WEB-ENHANCED TEACHING OF LANDSCAPE ARCHITECTURE DIGITAL GRAPHICS: AN EVALUATION OF BENEFITS AND CHALLENGES

YANG, BO
Associate Professor, Utah State University, bo.yang@usu.edu

LI, SHUJUAN
Associate Professor, Utah State University, shujuan.li@usu.edu

1 ABSTRACT

With the rapid development of web courses in higher education, there is a growing interest in the assessment of online education pedagogy. Landscape architecture digital graphics courses are traditionally taught in classrooms and require extensive interactions between students and instructors. This study assesses the benefits and challenges of using the web as a teaching method supplemental to classroom instruction. An experiment that integrated an online session with a classroom session for an introductory course of digital graphics was conducted. Survey instruments were used to solicit students' feedback on the challenges and benefits of the transition from classroom to web teaching (n=52). In addition, students reported the effectiveness of eight different learning vehicles (e.g., classroom lecture). Last, logistic regression analysis examined the effectiveness of the web session project tutorials. Results indicate that web teaching can bring multiple benefits to both students and instructors. However, the reduced level of interaction from the web session remains a major challenge, and this transition may have greater impacts on undergraduate students than on graduate students. Future study should also examine differentiated instruction methods in an online environment for students with different learning requirements.

1.1 Keywords

Landscape architecture education, digital communication graphics, web-enhanced teaching, classroom interaction

2 INTRODUCTION

With the rapid development of web courses in higher education in the United States, there is a growing interest in the assessment of online education pedagogy (Moore and Kearsley, 1995; Martindale and Ahern, 2001; Katz and Yablon, 2002). Previous studies suggest that convenience is a major reason that students choose web courses (Navarro and Shoemaker, 2000) and the web can enable students to achieve a similar, or even better, performance level as through traditional classroom instruction. Moore and Thompson (1990) and Russell (1999) reveal that there is no significant difference between web learners and classroom learners in academic performance. Navarro and Shoemaker (2000) further suggest that the performances of these two groups of learners are not related to their differences in gender, computer skills and academic background.

Although the web seems to be a promising substitute for the traditional classroom, other studies that have assessed users' perceptions of web teaching present mixed findings. Daugherty and Funke (1998) indicate the presence of both positive and negative perceptions from students and faculty. In their study, positive feedback from students included increased learning motivation, better access to course materials and enriched learning experiences. Faculty found the experience of experimenting with web teaching to be meaningful because of the flexibility of the teaching schedule and seemingly improved students' performance. However, faculty also expressed some negative views on web-based instruction, such as less available technical support and increased course preparation time. This extra time-commitment to web instruction is an important reason that some faculty members are reluctant to try online courses (Metcalf, 1997; Smith et al., 2001).

Previous studies were conducted mainly in business, liberal arts, science and engineering courses. Studies on online teaching in landscape architecture have been few, but Li and Murphy (2004) and Li (2007) have explored the perceptions from undergraduate and graduate students in web-enhanced landscape architecture construction courses. Results suggest that both groups appreciate web learning, but their perceptions differ. Undergraduate students enjoy the convenience and flexibility of online courses, as indicated by Navarro and Shoemaker (2000), but they generally disfavor the limited interactions with instructors and peers in the web session. In contrast, graduate students show more inclination to independent learning and seem neutral about the reduced interactions when learning online.

Similar to construction courses, other major landscape architecture courses, such as design studios and graphics courses, are traditionally taught in classrooms. Graphics as one of the core skills of landscape architects is traditionally taught in the classroom and this teaching method is almost exclusively used for hand graphics. Since the late 1990s, digital graphics have started to enjoy wider applications in landscape architecture, as well as other design disciplines (Tsai, 2007). As online teaching presumably will decrease the level of face-to-face interaction, the benefits it could bring to other disciplines may not be applicable for landscape architecture. In addition, the lack of studies on teaching digital graphics online may be the result of the current nature of computer technologies. Hence, discipline-specific baseline studies are needed for landscape architecture.

