PROFICIENCY WITH AND EFFECTIVENESS OF DESIGN AND COMMUNICATION TECHNOLOGY IN DISTANCE DESIGN STUDIO EDUCATION

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ABSTRACT

The purpose of this paper is to provide findings of distance learning research relative to specific digital design and communication tools and, in particular, to determine which tools are more or less helpful in the process of collaborative distance design. This determination is important both as a way of informing the purchase of hardware and software, and because the use of appropriate tools will contribute to the efficiency in the instruction of the distance studio experience.

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The distance studio teamed an upper-level architectural studio at one institution with an interior design studio at a second institution. Students from both programs, in four- to five-person teams, executed real-life projects currently on the boards in two different professional offices. The projects were defined by the practitioners and then critiqued on a daily basis by three to four practitioners in each office throughout the duration of the studio (approximately 10 weeks). Using web-based technology, professionals could engage the studio in real-time (scheduled studio critiques), or asynchronously, at their own convenience. Communication occurred in several ways using e-mail, instant messaging, threaded conversations on electronic bulletin boards, desktop video-conferencing, FTP document sharing, and Timbuktu (shared computer desktops). Design software included Dreamweaver, Flash, Adobe Photoshop, Illustrator, Pagemaker, Premier, Form•Z, AutoCAD, and Cosmoworld (VRML). Peripherals included scanners, printers, digital still, video cameras, phones, and faxes. This study evaluates the proficiency and effectiveness of the tool students used in the ten week design project.

Hasell and Scott (1996) indicate both technology and collaboration as top priorities in design education. “Distance education…methods and materials will require testing for their effectiveness.” In order to determine the proficiency and the effectiveness of various communication and design tools, data were collected from students via a survey process. One instrument used a pre- and post-assessment that asked students to rank their *proficiency* with communication and design tools on a 5-point Likert-type scale. Correlations between and within groups were tested using the Wilcoxon test for non-parametric data. A second instrument used a post-assessment that asked students to assess the *effectiveness* of communication and design tools on a 5-point Likert-type scale. Scores were ranked by mean response. To complement the use of Likert-type surveys, the authors also implemented open-ended, written assessments pertaining to the use of communication tools, team collaboration, and the use of design tools.

1. Technologies which facilitate synchronous communication (chat, desktop videoconferencing, telephone) most closely approximate face-to-face communication and should be given high priority in the digital studio.

2. The immediacy of the internet renders it a powerful communication tool. Given its increasing impact within both the academic and professional arenas, inclusion of web design in the interior design curriculum, as early as the first year, is strongly suggested.

3. Obsolete or redundant tools should be identified and eliminated. These might include the fax machine, conventional mail, and even e-mail.

4. The distance internet studio appears to be highly supportive of learning across the spectrum of tools, so long as risk taking is supported and students have freedom to explore different tools where appropriate. Students will generally learn and spend more time with tools which are fundamentally easier and which are seen as contributing to the task at hand.

5. The distance internet studio also appears to foster the exploration and mastery of digital design software.

Introduction

Rapid advances in Internet technology have allowed new types of distance design partnerships to occur in design programs. These partnerships include students at different institutions and in different majors as well as professional designers. This paper assesses student proficiency and the effectiveness of a variety of digital communication and design tools used in an experimental collaborative studio.

Purpose

This research examines: 1.) student proficiency related to communication and design tools and 2.) the effectiveness of these tools in an Internet-based collaborative studio environment. These assessments are important when selecting the appropriate tools in relation to the learning experience, helping design educators manage equipment and support resources, and providing a foundation of what tools and methods are effective for communicating with team members at a distance.

Review of Literature

Review of literature includes articles and papers from the Journal of Interior Design (JID), the Journal of Architectural Education (JAE), and proceedings from the Association for Computer-Aided Design in Architecture (ACADIA) from 1995 to the present. Hasell and Scott (1996) indicate that both technology and collaboration as top priorities in design education. "Distance education…methods and materials will require testing for their effectiveness." Ali and DiCicco

(1995) reiterate this need. “A needs assessment is the first step for any Interior Design program to complete when considering adding or supplementing a distance education component in their curriculum.” Matthews and Weigand (2001) cite advances in Internet communication and the potential for communication in a prototype studio case study, but they do not address student proficiency with technology or the effectiveness of specific tools.

