THE AMERICAN JOURNAL OF DISTANCE EDUCATION, *20*(3), 163–179

Web-Based Distance Learning Technology: The Impacts of Web Module Length and Format

Cristina Pomales-García and Yili Liu
Department of Industrial and Operations Engineering
University of Michigan–Ann Arbor

This research examined the impact of the length and format (video, audio or text) of instructional Web modules (segments of lectures) on information recall, persistence, perceived content difficulty, aesthetic appeal, and perceived module length. Twelve Web-based instructional modules with different formats and lengths were evaluated through an experiment with a balanced-incomplete block design. The study showed no difference in information recall between the different module lengths and formats; however, as module length increased, participants were more likely to not complete the modules. Systematic evaluations of module length along with its visual appearance gives us insight to understand important factors that need to be considered when designing Web-based distance learning environments.

Guidelines have been developed to suggest theoretical and practical considerations for Web-based instruction (Miller and Miller 2000), but these guidelines do not incorporate aesthetic factors as important variables in the design process. Appearance is not only important in the design process, but it is recognized that the affective domain plays an integral part in developing a complete taxonomy of educational objectives (Bloom 1972). Encouragingly, a few studies have stressed the importance of the attractiveness and appearance aspect of distance learning courses (Boshier et al. 1997; MacDonald et al. 2001; Ryan 1976; Schweizer 1999; Stewart, Hong, and Strudler 2004). Most of these studies, however, have not quantified the im-

Correspondence should be sent to Cristina Pomales-García, Department of Industrial Engineering, University of Puerto Rico at Mayagüez, P.O. Box 9043, Mayagüez, PR 00681. E-mail: cpomales@uprm.edu

portance of appearance within a Web-based distance learning (WBDL) course but only provided a qualitative assessment of it.

Evaluations of human–computer interaction commonly include measurements of ease of use, workload or information processing demand, and the physical effects the interaction may have on the users. Within these dimensions, the evaluation of the aesthetic/appearance domain is not usually incorporated (Liu 2003a, 2003b). The concept of aesthetics includes perceptual, cognitive, and affective components (Jennings 2000). Currently in the methods used to make aesthetic design decisions and conduct aesthetic evaluations, there is an obvious lack of systematic, scientific, and engineering methods (Liu 2003a).

According to Clark and Mayer (2003), to ensure successful self-directed learning we must consider factors ranging from how we might deploy online learning in the workplace to how engaging the courseware is. This points out not only the usability of the material and its interface but its aesthetic components as well. It is clearly an important research challenge to understand the effects of WBDL design factors on both the performance and the aesthetic/appearance judgments of the users.

To help meet this research challenge and contribute to the knowledge base of WBDL, we conducted a controlled experimental study using instructional Web modules (segments of lectures) of varying lengths (approximately seven minutes, fourteen minutes, and twenty minutes). We attempted to evaluate and systematically measure the effects of the length and format of the Web modules on information recall, perception of content difficulty, perceived module length, persistence, and visual appearance/aesthetic ratings. The objective of the experiment was to examine the following research questions:

1. *Do visual appearance judgments and keyword recall change as module length and format change?*
2. *Do perceived content difficulty and ratings of persistence change as module length and format change?*
3. *Do visual appearance ratings show any difference before and after participants are exposed to the Web module content?*
4. *Are students able to predict module length accurately independent of module format?*

Method

Participants

Eighteen engineering undergraduate students (nine women and nine men) between the ages of nineteen and twenty-three years ($M = 20$ years), enrolled at the University of Michigan, Ann Arbor, participated voluntarily in this experiment. Participants were paid $30 each for three hours of their time. The Index of Learning Styles Questionnaire (Felder and Soloman 1991) was used to measure the learning style characteristics of our sample. According to J. W. Keefe (in Park 2000), learning styles are "cognitive, affective and physiological traits that are relatively stable indicators of how learners perceive, interact with and respond to the learning environment" (249). The results (summarized in Table 1) suggest that participants in this study are able to retain and understand information best by either discussing or explaining the information to others and thinking about the information quietly (Felder 1994). Most of the participants in this study tend to like learning facts as well as discovering possibilities and relationships (Felder 1989). By being sequential, this group had a tendency to gain understanding in linear step while still learning from absorbing material randomly without seeing connections (Felder 1990). A large majority of the participants were visual, which suggests that they remember best what they see through pictures, diagrams, flow charts, timelines, and demonstrations (Felder and Soloman 1991). As an example of this, various participants in

