CASE STUDY: INCORPORATING 3D SOFTWARE INTO ARCHITECTURAL WORKING DRAWINGS COURSES

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1.0 Introduction

This paper discusses the incorporation of 3D CAD software (Architectural Desktop 3.3) into two sophomore-level courses within an Engineering Technology Construction Program. It discusses the potential of this software in this type of environment, in particular its attributes and its limitations, and focuses upon several key areas of concern:

1. The transition from generic, 2D CAD to 3D (Architectural Desktop) (herein ADT).
2. The phasing of the software through a particular project.
3. Effective delivery methods.
4. Assignments suited and ill-suited to the 3D software.
5. Concerns related to the sophomore year.
6. Future considerations.

The paper begins with a brief review of the use of computer software in architectural education. It then proceeds to discuss the author's methodology used to introduce ADT within two construction technology courses. The paper then examines the results of the data generated from questionnaires and interviews of the students and architectural practitioners. It continues to examine some of the limitations of this case study. The paper concludes with recommendations and conclusions on the use of ADT in successive construction technology courses.

2.0 Background

In looking at the last several decades in architectural technical education and industry we have seen influential advances in the development and application of information and computer technology. As a consequence, in architectural and engineering classrooms and professional firms, computer-based tools such as AutoCAD, 3D Studio, Form-Z and Photoshop have become the norm. Clients and professors have come to expect realistic renderings and virtual, animated building tours within presentations. Yet, as Gross, Yi-Luen Do and Johnson[1] note, these tools merely represent the commercialization of the first generation of CAD development, and further state: "We have hardly exhausted the possibilities of information technology in architectural design. Some of the most effective and exciting developments are yet to come." It therefore behooves the educator to embrace this trail of technology into this exciting future to ensure that students are making the best use of the most current technology that exists.

As a result of this expanding use of architecturally related software, there has been an increase in research in areas such as the development of virtual worlds (e.g. Johnson[2]), interactive Web-based studios and labs (e.g. Gross, Yi-Luen Do, McCall, Citrin, Hamill, Warmack, & Kuczun [3]; Hui & Cheung[4]) and building performance and simulation (e.g. Bentz[5]; Selkowitz, Rubin & Sullivan[6]). There is thus a lot of software and research that supports and monitors the development of conceptual design, presentation and illustration, animation, scheduling, estimating, and energy simulation of architecture. However, there has been less research that has focused on the attempt to incorporate 3D models and software into production/ construction drawings; that part of the architectural industry that typically consumes the greatest amount of time and labor. This paper attempts to address some of the issues in this area through a discussion of two courses where three dimensional software and modeling were introduced.

3.0 Purpose

The specific purpose of this study was to determine how effective ADT is in producing construction (working) drawings, as well as to determine how to effectively teach and introduce this software within construction technology courses aimed at teaching working drawings.

4.0 Objectives

There were several objectives to this study:

1. To determine the most effective stage to introduce 3D modeling software into construction drawing courses.
2. To determine the effectiveness of this software in producing architectural working drawings.
3. To determine effective methods of introducing 3D modeling.
4. To determine the extent of use of 3D modeling software (in particular ADT) within the local Indianapolis architectural industry

5.0 Methodology

The following sub-sections describe the methodology used to develop the data for this study to provide some answers to the objectives and purposes posed above. Questionnaires of students were used as well as telephone interviews of architectural practitioners.

5.1 Over View

To develop a baseline for this type of research the author decided to introduce ADT into two working drawings courses and get feedback on its effectiveness from surveys of students. The study thus addressed the academic environment first, before adding the complexities of the software's viability with contractors and consultants. The classroom environment was also seen as one of exploration; some instruction was given, yet students were free to explore either ADT or Generic AutoCAD to produce their details and construction drawings. Those students that championed and embraced the new software enticed other students to try it. As a counterpoint to the research within the classroom, industry experts were also called upon to give their impressions of the effectiveness and extent of use of this software.