There are generally three types of classroom instruction: (1) traditional face-to-face, (2) exclusive on-line (i.e., web-based), and (3) a hybrid approach that mixes the two (i.e., web-enhanced). The first approach (traditional face-to-face) is perhaps the most common one for landscape architecture studio courses (e.g., construction, graphics), and the latter two may be more applicable to lecture courses (e.g., history). This study reports lessons learned from a digital graphics course that uses a hybrid approach (web-enhanced). The study evaluates the benefits and challenges of wed teaching and assesses students' satisfaction rate and their perspectives on different learning environments. Last, the study assesses the effectiveness of the web session teaching materials and students' digital literacy (e.g., students' background experience with computer programs) in relationship to learning satisfaction.

3 MATERIALS AND METHODS

The course introduced the basic applications of four digital graphics programs, including AutoCAD, Photoshop, SketchUp and InDesign. Project assignments included the preparation of various types of drawings such as plan, section and perspective view. Students also created drawings at different design stages using different software packages: (1) schematic design (e.g., diagram and rendering with

Photoshop, drafting plan with AutoCAD and 3D modeling and animation with SketchUp), (2) design development, and (3) construction drawing (e.g., retaining wall detail with AutoCAD).

3.1 Sample

There were 52 students (39 males and 13 females) in this class including 44 undergraduate students and 8 graduate students. All the graduate students were from the landscape architecture master's program. The undergraduate students were from diverse disciplines, such as civil engineering, geography, plant science, and university general studies.

3.2 Instruments

One third of the lectures and all the project assignments were delivered through a web session. Comparison was made between the web session and classroom session to examine whether web teaching can achieve the same level of effectiveness as classroom instruction. In the web session, students referred to the class lectures, project tutorials and finished project examples to complete the assignments. Blackboard Vista (webCT) was used to store course materials online. Generally, the web session allowed limited interactive opportunities. Students approached instructors during office hours or via email. Students interacted with peers via chat rooms on Blackboard or meetings scheduled on their own.

Teaching effectiveness of the web session was examined via use of a midterm and final anonymous surveys (survey form in paper format conducted in classroom), both approved by the university Institutional Review Board (IRB). These two surveys were conducted for feedback on students' perception of online teaching, the benefits and challenges they considered, and their overall satisfaction with online learning. Students rated the effectiveness of eight different learning vehicles (adapted from Li, 2007) emphasized in different sessions. They also reported their background in the digital graphics programs before taking this class.

Logistic regression analysis was conducted to explore the relationship between students' background knowledge of the digital programs and the effectiveness of course materials with their learning satisfaction with online learning. Logistic regression analysis is applicable for this study because the dependent variables are categorical (such as "yes or no" binary category). Further, as suggested by Li and Murphy (2004), the assessment of the level of satisfaction will yield valid results for the improvement of students' learning skills. The assumption is that satisfied students are likely to explore additional learning opportunities in order to absorb new contents and develop skills to more advanced levels.

3.3 Procedure

Previous studies suggested that course materials supplemented online could enhance web teaching (Jiang and Ting, 2000, McKnight and Demers, 2003; Li, 2007). In this current study, detailed course materials were prepared in an attempt to recreate the lectures that would be delivered in a traditional classroom.

The course was structured based on 11 graphics projects, covering the basic applications of four digital graphics programs in landscape architecture. Of the 30 lectures, 12 were delivered in the web session and all the 11 project assignments were issued in this session. A project tutorial was developed for each project assignment. These 11 project tutorials were prepared by assembling print-screen images for each step needed to accomplish the projects. Project steps were also augmented by detailed descriptions of the purpose of the steps. The goal was to provide demonstrations with sufficient detail to compensate for the lack of interaction in an online learning environment.