Methodology

The collaborative studio paired students from two universities with one of two professional design firms. The collaborative studio also teamed an upper-level architectural studio from the first institution with an interior design studio at the second institution. Students from both programs, in four- to-five person teams, executed real-life projects currently on the boards in two different professional offices (see Table 1—Demographics). The projects were defined by the practitioners and then critiqued on a daily basis by three to four practitioners in each office throughout the duration of the studio (approximately 10 weeks). Using web-based technology, professionals could engage the students in real-time (scheduled studio critiques), or asynchronously, at their own convenience, during free moments in the workday or after-hours. A central objective to the studio was to provide the students with an experience of interaction between related disciplines and award winning design professionals. This type of interaction was not available on campus, thus distance technology was implemented in this project to expand learning opportunities not available on locally.

To accomplish both collaborative design and ongoing distance critiques, the studio utilized an array of internet communication tools. Team web sites allowed each participant to become

acquainted team members using digital still photographs and video, to document three weeks of research work directed by practitioners, and to record design process through conceptual, schematic, and design development phases. Communication occurred in several ways using e-mail, instant messaging, threaded conversations on electronic bulletin boards, desktop videoconferencing, FTP document sharing, and Timbuktu (shared computer desktops). Design software included Dreamweaver, Flash, Adobe Photoshop, Illustrator, Pagemaker, Premier, Form•Z, AutoCAD, and Cosmoworld (VRML). Peripherals included scanners, printers, digital still, video cameras, phones, and faxes.

In order to determine the proficiency and the effectiveness of various communication and design tools, data were collected from students via a survey process. One instrument used a pre- and post-assessment that asked students to rank their *proficiency* with communication and design tools on a 5-point Likert-type scale. A response of 1-1.99 indicated "unfamiliar knowledge," 2-2.99 indicated "novice knowledge," 3-3.99 indicated "intermediate knowledge," and 4-5 indicated "expert knowledge." Correlations between and within groups were tested using the Wilcoxon test for non-parametric data. Level of confidence was set at 0.95.

A second instrument used a post-assessment that asked students to assess the *effectiveness* of communication and design tools on a 5-point Likert-type scale. A response of 1-1.99 indicated "not effective," 2-2.99 indicated "slightly effective," 3-3.99 indicated "effective," and 4-5 indicated "highly effective." Scores were ranked by mean response.

To complement the use of Likert-type surveys, the authors also implemented open-ended, written assessments pertaining to the use of communication tools, team collaboration, and the use of design tools. The written assessments were completed by the students at the end of the course.

The inter-university and interdisciplinary nature of this project challenged students to problem solve in a team environment. The ongoing dialogue with, and feedback from, professional designers became an integral part of the experience. Within this context, students were presented an array of tools, given introductory instruction in the use of these tools, and then asked to select and use those tools which could best solve the problem. There was a great deal of freedom for experimenting and selecting of appropriate tools. Based on both pre- and post-assessment, students cited their initial and achieved level of mastery for each tool (see Table 2 —Technology Proficiency). At the completion of the studio, students also were surveyed in order to determine which tools were most effective (see Table 3—Technology Effectiveness).

Findings

Table 2—Technology Proficiency

Key statistical findings include:

- The increase in student knowledge between pre- and post- test was statistically significant for many communication and design tools.
- Initial expert knowledge was indicated in word-processing, e-mail, and the ability to search the internet.
- Initial poor or average knowledge was indicated in most other categories.

- Post-studio assessment indicated expert knowledge in the specific tools related to the creation of web sites, including HTML editor(s), Adobe Photoshop, and file transfer.