5.2 Architectural Desktop (ADT) Within the Classroom

This study was developed in several stages and settings. The first involved the introduction of Auto Desk Architectural Desktop (Ver. 3.3) into two Architectural Engineering Technology undergraduate sophomore level courses: Residential Construction (ART 155) and Commercial Construction (ART 222) in the Construction Technology Department at IUPUI (Indiana University/Purdue University/Indianapolis). The author was initially interested in the type and extent of use of the software in the Commercial course. However, due to the small numbers of students (14), and to further understand the effective use of the software, it was also introduced into the Residential Construction course as well.

The Residential Course was composed of 17 students from varying programs: Interior Design (Associate Degree Two Year Program) (6 Students), Architectural Engineering Technology (Associate Degree Two Year Program) (2 Students), Construction Technology (Associate Two Year Program and Bachelor's Degree Four Year Program) (8 Students) and Organizational Leadership and Supervision (1 Student) (see Appendix C). Students enrolled in ART 155 had exposure to at least one introductory AutoCAD course (ART 117) prior to taking this course (as a minimum prerequisite).

The software was introduced into ART 155 mid way through the semester. A variety of delivery methods were used, such as formal demonstrations, individual guidance, tutorials and self-study based on the tutorials. This was done to expose the students to different instructional methods and to enable them to decide what methods seemed to be the most effective. It also allowed the instructor to experiment with these methods as well. At the time of introduction of ADT, students were just beginning to design their term project: a small, two storey wood frame house. They had just finished half of the term working on developing details using two dimensional CAD. They were told to use Architectural Desktop to help develop their projects, yet were allowed to revert to using generic CAD whenever they wanted. However, they had to develop one oral presentation showing their use of Architectural Desktop in the course, so could not abandon the new software completely; they were forced, at the least, to explore it and document their exploration. After the presentation they were told that they could use whatever software they wanted to complete the work assigned in the course.

In the Commercial Construction course, the software was also introduced part way through the semester. A variety of delivery methods were similarly used to introduce the software: formal demonstrations, individual guidance and handouts of tutorials and self-study. All students had completed the residential course as a prerequisite and some (10 out of 14) had been briefly exposed to Architectural Desktop prior to this course. Students were either in the Architectural Engineering Technology Program (10 students) or the Construction Technology Program (4 students). Students were encouraged to use the software upon beginning the design of their term project: a two storey office building. They were allowed to use generic CAD and ADT whenever they wanted, so that the decision to use a software type would be determined by the students, rather than dictated by the instructor.

In both courses, near the end of the term (November), (though prior to getting their final grades) students were asked to fill out a questionnaire summarizing their impressions of working with Architectural Desktop 3.3 (see Appendix A). The questionnaire was distributed and filled out in absence of the instructor.

5.3 Architectural Desktop (ADT) Use in Industry

To understand the type and extent of the use of ADT in the local Indianapolis architectural community, several (20) architectural firms were surveyed via short telephone interviews (see Appendix B). The purpose of this stage of the study was to compare the type and extent of use of the software in industry to that within the classroom setting, as well as to gain an insight into the software's attributes and limitations within each firm. Telephone interviews were conducted over a two week period. The interviews were relatively short and consisted of both open and closed questions. Firms were selected from the yellow pages of the telephone book, yet as the author was not familiar with any of the firms, there was some degree of randomness in the calls.

6.0 Results from the Questionnaire

Results from each of the questionnaires and telephone interviews have been recorded onto tables that are within Appendix C. The following sections discuss the details of the findings with respect to each question.

6.1 Preferred Delivery Method

The most preferred method of instruction in ART 222 was formal demonstrations and tutorials with 57% (8 out of 14 students) preferring this method. In the Residential Course, this was also the most preferred method, with 9 out of 17 students (53%) preferring this method. In this method, the instructor formally demonstrated some of the tutorials that were available with the software, going through the steps one by one; with the students able to join in on their computers when and if they wanted. The next most preferred delivery methods were the tutorials (2 out of all the students in ART 222, and none in Art 155), self study (1 student in ART 222 and 5 students in ART 155) and formal demonstrations (1 student in Art 222 and 6 students in ART 155). Formal demonstrations given by the instructor were not tied to any particular tutorial, yet were used to introduce a particular concept or command (e.g. creating a gable-end wall). Tutorials were available on-line for the students to work at when they wanted, and self-study consisted of work on their own, exploring the software through trial and error and help menus.