In the web session, course materials were uploaded in Blackboard Vista (WebCT), such as PowerPoint slides, project base map, finished project examples, and self-learning project tutorials. The web session was meant for semi-independent study. Student used online course materials to self-orient and complete project assignments. At the same time, students were encouraged to contact the instructors with questions and to collaborate with classmates on projects at irregular times. Off-campus collaboration among students was facilitated via the chat room in Blackboard.

4 RESULTS AND DISCUSSION

4.1 Overall satisfaction with web learning

The midterm survey and final survey showed consistently that around 60% of the students reported that they benefited from the web session. In the midterm survey (n=52), 31students (60%) said it is “definitely” or “probably” good to continue this course as a web-enhanced one. In the final survey (n=47), a similar result emerged; 23 students (58%) said that they preferred a web-enhanced learning environment. Of these 23 students, 17 would increase the instructional time for the online session and said they preferred a more frequent face-to-face lab session, which is currently offered at least once a week for additional questions and in-depth lectures. The remaining 5 students from this 23-student group thought a biweekly lab session was acceptable.

Overall, students showed enthusiasm for web learning. Detailed analyses below show the associated benefits and challenges of teaching online. Then, an analysis of the students’ background with digital programs and their perception of the online project tutorials follows. Interestingly, these two factors are not necessarily influential on students’ satisfaction with online learning according to this study.

4.2 Benefits

Table 1 shows the benefits and challenge, presented as number of mentions by students. The foremost benefit was flexibility of the learning schedule, as reported by 36 out of the 47 students who participated in the survey. This finding is consistent with Navarro and Shoemaker (2000), who indicate that convenience is a major reason why students choose to take online courses. As the web session class materials were readily accessible, students were granted the latitude to study any time according to their schedules.

Table 1. Number of students who mention benefits and challenges for web-enhanced teaching of a landscape architecture digital graphics course in the midterm and the final surveys.

Benefits	No.	Challenges	No.
Flexibility in learning schedule	36	Less timely feedback from instructors	47
Self-paced study (improved performance)	26	Limited peer interaction and collaboration	18
Lower lab fees	8	Project tutorials not informative enough	14
Less travel to class (save time and cost)	5	Expensive software	9
More students can take online class	4	Computer technical questions	5
Less need for classroom facilities	4	Class website technical questions	2
Incorporate other online materials	1	Less accessibility to university labs	2
		Perception of online course as less rigorous	1

Another related benefit was that students could self-pace their learning. Depending on their energy peak time, they could watch the course materials and work on projects at multiple times during a day, repeat the exercises and balance the time devoted to different parts of the course content. However, in a classroom situation, they are given fewer options and subjected to a schedule pre-determined by instructors. Because of these benefits, some students reported that their performances improved when they were self teaching, since they often spent more time in the online session than they expected.

Reduced course fees was another benefit, reported as lower lab fees and less commute to class, which led to reduced travel related costs. In addition, some students pointed out another win-win situation. That is, the university may benefit from online courses since there is less demand on classroom and technology facilities. In the meantime, more students can take online courses and avoid the bottleneck in lab facilities (e.g., number of computers).

The majority of the benefits reported above are also shared by other disciplines, as reported in previous studies (Daugherty and Funke, 1998; Navarro and Shoemaker, 2000; Pérez-Prado and

Thirunarayanan, 2002). However, the challenges reflect more the characteristics of landscape architecture major's.

4.3 Challenges

Students unanimously rated the most challenging issue to be the prolonged process of getting feedback from instructors (see Table 1). The digital graphics course, like many other landscape architecture courses, requires significant face-to-face interaction. When this process was hindered, students were unable to have questions answered in a timely fashion as they typically experience in a traditional classroom. In the same manner, spontaneous feedback from classmates was jeopardized and group study opportunities also diminished. Landscape architecture education has a culture that encourages students to collaborate on class projects and work on design competition entries. The interactive components available in an online teaching environment do not seem to maintain this culture.