Table 1. Summary of Participants' Learning Style, Measured With the Index of Learning Styles Questionnaire

Learning Styles	*N*	*%*
Active	3	16.7
Balanced active-reflective	13	72.2
Reflective	2	11.1
Sensing	8	44.4
Balanced sensing-intuitive	6	33.3
Intuitive	4	22.3
Visual	17	94.4
Balanced visual-verbal	1	5.6
Verbal	0	0
Sequential	7	38.9
Balanced sequential-global	8	44.4
Global	3	16.7

the information recall task draw pictures instead of words, to show what they remembered from the material they just saw.

Ninety-four percent of the sample reported that they preferred to read text from paper as opposed to reading text from a computer screen. This is an important characteristic as the information in Web-based environments is presented on a computer screen as opposed to books or printed material. Each participant was also asked to give a self-assessment rating between 0 and 10 to describe his or her previous knowledge of the content presented in the module (0 = this is completely new; 10 = I feel like an expert in the topic). Only 8% of the participants reported a rating between 6 and 10, 6% rated their knowledge of the topic in the middle of the scale, and the majority of the participants (86%) reported it was new material for them or they were barely familiar with the content presented in the module. This suggests that the participants are being exposed to novel content and would be considered novices.

Equipment and Materials

The experiment took place in the Industrial and Operations Engineering Human Factors Laboratory at the University of Michigan. The participant station consisted of a Dell Computer running Windows XP with a screen resolution of 1024*768 pixels at sixteen bit of color, with speakers, mouse, and keyboard. The mouse was used by each participant to advance to a new slide on the text modules. Each participant used the speakers to adjust the volume intensity of the different sounds played by the computer during each Web module. The experimenter station had a Dell Laptop running in Windows 2000.

Web Modules

Twelve Web modules were used as experimental materials; the theme and length for each of the modules is shown in Table 2. The topics were selected from the lectures given by an instructor at the School of Public Health at the University of Michigan for the Environmental Impact Assessment (EHS-572) course. These topics were then recorded using either video, audio only, or text only (called audio and text modules) of the instructor explanations of the content and formatted as Web modules. Each of the modules was shown to the participants using an Internet Explorer browser. Figure 1 shows examples of the visual appearance of the interface with the different formats of audio, video, and text.

Table 2. Summary of Module Format, Topic, and Length

Format	Module Number	Topic	Length (Minutes)	Mean Module Length (Minutes)
Practice	A	Scales of motion of winds	4:06	4:45
	B	Petroleum contamination	4:38	
	C	Chemical transport and fate	5:30	
Short	1	Ground water flows	7:14	7:25
	5	Air quality	7:30	
	9	Air quality standards	7:32	
Medium	8	Aquifers	14:55	14:42
	4	Water treatment and distribution	14:44	
	7	Bioaccumulation	14:27	
Long	2	Air pollution regulations	22:35	20:25
	3	Mass balance	20:17	
	6	Surface water quality	18:22	

The design of the modules in this experiment followed the principles and guidelines proposed by Clark and Mayer (2003) on the design of e-learning environments and multimedia presentations. The modules presented words and pictures simultaneously in accordance with the multimedia principle rather than successively (temporal contiguity principle) and near each other (spatial contiguity principle), extraneous material such as background music was excluded from the modules (coherence principle), words were presented either in audio or text and text was never narrated (redundancy principle), and audio and text were presented in technical but conversational format rather than formal (personalization principle).