Table 3—Technology Effectiveness

Key statistical findings include:

- Most all communication and design tools were ranked as “effective” or “highly effective.”
- Fax and conventional mail were the only tools ranked as “not applicable” by a large majority of the respondents.
- Face-to-face communication was cited as the most effective interpersonal/small group communication tool (4.70 mean score/Table 3). This finding was supported by the authors’ observations in the studios.
- HTML editor(s) was sited as the most effective visual communication tool (4.76 mean score/Table 3).
- Tools related to the creation of web sites, including “team web sites,” FTP/document sharing, Adobe Photoshop, and HTML editor(s) were ranked as “highly effective.”
- Tools related to synchronous communication, including desktop video-conferencing, “chat,” and the telephone were ranked as “highly effective.”
- Digital design tools (FormZ) were ranked as “highly effective,” even though students were allowed to work in conventional hand media (drawing and model-building).
- Cosmoworld/VRML and Adobe Premier were ranked as “effective,” but received lower mean scores than other tools.

Conclusions

Based on the above findings, the authors form the following conclusions.

The studio was successful in increasing student learning relative to a variety of digital communication and design tools. Communication was effective when web page technology and face to face communication were combined. Web page creation should be *synthesized* with face-to-face communication as a way of augmenting the traditional collaborative design process. Both web page effectiveness and face to face communication were ranked high with students. Further research should be conducted to investigate the potential coloration of face to face communication and use of web sites. Face-to-face communication was essential to successful team communication within the studio.

Technologies which facilitate synchronous communication (chat, desktop video-conferencing, telephone) most closely approximate face-to-face communication and should be given high priority in the digital studio. These technologies tended to be ranked highly effective. Observations and student comments indicated that students became frustrated waiting on e-mail and bulletin board responses. It is interesting to compare “chat” and e-mail communication. E-mail, though quite similar to chat, is fundamentally different in that it is less synchronous. It more resembles digital letter-writing (“mail”) than digital “talking” or face-to-face communication. The synchronous communication afforded by chat was also made possible by concurrent scheduling of the two classes. For the same reasons, desktop videoconferencing was valued by the students—even the conventional telephone received a great amount of use. During web critiques, when internet traffic limited audio communication, the speaker phone was highly

useful. Students noted, however, the acoustic limitations of both the telephone and videoconferencing. Within the non-partitioned studio, both could and did become distracting. These acoustic limitations suggest the need to fundamentally re-envision the design of the studio space if these tools are to be used.

Feedback indicated that the immediacy of the web site positioned this tool as a centerpiece of the project. Furthermore, the students' level of comfort and experience with the web contributed to its effectiveness. It is interesting to note that although the students were highly proficient at accessing the web at the outset of the project, they had little experience in creating their own sites (Table 2). The need to communicate likely created intrinsic motivation to learn web design (Dreamweaver). Clearly, this generation of students (all ages 20-22/Table 1) is fluent with the web as a communication device. It is important to note that web site creation must be viewed as a *package* of tools, including HTML editor(s), Photoshop, FTP document sharing, scanners, and digital cameras. Given its increasing impact within both the academic and professional arenas, inclusion of web design in the interior design curriculum, as early as the first year, is strongly suggested. It should be noted that students used advanced web tools such as Flash to enhance design interaction and visual presentation within web sites.

Fax machines and conventional mail services were viewed by the students as largely obsolete. The authors had purchased fax machines specifically for this studio and they were never used. The ease with which hard sketches, models, etc. could be scanned or digitally photographed and sent to team members over the internet negated any value the fax or conventional mail might have had otherwise. The scanner was highly valued as a tool (4.69 mean score/Table 3), as was

the digital still camera (4.34 mean score/Table 3). Obsolete or redundant tools should be eliminated.

The overall improvement in proficiency across the range of available tools is high. Students were encouraged to "dive in" and experiment with as many tools as possible. Risk taking was supported and there was little perceived penalty for trying something new. Nonetheless, at some point the project needed to be completed, and students began to work within a comfort zone and with specific tools. A "divide and conquer" strategy was often most helpful in moving forward on the project. This would explain why some of the more difficult tools, such as Adobe Premier and VRML, were less mastered across the studio as a whole. These applications were not only more challenging, but the students had less initial knowledge of this software—and it was less essential that the software be mastered by *all* team members. Students will generally learn and spend more time with tools which are fundamentally easier and which are seen as contributing to the task at hand.