Another challenge was that the online course materials, especially project tutorials, were not informative enough and self-explanatory as to allow students to pursue self teaching comfortably. Certain students also pointed out that these tutorials may not reflect the latest software versions being taught. Other concerns raised by students were related to learning associated costs and technical problems, both of which dampen the enthusiasm of learning online. Students disfavored the potential increase of course fees, especially the less affordable digital software programs. Some students reported that they experienced technical problems with the class website and some computer-related questions.

4.4 Effectiveness of eight different learning vehicles

Eight different learning vehicles were emphasized in the web and classroom sessions (adapted from Li, 2007). Their effectiveness was rated separately by undergraduate and graduate students and the results are presented in Figure 1. A dichotomy shows that undergraduate students and graduate students preferred different learning environments. The top three learning vehicles appreciated by undergraduate students were: (1) classroom lecture, (2) learning from instructors, and (3) learning from classmates. These three are mainly used in the traditional classroom. Clearly, undergraduate students appreciate an interactive learning environment that allows for substantial face-to-face interactions.

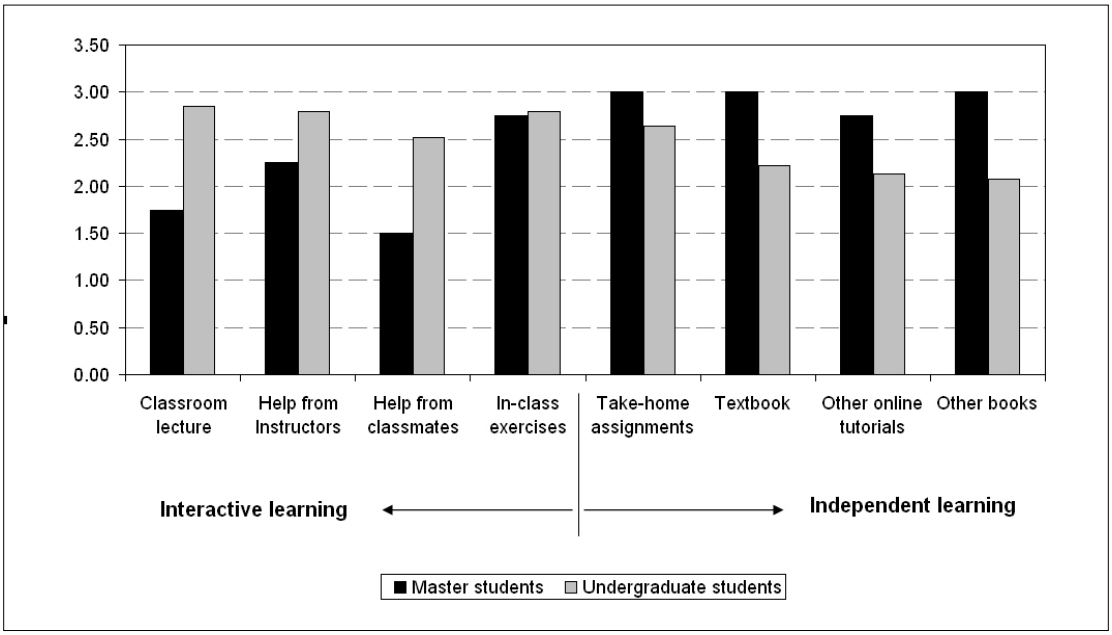

Figure 1. Average rating of eight learning vehicles from master's and undergraduate students in the final survey in a digital graphics course. Notes: The categories are adapted from (Li, 2007). N=47, including 41 undergraduate and 6 graduate students.

4.5 Regression analysis of students' learning satisfaction

Tables 2 and 3 show the independent variables in the regression analysis of the midterm and final surveys, with significant variables presented. The quality of the online tutorials and students' background with the four digital programs are independent variables. Students' satisfaction with online learning is the dependent variable, presented as a "yes or no" binary category. Four tutorials were delivered by the middle of the semester. An additional five tutorials were issued during the remainder of the semester. The last tutorial was not included in the final survey due to the class schedule.

Table 2. Independent variables used in the regression analysis in the midterm survey in a landscape architecture digital graphics course. No variable presents statistical significance in the logistic regression.