6.2 Value of the Software

In ART 222, 6 students (43%) rated the software value at the highest level (5). Seven students (50%) rated it as a 4, the next level, and only 1 student rated it one level lower (3). In the Residential Course, 6 students (35%) rated it at the highest level (5), with 7 students (41%) rating it at the next level (4). Three students (18%) in ART 155 rated the value of the software as a 3. There were no ratings given below a 3.

6.3 Limitations and Attributes of the Software

The most common limitation cited for the software was its high learning curve (HLC). In the Commercial Course only 3 students noted other limitations, and in the Residential Course 6 students listed other reasons (e.g. incompatibility with generic CAD).

Seven students (50%) in ART 222 noted that ADT saved them a lot of time on completing their project. Five others noted that it saved them a little time. Thus few students (only 2) felt that ADT was not valuable in terms of completing their projects faster.

In the ART 155 course, 5 students noted that ADT saved them a lot of time. Eight others noted that it saved them a little time. Thus 13 students, or over 76% of the class, felt that ADT saved them some time with completing their project.

6.4 Drawing Type Most Used

In the ART 222 course, elevations were the most popular drawing type produced by ADT with 10 of 14 students or 71% of the class using ADT to produce their elevations (two elevations were required). In ART 155, 10 out of 17 students (59%) noted that they used ADT the most to produce their elevations. In the Commercial Course building sections were the next most popular drawing type, with plans being the second most popular in the ART 155 course.

6.5 Greater Use of the Software

In both courses, students were supportive of more use of 3Dimensional software in their respective programs. All but 1 student in the Commercial Course stated that they *definitely* would like to see more of this type of software used in their respective programs. In the Residential Course 7 students rated this as a possibility with 12 stating that they *definitely* supported greater use of 3D software in their program. In ART 222 all of the students noted that they wanted to learn more about ADT. As well, only 3 students indicated that they would possibly use it again and all but 3 would definitely recommend its use in the course again. In the Residential Course, 12 out of 17 students (71%) stated that they *definitely* wanted to learn more about this software. Eleven stated that they would *definitely* use ADT again.

A good understanding of the value of the software to the student is to determine whether or not they are using it in other courses. Of the ART 222 students, only 3 students had used it in other courses. In the ART 155 course, only 3 had used it as well, despite 11 students stating that they would use it again.

7.0 Results from the Telephone Interviews

The following section examines the results from the telephone interviews of the architectural firms within Indianapolis.

7.1 Use of ADT

Of the 20 firms interviewed, 12 out of 20 (60%) said that they were either currently using ADT or intended to use it in the near future. Eight out of the 20 (40%) also stated that they did not use any other 3D software (other than AutoCAD). Only 3 out of 18 (17%) stated that they did not see the need to have graduates learn this program prior to entering industry. Of those that responded to the question about the value of the software, all of the answers, to some degree, indicated that its greatest value was increased speed or quickness in developing some phase of the work required within an architectural office.

Eight of the firms noted that a high learning curve was the greatest limitation of the software. This was the most frequent response to this question (40%). Other respondents also stated the need for more CADD management and organization within the project with ADT, which, as one respondent noted, "took time away from being a designer". Others commented that more time and designated training were needed to make more use of the program. A few of the respondents mentioned the expense of ADT and noted that they had adopted cheaper alternatives such as AutoCAD LT. Two of the firms indicated that they were considering using Autodesk Revit as an alternative.

8.0 Limitations of This Study

This section discusses the limitations of this particular case study. These limitations were either discovered during the course of the study or during the analysis of the results.