Finally, within the design realm, architectural design and modeling software such as Form•Z was evaluated as highly effective. The use of digital design tools such as form-z may be attributed to the intense use of digital communication tools. Students tended to link digital communication with the digital design tools.

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Table 1. Distance Studio Demographics*

	Total Group		Interior Design		Architecture	
	Number	Percent	Number	Percent	Number	Percent
Major						
Architecture	14	48				
Interior Design	15	52				
Rank						
Junior	3	10			3	21
Senior	26	90	15	100	11	79
Gender						
Female	20	69	14	93	6	43
Male	9	31	1	7	8	57
Age						
20	5	17	2	13	3	21
21	18	62	9	60	9	65
22	6	21	4	27	2	14

GPA						
2.6-2.9	6	22	2	13	4	31
3.0-3.3	13	46	8	54	5	38
3.4-3.5	7	25	3	20	4	31
3.9+	2	7	2	13		
Courses Completed Implemented Distant Technology						
No Courses	26	90	15	100	11	79
1 Course	2	7			2	14
4+ Courses	1	3			1	7
Courses Utilized Computer Skills						
1-2 Courses	10	34			10	70
3-4 Courses	19	66	15	100	4	30

*n=29

Table 2 Student Self Assessment of Technology Effectiveness

1-1.99 not effective, 2-2.99 slightly effective, 3-3.99 effective, and 4-5 highly effective

Overall effectiveness ratings for enhancing communications with teammates and practitioners using the following tools:

	Mean (n=29)
Site Visit/Face To face	4.70
Chat Environments	4.48
Desktop Conferencing/Netmeeting	4.41
Telephone	4.41
FTP/Document Sharing	4.38
Team Web Sites	4.38
Email	3.90
Timbuktu/Shared Desktop	3.62
Discussion Forums/ Threaded Conversations	3.24
VRML/Multi-user Domains	3.15

Overall effectiveness of enhancing visual communications with software tools:

Form-z	4.59

HTML Editors/Dreamweaver or Frontpage	4.76
Adobe Photoshop	4.48
Adobe Premier	3.93
Cosmoworlds/VRML Editor	3.73

Overall effectiveness of enhancing visual communications with hardware tools:

Digital Video Camera	3.97
Scanner	4.69
Digital Camera	4.34
Fax	*
Mail	*

*No responses.

Table 3 Technology Proficiency*

Pre and post student self assessment of technology proficiency
1-1.99 unfamiliar knowledge, 2-2.99 novice knowledge, 3-3.99 intermediate knowledge, and 4-5 expert knowledge

	Initial Mean (n=29)	Final Mean (n=29)	Sig.*
COMMUNICATION TOOLS			
Create a word processing document	4.55	4.69	.102
Send and receive email	4.55	4.86	.007*
Search for information on the Internet	4.41	4.55	.206
Create a web site	2.72	4.03	.000*
Electronically send, receive and download files via the Internet	3.21	4.07	.002*
Communicating using desktop video conferencing such as Netmeeting or CU-SeeMe	1.52	3.80	.000*
Communicate using internet chat environments	2.96	4.62	.000*
Communicate using electronic bulletin boards or threaded conversations	2.10	4.17	.000*
DESIGN SOFTWARE			
AutoCAD	3.03	3.17	.614

Adobe Illustrator or Maromedia Freehand	2.36	2.41	.822
Adobe Photoshop	3.76	4.17	.005*
Adobe Premier or other video editing software	1.55	2.80	.000*
form-z	3.28	3.80	.000*
3-d studio or other 3-diminsional modeling software	1.48	2.52	.000*
VRML (virtual reality modeling language)	1.50	3.03	.000*
HTML editor such as Dreamweaver or Frontpage	2.89	4.07	.001*
Pagemaker or QuarkXPress	2.11	2.62	.003*

Table 3 Technology Proficiency Continued

	Initial Mean (n=29)	Final Mean (n=29)	>.05
COMPUTER HARDWARE			
Scanner	3.93	4.55	.002*
Digital Camera	2.69	4.07	.000*
Digital Video Camera	1.90	3.83	.000*
OTHER			
Computer programming language such as C++, FORTRAN, or JAVA	1.37	1.41	.813
OVERALL COMPUER EXPERIENCE	3.45	4.00	.000*