Construct	Variable	Measurement
Independent variables		
1. Digital literacy of software	1.1 AutoCAD 1.2 Photoshop 1.3 SketchUp 1.4 InDesign	5-point Likert scale was converted to: somewhat or strongly agree =1, other = 0
2. Satisfaction with tutorials	2.1 Tutorial 1 Basic Commands 2.2 Tutorial 2 Raster Image 2.3 Tutorial 3 Section 2.4 Tutorial 4 Scale and Printing	5-point Likert scale was converted to: somewhat or strongly agree =1, other = 0
Dependent variable		
3. Satisfaction with web teaching	3.1 Satisfaction rate	5-point Likert scale was converted to: somewhat or strongly agree =1, other = 0

In the midterm survey (see Table 2), none of the eight variables are significantly correlated with students' positive perception of learning online. In the final survey (Table 3), background with Photoshop and the quality of the four Photoshop tutorials are variables with statistical significance. However, these variables do not construct a separate model that could predict students' satisfaction level. Logistic regression analysis therefore showed a weak relationship between students' digital literacy and the quality of tutorials with their satisfaction with online learning. Detailed explorations of the independent variables are as follows.

Table 3. Independent variables used in the regression analysis in the final survey in a landscape architecture digital graphics course.

Construct	Variable	Measurement
Independent variables		
1. Digital literacy of software	1.1 AutoCAD 1.2 Photoshop* 1.3 SketchUp 1.4 InDesign	5-point Likert scale was converted to: somewhat or strongly agree = 1, other = 0
2. Satisfaction with tutorials	2.1 Tutorial 5 Plan Rendering** 2.2 Tutorial 6 Section Rendering** 2.3 Tutorial 7 Perspective Rendering** 2.4 Tutorial 9 Model Building 2.5 Tutorial 10 Animation	5-point Likert scale was converted to: somewhat or strongly agree =1, other = 0
Dependent variable		
3. Satisfaction with web teaching	3.1 Satisfaction rate	5-point Likert scale was converted to: somewhat or strongly agree =1, other = 0

* Significant variable at $p < 0.05$ level

** Significant variable at $p < 0.001$ level

4.6 Before-class digital literacy

In the midterm and the final surveys, students rated their digital literacy with the four computer programs *before* taking this class (Figure 2). An interesting finding emerges when comparing the two surveys' results. Students rated their before-class digital literacy relatively low when they completed the first half of the semester. However, in the final survey, students' confidence level with the digital programs increased across the four computer programs, with an average 11% increase in their perception.

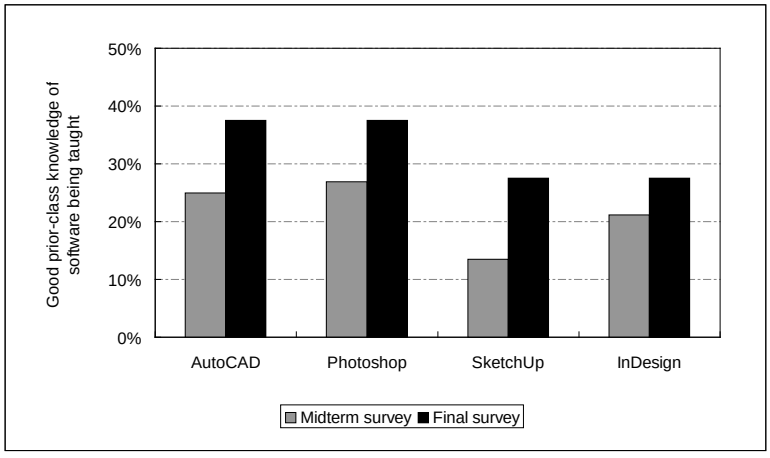

Figure 2. Students' perception of having good before-class knowledge of the four software programs in the midterm and the final surveys in a landscape architecture digital graphics course.