8.1 Limitations in the Classroom

Although the questionnaire provided useful data, in retrospect there were some questions that needed to be reworded or reconstructed. The question discussing the *value* of the software could be misinterpreted, for example. It was too vague; for *value* should have been attached to something concrete, as is tied to many things, such as the software's value in quickness, in visualization or in client presentations.

As well, with respect to delivery methods, students may have preferred the formal demonstration and tutorial method as this is what the instructor preferred and felt more comfortable in using this hybrid method. Some students in both classes also voiced (in the classroom) that they preferred this method, rather than learning the tutorials on their own, and this may have influenced responses to this question.

In ART 222, several students (10 out of 14 or 71%) had some exposure to ADT previously. This seemed to force the novice users to follow along with the others, adopt and use the software and to learn from them. Not using ADT may have been seen as being *behind* in the course. In ART 155, a less advanced course, some students became intimidated by the progress that some students were making with ADT in comparison to themselves. Some took this up as a challenge, whereas others perhaps admitted defeat, and returned to using generic CAD as soon as possible. By allowing students to choose which software they wanted to use there may have been a tendency, with some, to revert to using tools with which they had more familiarity.

Another limitation, particularly in the ART 155 class, was that many students were working full time (approximately 93% of the students in Construction Technology work while going to school) so there was a reluctance and inability to complete work outside of class. If any software was available outside of the classroom it was typically AutoCAD, not ADT, and thus the students tended to default to using the software that they had access to at both home and school. As well, although only 3 students in each class had only used the software in other courses, many indicated that they would use it again. There is therefore a need to monitor its extended use beyond this one semester.

This study should also be conducted with a greater number of students and over several semesters to attain the necessary longitudinal results mentioned above. If courses taken in ADT at other institutions initiated similar studies, then more could be gained from a larger sample base as well.

8.2 Limitations in Industry

The telephone surveys of architectural firms needs to be expanded. A sample size greater than 20 would help in developing more substantial conclusions. As well, a more random survey, uninfluenced by the comments made by the subjects to phone particular firms, may develop a more accurate picture of the use of ADT in this city. Similarly, it would be advisable to discuss the questions with several members within a firm to assure that the answers were representative of a particular firm, rather than the opinions of one individual.

It may also be questioned as to whether or not statements made by individuals about the extensive use of the software were made to appear progressive, whereas in reality the extent of use may have been less. There were few that admitted that they had ADT and, at the same time, really didn't use it that much.

9.0 Conclusions and Recommendations for Future Research

It appears, from a student's perspective, that this software is complex with a high learning curve that accompanies it. One student noted that a separate course should be developed to introduce the software before taking upon the construction concepts required in the Residential Construction course. Several others, after taking the Commercial Course, have already signed up for a directed study course in advanced ADT. Short term courses in ADT (offered within a week of intensive study in the intersession and summer) are currently being designed and considered to possibly accommodate this high learning curve of ADT, should the demand exist. This necessity of more software training is also supported by the data that notes that most students do not want to begin either of these courses from the start without reviewing generic CAD in some manner. This might indicate that the students did not feel confident in their CAD abilities before taking on the learning of new software.

According to the results of this study, ADT has limitations in construction drawings. Possibly because of the high learning curve, and some limitations of the software and/or user,

ADT was seen as being more effective in presentation and design drawings and more effective with the production of plans and elevations than with construction drawings or details. The frequencies of responses showed that students valued the ability of ADT to quickly generate elevations and building sections from the plans developed in a 3D model. The questionnaire results also revealed that these students felt that phasing in the ADT after some initial instruction/review in CAD would be the most effective method of learning the software. Formal demonstrations of tutorials were seen as the most effective delivery method.

The responses generated from this study would also indicate that there maybe a growing demand for the use of 3D modeling within the architectural industry. Hurdles such as high learning curves and acquiring the time to learn the software need to be addressed, both at the office and classroom level as well as with the software developers. Industry responses seemed to support the use of this software within the classroom so that, as one respondent noted, "the learning curve of starting in industry is reduced". It also appeared from several within industry that there was a growing client demand for 3D modeling, in fact one firm did nothing other than 3D rendering and animations and could not keep up with the demand.