Experimental Procedure

Before the start of the experiment, the participants read and signed a consent form if they agreed to it. Then they were given the Index of Learning Styles Questionnaire (Felder and Soloman 1991) and asked to complete a biographical information sheet. Biographical information col-

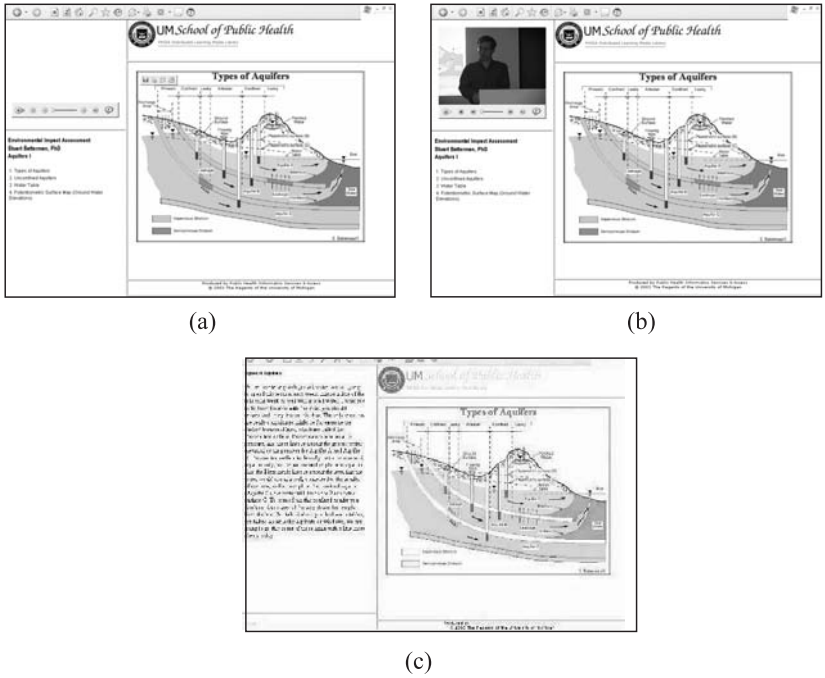

Figure 1. Examples of Web Module Formats with (a) Audio, (b) Video, and (c) Text with Corresponding Slide and Headers
Reprinted with permission of the University of Michigan.

lected included each participant's age, gender, department, previous experience with distance learning or online courses, and reading preference (reading text from computer screen or reading text in paper form). In the meantime, the experimenter opened module A and maximized the window to full screen. This was done through a remote access software called "Communique I'm in touch" operated from the experimenter station. Before examining the content of the module, each participant was asked to evaluate the visual appearance of the screen without considering the content of the Web module. The participants were shown a sample copy of a page of a book and asked to imagine "the page contains the same material

as the Web module and it represents a visual attractiveness rating of 10." They were then asked to rate "how visually/aesthetically more *attractive/appealing* is this Web module shown in the computer screen?" Then they were asked to imagine the same sample page of a book "contains the same material as the Web module and it represents an excitement rating of 10." Then using the same procedure, they were asked to rate "how more *exciting* is this Web module shown in the computer screen?" Both of these questions were considered as the visual appearance questions and both were asked before and after the participants viewed the module to perform prestudy and poststudy appearance ratings comparisons.

Following the prestudy appearance questions, the module was played and each participant was told to adjust the volume of the computer speakers at any time, given that the material he or she would be listening to (in audio and video modules) was recorded at different sound intensities. Once the module finished playing and stopped, the window on the participant's computer screen that showed the module was closed by the experimenter using the remote viewer software. Each participant was handed a sheet of paper that contained the recall question with the following instructions: "In the next two minutes please write as much as you can about what you heard or remember from the Web module you just saw." After the two-minute period, each participant was asked to wrap up his or her writing and hand back the sheet. The experimenter then proceeded to ask the following general content questions in which the participants were instructed to consider only the content of the Web module:

1. If the rating for the level of difficulty of a children's story for a four-year-old represents a rating of 10, what is the level of difficulty of the content that this Web module presented?
2. How many minutes do you think you have been working with the module?
3. How much do you know about the topic discussed in the module using a scale of 0–10, where 0 = completely new material and 10 = expert?

After the general content questions, the participants were asked one more time about the visual appearance of the module. These poststudy appearance questions were exactly the same as the initial or prestudy appearance questions, based on attractiveness and excitement ratings. The last set of questions was designed to measure persistence. Each participant was asked to rate how much he or she agrees or disagrees with three statements using a seven-point Likert scale with the following response choices: 1 (*strongly dis-*

agree), 2 (*disagree*), 3 (*slightly disagree*), 4 (*neutral*), 5 (*slightly agree*), 6 (*agree*), and 7 (*strongly agree*). The statements provided were the following: (1) I would finish viewing the module, (2) I would pause the module and finish viewing it later, and (3) I would not complete the module.