4.7 Effectiveness of tutorials

The premise of the project tutorials was to provide self-explanatory materials so that students have a similar learning experience in a web virtual classroom as in a traditional classroom. Although 60% of the students favored a web-enhanced learning environment, the web session project tutorials were generally not considered to be as effective (Table 4) and the quality of the tutorials generally does not seem to meet students' expectation as independent study materials.

An important issue emerged after the first four tutorials on AutoCAD were issued. Students raised the concern about the optimal level of details to be included in the tutorials. Because face-to-face interactions are not readily available online, students purely rely on the informative nature and coherence of tutorials to complete the assignments. Following the first tutorial on AutoCAD basic commands, later project tutorials skipped some basic steps. This was reported to pose a challenge to students with little background with AutoCAD in that the omitted steps made the tutorials hard to follow. Students could not have immediate communication with instructors or peers to continue the learning process.

Photoshop tutorials were rated low in the satisfaction level (Table 4). In the regression analysis (Tables 2 and 3), the low acceptance rate of the Photoshop tutorials is a significant variable that correlates with students' disfavor of learning the Photoshop session online. The satisfaction rate across the digital programs is also reflected by the page numbers of the tutorial, which is an indicator of its thoroughness. This study suggested that stagnant tutorials, despite their level of detail, could not substitute for face-to-face interaction. In this regard, a better venue for delivering online courses requires further exploration.

Table 4. Students' satisfaction rate with the online session project tutorials in a landscape architecture digital graphics course.

	Percent satisfied*	Avg. percent satisfied	Tutorial page No. (11x17)	Avg. tutorial page No.(11x17)
AutoCAD				
Tutorial 1 Basic Commands	50%		3	
Tutorial 2 Raster Image	33%		7	
Tutorial 3 Section	38%		4	
Tutorial 4. Scale and Printing	38%	40%	5	5
Photoshop				
Tutorial 5. Plan Rendering	28%		4	
Tutorial 6. Section Rendering	30%		4	
Tutorial 7. Perspective Rendering	28%		3	
Tutorial 8. Photo Montage	30%	29%	3	4
SketchUp				
Tutorial 9. Model Building	33%		6	
Tutorial 10. Animation	33%	33%	2	4
InDesign**				
Tutorial 11. Portfolio	NA	NA	4	4

* "Somewhat" or "strongly" agree=satisfied; other=not satisfied

** InDesign was not included in the final survey due to the class schedule

4.8 Instructors' perspectives

For instructors, web teaching also brings multiple benefits and challenges. First, the benefit of flexibility in schedule is also true for instructors. Instructors appreciate the convenience to teach and provide feedback at irregular times. In addition, as some students pointed out, with the web being the teaching platform, instructors can teach a larger number of students and partly avoid the bottleneck of available lab facilities. Second, online courses may be offered with a higher frequency than classroom-taught courses

(e.g., from once a year to every semester). This may help alleviate faculty course loads since lack of staff is currently a concern for many landscape architecture programs. Last, web teaching shall allow instructors to differentiate teaching strategies for different student groups. For example, in an online situation, instructors can adjust course materials to fit students with different computer backgrounds, learning needs and area of concentration, whereas in a classroom situation, students are usually treated with the same contents.

The prime challenge for instructors is to explore a more effective way to deliver contents online. With the rapid advancement of computer technologies, the lack of interaction may not remain a serious challenge in the future. In this experiment, instructors provided the same course materials in the web session as they would use in a traditional classroom. The intent was to use detailed explanations to compensate for the missing component of classroom interaction. This effort, however, was not considered to be promising, according to student feedback. For instructors, developing detailed project tutorials is a time consuming effort and they may become outdated when software versions upgrade. Video-taped lectures with narrations may be a next step for testing an alternative way to teach digital graphics online.