It is hoped that future construction courses will develop from current and traditional conventions of using AutoCAD combined with these forward looking applications of emerging technologies (e.g. Architectural Desktop). To advance the production efficiency and quality of architecture produced within both the classroom and the industry, attempts should be continually made to increase efficiency through the exploration of new computer software.

"We have hardly exhausted the possibilities of information technology in architectural design. Some of the most effective and exciting developments are yet to come." [1]

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APPENDIX A

STUDENT QUESTIONNAIRE

ARCHITECTURAL DESKTOP: A SURVEY ABOUT THE USE OF 3D CADD

COURSE: ART 222: COMMERCIAL CONSTRUCTION FALL 2003
INDIANA UNIVERSITY/PURDUE UNIVERSITY INDIANA (IUPUI)

DATE: _____

The purpose of this questionnaire is to evaluate your perceptions about the use and introduction of 3D CADD Software (Architectural Desktop 3.3) into the curriculum of this course. You should be aware that:

1. You will not be graded on this, nor will your comments affect your grade.
2. All information will be kept confidential. Please do not sign your name to these pages.

1. Which of the following programs are you currently registered in (check one):

☐ Interior Design (Associate Degree Program)

☐ Architectural Engineering Technology (Associate Degree Program)

☐ Civil Engineering Technology (Associate Degree Program)

☐ Construction Management Program (Bachelor's Degree Program)

☐ Other: Please Specify: _____

2. Which year of the above program are you currently registered in (check one):

☐ First

☐ Second

☐ Third

☐ Fourth

☐ Other: Please Specify: _____

3. What was your level of exposure to Architectural Desktop prior to entering this class (check one)?

☐ None at all.

☐ Less than 2 hours

☐ 2-5 hours

☐ 6-10 hours

☐ Greater than 10 hours: Specify _____

4. When did you last take ART 117 (Introduction to AutoCAD) prior to taking this class (check one)?

☐ Summer Semester 2003

☐ Spring Semester 2003

☐ Fall Semester 2002

☐ Summer Semester 2002

☐ Other: Specify _____

5. When do you see the MOST opportune time to introduce Architectural Desktop into this course (check one)?

☐ At the very beginning of the course, first lecture, first day.

☐ After some basic review of 2D Generic CAD (Second or Third Lecture Period)

☐ After doing some preliminary details in 2D CAD (3 weeks into the course)

☐ Near the end of the course (Last two to three weeks).

☐ Other: Please Specify: _____

6. What is your MOST preferred method of learning this software (check one)?

☐ Through Formal Demonstrations

☐ Through Tutorials

☐ Self-Study

☐ Formal Demonstrations and Tutorials

☐ Other: Please Specify: _____

7. What drawing type did you make the most use of with this software (check one)?

☐ Details

☐ Plans

☐ Elevations

☐ Building Sections

☐ Framing Plans

☐ Site Plans

☐ Other: Please Specify: _____

8. How would you rate the value of this software to this course (circle one)?

Low Value					High Value
0	1	2	3	4	5

9. Would you recommend using this software in this course again (check one)?

☐ Definitely

☐ Possibly

☐ No

10. Where do you see the highest value of using this software (check one)?

☐ Presentations

☐ Construction Drawings

☐ Design Drawings

☐ Concept/First Stage Design Drawings

☐ Other: Please Specify_____

11. What do you see as the main limitation of this software (check one)?

☐ High Learning Curve

☐ Poor compatibility with generic CAD

☐ Other: Please Specify_____

12. Did this software save you any time in producing this project (check one)?

☐ A lot

☐ A little

☐ Not at all

13. Would you like to learn more about this software (check one)?

☐ Definitely

☐ Possibly

☐ No

14. Have you used this software in any other courses/projects this term (check one)?

☐ Yes

☐ No

15. Do you see yourself using this software again (check one)?

☐ Definitely

☐ Possibly

☐ No

16. Do you think that there should be a greater use of 3D CAD in your program of study (check one)?

☐ Definitely

☐ Possibly

☐ No

APPENDIX B

TELEPHONE SURVEY: ARCHITECTURAL FIRMS IN INDIANAPOLIS

Interview Questions for Architectural Practitioners:
Case Study of Architectural Desktop Software

These questions are only to be used to gather data about the use of this software in industry. You will not be identified in any manner. Responses will be kept anonymous.