Next, the experimenter presented Web module B again maximizing the window. This procedure was repeated for nine of the twelve modules, representing a total of nine trials. Also, each participant was given a break 1.5 hours after the experiment started. For analysis purposes, the first three trials (A, B, and C) were considered practice modules, and they were shorter than experimental trials (about five minutes in length) for the purpose of making each participant feel familiar and comfortable with the task. The participants were not told that the first three trials were practice and they were not informed how many modules they were going to see. Table 3 shows the 6 × 6 Latin-Square matrix used for the presentation order and participant assign-

Table 3. The 6 × 6 Latin-Square Matrix Used to Assign Participants to the Different Experimental Conditions

		Trial Number								
		Practice			Experimental					
Participant No.	Gender	1	2	3	1	2	3	4	5	6
1	M	A	B	C	1	2	4	5	7	8
2	M	A	B	C	2	3	5	6	8	9
3	M	A	B	C	1	3	4	6	7	9
4	M	A	B	C	1	2	4	5	7	8
5	M	A	B	C	2	3	5	6	8	9
6	M	A	B	C	1	3	4	6	7	9
7	M	A	B	C	1	2	5	6	7	9
8	M	A	B	C	1	3	4	5	8	9
9	M	A	B	C	2	3	4	6	7	8
10	F	A	B	C	1	2	5	6	7	9
11	F	A	B	C	1	3	4	5	8	9
12	F	A	B	C	2	3	4	6	7	8
13	F	A	B	C	1	3	5	6	7	8
14	F	A	B	C	1	2	4	6	8	9
15	F	A	B	C	2	3	4	5	7	9
16	F	A	B	C	1	3	5	6	7	8
17	F	A	B	C	1	2	4	6	8	9
18	F	A	B	C	2	3	4	5	7	9

Note: Incomplete block design plan 11.13. Number of treatments (t) = 9, block size (k) = 6, r = 8, b = 12, lambda = 5, E = 0.94, Type II (Cochran and Cox 1957).

ment to Web modules. Each module type and length was combined to create an experimental trial. Due to the length of some of the modules and to keep the length of the experiment manageable, an incomplete block design plan was used to assign modules to each of the participants. Our design allowed each participant to evaluate nine of the twelve modules. This type of experimental design has been used in experiments in which individuals are asked to make a comparative rating of different objects (Cochran and Cox 1957). Table 4 shows the coding for each of the trials.

Data Analysis and Results

Five dependent variables were measured. Four of the dependent variables were related to content and length, one related to visual appearance or aesthetic response. The content-related dependent measures included information/keyword recall, perceived module length, content difficulty of the Web module material, and persistence. Information recall was measured as the total number of keywords that the participants recalled/wrote down during the two-minute interval immediately following the Web module presentation. Perceived difficulty was measured as the magnitude estimation ratings of the module's content difficulty as compared with a children's story for a four-year-old. The difficulty of the children story was rated as a baseline difficulty of ten. Perceived module length was measured as the subjective report of perceived length in minutes. Persistence was measured through the participant's ratings on the three statements, using a seven-point Likert scale, described in the method section. Perceived visual appearance or aesthetic response was measured as the magnitude estimation ratings of perceived excitement and attractiveness, before viewing module content and after the recall and content questions, and compared to a sample copy of a book, in which the book presented a baseline aesthetic appeal and excitement magnitude of ten.

Table 4. Coding Used for the Latin-Square Variables

Module	Description	Trial
Format	Video	1, 3, 4, B
	Audio	5, 6, 7, C
	Text	2, 8, 9, A
Length	Short	1, 5, 9, A, B, C
	Medium	4, 7, 8
	Long	2, 3, 6

The data analysis evaluated the effect of module type and length on content and visual appearance variables using analysis of variance (ANOVA). Paired comparison *t* test was used to measure the differences between pre- and postvisual appearance ratings. The Statistical Package for the Social Sciences (SPSS) version 11 software was used as the data analysis tool. Prior to the ANOVA, the data were tested for normality. Based on the results, a few data points were identified as outliers and removed from further analysis: One data point was removed from the recalled keywords variable (0.6%), four data points for perceived difficulty (2.5%), one missing and one outlier for the pre-exciting ratings (1.2%), and one missing for the pre-attractive/appearance ratings (0.6%).