5 CONCLUSIONS

This study reports lessons learned from web teaching of an introductory course of digital graphics in landscape architecture. The study shows that web teaching can bring students and instructors both multiple benefits and challenges. Students prefer web learning mainly because of the convenience in learning and this benefit is also appreciated by instructors. Online teaching suggests its feasibility, as reflected by students' overall learning satisfaction with this web-enhanced course. The study also examines the factors that may contribute to students' learning satisfaction. However, neither the students' digital literacy prior to taking the class nor the quality of the project tutorials accounts for the satisfaction level of learning. Detailed course materials (e.g., tutorials) may not be able to compensate for the missing component of face-to-face interaction in a traditional classroom. In addition, the reduced level of interaction from the web session remains a major challenge, and this transition may have greater impacts on undergraduate students than on graduate students.

Given the level of interactions that web teaching tools can provide at this stage, a complete shift from the traditional classroom to a virtual web classroom may not be feasible. However, with the rapid advancement of web technologies, the potential and merits of online teaching deserve further examination. The manner in which instructors design an online course is as critical as the contents to be delivered. Hence, this study provides a departure point for future research that explores the paradigm shift of teaching method in which interaction is an important consideration. Future study is recommended that explores the factors that account for students' learning satisfaction, which are instrumental in designing future web courses. Finally, although the sample size (n=52) used in this current study is not ideal, it is nonetheless more than the average class size of this digital graphics course. A larger sample size is needed in order to represent a more diverse student population. Future research to evaluate students' performance is also highly recommended.

6 ACKNOWLEDGMENTS

This research was supported by the Utah Agricultural Experiment Station, Utah State University (approved as journal paper number 8626).

7 REFERENCES

Daugherty, M. & Funke, B. (1998). University faculty and student perceptions of web-based instruction. Journal of Distance Education, 13(1), 21–39.

Jiang, M. & Ting, E. (2000). A study of factors influencing students' perceived learning in a web-based course environment. International Journal of Educational Telecommunications, 6(4), 317-338.

Katz, Y. J. & Yablon, Y. B. (2002). Who is afraid of university Internet courses? Educational Media International, 39(1), 69–73.

Li, M. -H. (2007). Lessons learned from web-enhanced teaching in landscape architecture studios. International Journal on E-Learning, 6(2), 205–212.

Li, M. –H. & Murphy, M. D. (2004). Assessing the effect of supplemental web-based learning in two landscape construction courses. Landscape Review, 9(1), 157–161.

Martindale, T. & Ahern, T. C. (2001). The effects of three web-based delivery models on undergraduate college student achievement. International Journal of Educational Telecommunications, 7(4), 379–392.

McKnight, R. & Demers, N. (2003). Evaluating course website utilization by students using web tracking software: A constructivist approach. International Journal on E-Learning, 2(3), 13-17.

Metcalf, T. (1997). Distance education: The issue of faculty time. 5th Annual Distance Education Conference Proceedings, College Station, TX: Texas A&M University, Center for Distance Learning Research.

Moore, M. G. & Kearsley, G. (1995). Distance education: A systems view. Belmont, CA: Wadsworth Publishing.

Moore, M. G., Thompson, M. M., Quigley, A. B., Clark, G. C., & Goff, G. G. (1990). The effects of distance learning: A summary of the literature, Research Monograph No. 2. The Pennsylvania State University, American Center for the Study of Distance Education, University Park, PA. ERIC Microfiche Number ED 330–321.

Navarro, P. & Shoemaker, J. (2000). Performance and perceptions of distance learners in cyberspace. The American Journal of Distance Education, 14(2), 15–35.

Pérez-Prado, A. & Thirunarayanan, M.O. (2002). A qualitative comparison of online and classroom-based sections of a course: Exploring student perspectives. Educational Media International, 39(2), 195–202.

Russell, T. L. (1999). No Significant Difference Phenomenon. Raleigh, NC: North Carolina State University.

Smith, G, Ferguson, D., & Caris, M. (2001). Teaching courses online v. face to face. Technological Horizons in Education Journal, 28, 18–26.

Tsai, H. (2007). Core-skill software programs for undergraduate landscape architecture education (Bachelor of Science of Landscape Architecture Thesis, University of California, Davis).