (2002) design situation, which becomes determinant aspect of creativity in design can be defined by four essential components: problem representation, design space, design process and evaluation criteria.

Format of digital databases becomes determinant factor for the successful of courses management method developed based on local academic situation at Department of Architecture USU. As part of the research, the resulted method has established particular standard for digital modeling projects. Neutral file format proposed by Turner (1991) has become the main consideration in building databases. Although it hasn’t developed as specific outcome of this research yet, at least some standard for digital modeling format has been successfully produced as main references for the digital design database system. All digital modeling works should be executed as solid model in \textit{dwg} format, as AutoCAD\textsuperscript{TM} is still the most common digital modeling application program either in academic or in professional area. Standard animation is built in VRML. In the meantime databases library is structured and developed as web based information. For having a more interactive animation, sound effect attachment, and any form of advanced model exploration digital model can be executed as separated computer works according to the objective of each course work.

6. Conclusion

Facing limited educational resources, academics from concerned institution can choose a prospective teaching strategy alternative by integrating digital modeling projects in CAAD course with other course works. It can enhance content and instruction of not only the computing courses itself but also the non-computing courses involved. This strategy can only be effective as long
as intensive coordination among involved instructors occurs. The main handicapped is choosing the right format of databases system. Therefore digital databases should be developed through continuous research to have the most effective system, where most of prospective digital modeling projects needed by non-computing courses may be adapted to be included as part of updating process in the databases system.

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References