*P>.05

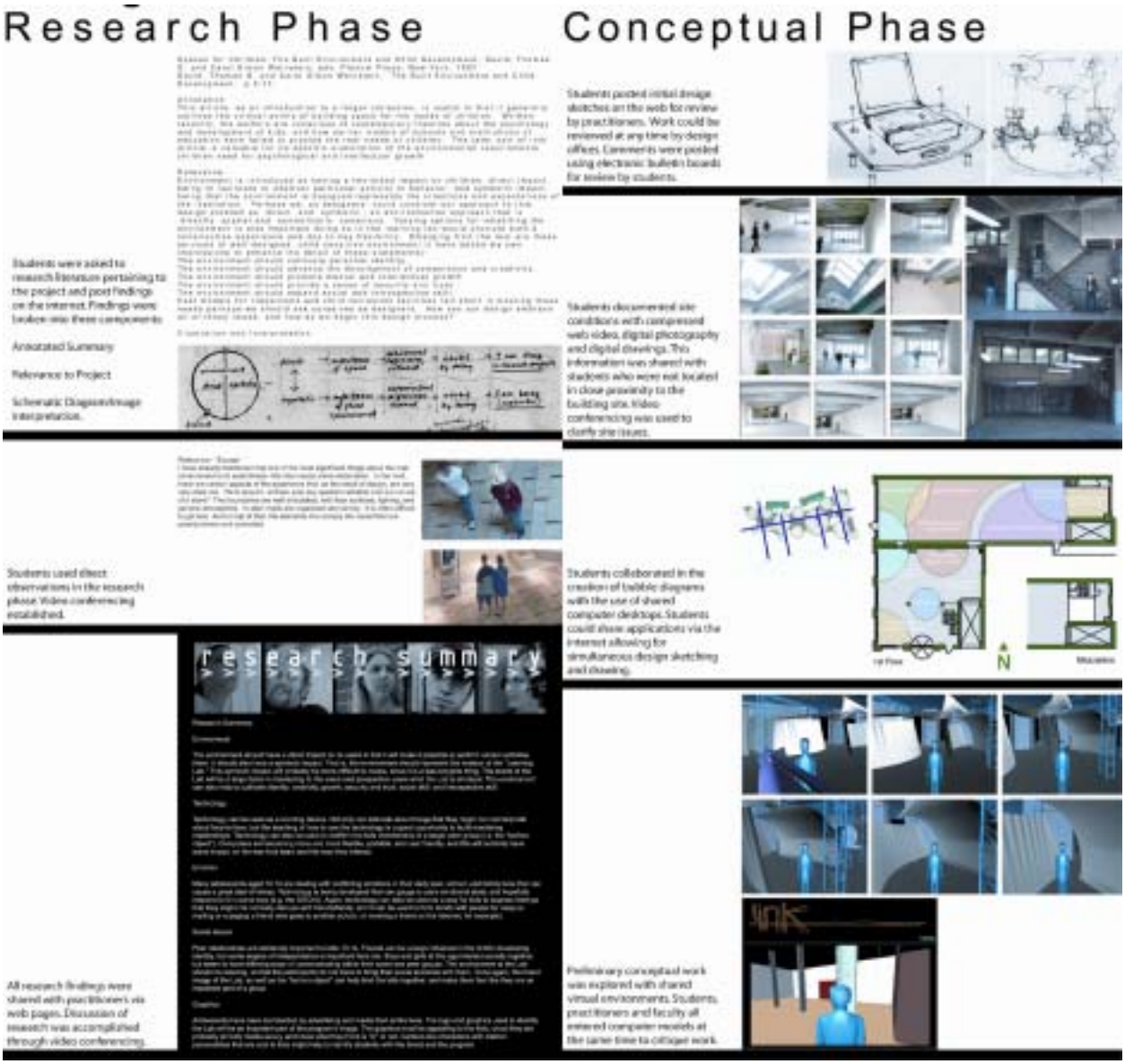

Illustration 1. Example of student work including web pages, research findings, web video, and virtual reality interaction.