1. Are you currently using Architectural Desktop (ADT) to produce your construction drawings? Why? Why not?
2. If not, do you foresee using it in the future?
3. Are you using any other 3D software?
4. If you are using ADT, where do you gain the MOST value from it?
5. Would you like to see more junior personnel having training in this software prior to joining your firm?
6. What do you see are the limitations of ADT in creating construction drawings?

APPENDIX C

QUESTIONNAIRE AND SURVEY RESULTS

QUESTIONNAIRE RESULTS FROM COMMERCIAL CONSTRUCTION COURSE (ART 222)

Program & Year	Previous Exposure	Art 155	Best Time to Introduce	Best Method to Learn	Drawing Type Used Most	Value	Recommend Greater Use?	Learn More? Use Again?	Limitation	Save Time? Other Courses
CMGT [3]	2-5 Hrs.	F01	After Review	Demos and Tutorials	Elevations Building Sections	5 Pres.	Def. Def.	Def. Def.	HLC	Lot No
AET [2]	6-10 Hrs.	S03	After Details	Demos and Tutorials	Building Sections	5 Design	Def. Def.	Def. Def.	HLC	Litt. No
AET [2]	None	F02	After Details	Formal Demos	Restroom Elevations	3 1st	Possibly Possibly	Def. Poss.	HLC	No No
AET [2]	>10Hrs.	S03	After Review	Tutorials	Elevations	5 Constr.	Def. Def.	Def. Def.	HLC	Lot Yes
AET [2]	6-10 Hrs.	S03	After Review	Self-Study	Elevations	4 Design	Def. Def.	Def. Def.	HLC	Litt. No
AET [2]	2-5 Hrs.	S03	After Review	Tutorials	Elevations	4 Constr.	Def. Def.	Def. Def.	HLC	Litt. No
CMGT [2]	2-5 Hrs.	S03	After Details	Demos and Tutorials	Elevations Building Sections	4 NA	Def. NA	Def. Poss.	NA	Lot No
AET [2]	2-5 Hrs.	S03	After Review	Demos and Tutorials	Plans	4 Design	Def. Def.	Def. Def.	Poor Cad	Lot Yes
CMGT [2]	None	Sum03	After Details	Demos and Tutorials	Elevations	5 Design	Def. Def.	Def. Def.	HLC	Litt. No
AET [?]	None	?	Begin	Demos and Tutorials	Plans	4 Design	Poss. Def.	Def. Def.	HLC	No No
AET [2]	2-5 Hrs.	S03	After Review	Text	Elevations	5 Constr.	Def. Def.	Def. Def.	HLC	Lot No
AET [2]	6-10	F02	After Details	Tutorials	Elevations	4 Pres.	Def. Def.	Def. Poss.	HLC	Litt. No
AET [3]	None	S03	After Review	Demos and Tutorials	Plans Elevations Building Sections	5 Pres. Design	Def. Def.	Def. Def.	HLC	Lot No
CMGT [2]	2-5 Hours	F02	Begin	Demos and Tutorials	Elevations	4 Pres.	Poss. Def.	Def. Def.	Poor Cad	Lot Yes

QUESTIONNAIRE RESULTS FROM RESIDENTIAL CONSTRUCTION COURSE (ART 155)