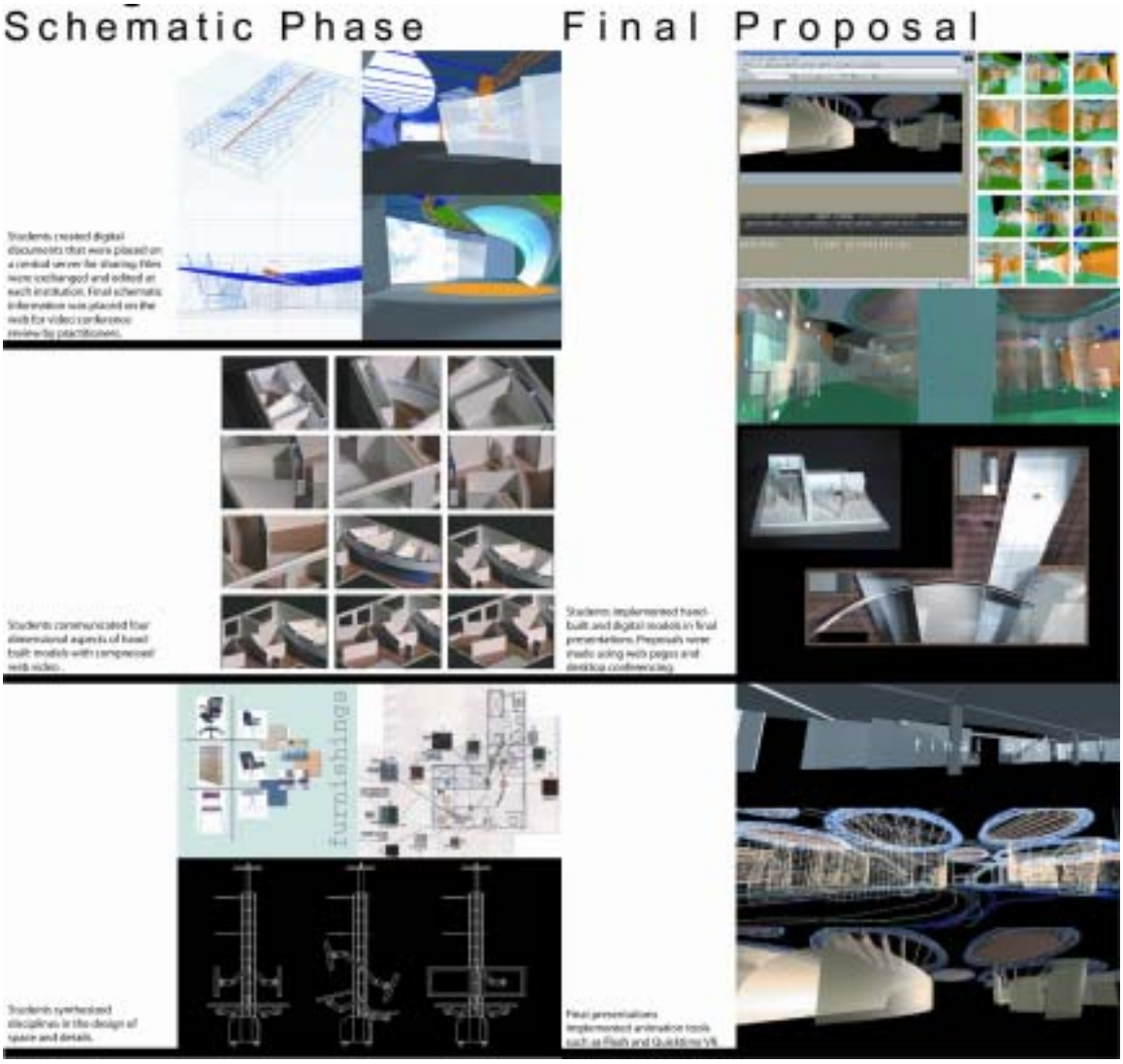

Illustration 2. Examples of student schematic design, and final proposal web pages.