Program & Year	Previous Exposure	Art 117	Best Time to Introduce	Best Method to	Drawing Type Used	Value	Recomm? Greater Use?	Learn More? Use	Limitation	Save Time? Other
OLS [2]	None	S03	After Review	Formal Demos	Building Sections	5 Pres.	Def. Def.	Def. Def.	HLC	Lot No
CIVIL[1]	None	S03	After Details	Demos and Tutorials	Elevations	4 Pres.	Def. Def.	Def. Def.	HLC	Lot No
AET [2]	None	Sum02	After Details	Formal Demos	Elevations	4 Design	Def. Def.	Def. Def.	HLC	Litt. No
INTR [2]	< 2Hrs.	S03	After Details	Formal Demos	Elevations Building Sections	5 All	Poss. Def.	Def. Def.	Poor Cad	Litt. Yes
INTR [2]	None	Sum03	After Review	Demos and Tutorials	Elevations	3 Pres.	Poss. Poss.	Poss. Poss.	Poor Cad Cost	Litt. No
INTR [2]	None	S03	Beginning	Formal Demos	Elevations	5 Design	Def. Poss.	Def. Def.	HLC	Litt. No
CMGT [2]	None	F02	After Details	Demos and Tutorials	Plans	5 Pres.	Def. Def.	Def. Def.	HLC	Lot No
CIVIL [2]	None	F02	After Details	Demos and Tutorials	Elevations	4 Pres.	Def. Poss.	Def. Poss.	HLC	Litt No
INTR [2]	None	F02	After Review	Formal Demo Self-Study	Elevations	4 Pres.	Def. Def.	Poss. Def.	HLC	? Yes
CMGT [2]	None	S03	After Details	Self-Study	Plans	5 Contr.	Def. Def.	Def. Def.	Facilities	No No
INTR [2]	None	F02	Separate Class	Demos and Tutorials	Plans	2 Pres.	Poss. Poss.	Poss. Poss.	HLC	No No
AET [2]	None	S01	After Details	Demos and Tutorials	Elevations	4 All	Def. Poss.	Def. Def.	Poor Cad	Lot No
CMGT [1]	None	S03	Beginning	Demos and Tutorials	Elevations	4 Pres.	Def. Poss.	Def. Poss.	Glitches	Litt No
CMGT [2]	None	S03	Start in Art 117	Self-Study	Elevations	3 Pres.	Poss. Poss.	Poss. Poss.	Poor Cad	Litt No
CIVIL [1] CMGT[1]	None None	S03 S03	Beginning Beginning	Demos and Tutorials Formal Demos Self-Study	3D Modeling Details	5 1st. 4 Pres.	Def. Def. Def. Def.	Def. Def. Def. Poss.	HLC HLC	Lot No Litt No
INTR [2]	None	F01	After Review	Demos and Tutorials	Plans	3 Pres.	Poss. Poss.	Def. Def.	HLC	No Yes

TELEPHONE SURVEY RESULTS: ARCHITECTURAL FIRMS: INDIANAPOLIS

Firm Number	Using ADT?	Other 3D	Most Value?	Train Grads	Limitations Of ADT
1	Use ADT 3.3	3D Studio Vis	Speed up Production Scheduling	Yes	High Learning Curve
2	No	None	-	-	Not suited to their work in Civil Engineering
3	Yes	None	Symbols	Yes	No Limitations
4	No	None	-	-	-
5	No	None	-	-	-
6	ADT 2004	FormZ 3D Studio Max	Schedules	Yes	Details still 2D
7	No	Vector Works Mac	Quick Efficient	Yes	Use Macs
8	Yes	3D Studio Max		Yes	Use ADT very little.
9	Yes	None	Quick	Yes	High Learning Curve
10	No Will Use it Soon	No		Yes	Too Expensive
11	Yes 2004	3D VIS	Presentation	Yes	High Learning Curve
12	Yes	No	Editing Drawings	Yes	Too much CAD management Required
13	No	ACAD Light	-	-	Complex
14	Yes 2004	No	Parametric Construction Drawings	Yes	Revision Process
15	No	-	-	No	Not doing any 3D Modeling
16	No	3D VIS Sketch-up	-	No	High Learning Curve
17	No	REVIT	-	Focus More on AutoCAD	Outdated Software
18	No Will in Future	No	-	Yes	Expensive
19	Yes	3D Studio	-	Yes	Not Everyone Trained in It High Learning Curve
20	Yes	3D Studio	-	Yes	High Learning Curve