Aesthetic Appeal and Difficulty Ratings

The measured visual appearance and difficulty ratings were based on a magnitude estimation scale. Table 5 shows the geometric means for the appearance/aesthetic and difficulty variables. Overall poststudy measure ratings tend to be higher when compared to prestudy ratings of visual appearance and perceived difficulty.

There was a significant difference between mean prestudy and poststudy excitement ratings ($F(2, 157) = 3.07$, $p < .05$ and $F(2, 159) = 4.35$, $p < .05$, respectively) and module type. Means for post excitement ratings were significantly different for the different module lengths ($F(2, 159) = 3.57$, $p < .05$), as shown in Figure 2.

Table 5. Geometric Means for the Appearance and Difficulty Ratings by Independent Variable

Variable			Attractive/ Appealing		Exciting		
			Pre	**Post**	**Pre**	**Post**	**Difficulty**
Module length	Short		42.26	48.87	31.17	38.45	63.21
	Medium		50.61	49.63	38.26	36.18	62.39
	Long		33.19	35.33	28.07	27.44	71.53
		Total	41.75	45.63	31.91	35.20	64.77
Module type	Video		48.84	52.53	37.15	40.47	61.13
	Audio		39.48	44.62	32.67	36.65	67.86
	Text		37.70	40.52	26.84	29.39	65.58
		Total	41.75	45.63	31.91	35.20	64.77

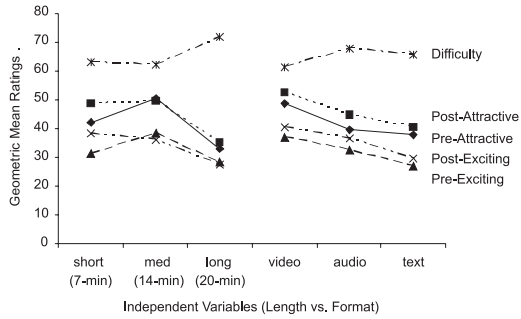

Figure 2. Geometric Means of Pre- and Poststudy Appearance/Aesthetic Ratings and Perceived Difficulty by Module Length and Module Format

Overall, the results show that the seven- and fourteen-minute modules and those containing video are perceived as less difficult than twenty-minute modules or modules containing only audio or text. Higher mean ratings suggest more attractive, more exciting, and more difficult modules. Those modules that are perceived as more difficult are also rated as less visually attractive and exciting.

To further understand the relationship between the pre- and postvisual attractiveness ratings the results were analyzed using a paired *t* test and correlation analysis. The variables were transformed from magnitude values to logarithmic values. The results showed a high correlation between the prestudy and poststudy appearance/aesthetic variables. A high correlation was expected given the variables are measuring the same attributes. The results for the paired *t* test were surprising as they showed a significant difference between the two sets of ratings (Table 6). This finding suggests that the content might have an impact on visual appearance ratings or that participants might be biased by the module content when making visual appearance and excitement judgments.

Perceived Module Length Analysis

The ANOVA showed significant differences in the perceived module length and actual module length ($F(2, 159) = 99.96, p < .0001$) but no significant difference between module types and actual module length ($F(2, 159) = 1.7, p = .185$). Perception of module length seems to be affected by the length of the module and not by the presence of video, audio, or text in the module.

Table 6. Correlation Analysis and Paired Sample *t* Test for Appearance/Aesthetic Variables

				Paired Differences							
							95% Confidence Interval of the Difference				
Variables	***N***	**Correlation**	**Sig.**	***M***	***SD***	***SEM***	**Lower**	**Upper**	***t***	***d.f.***	**Sig. (two-tailed)**
Pre-Attractive vs. Post-Attractive	161	.862	.000	–.0416	.195	.01543	–.0720	–.0111	–2.696	160	.008
Pre-Exciting vs. Post-Exciting	160	.702	.000	–.0444	.237	.01875	–.0814	–.0074	–2.369	159	.019

Note: Sig. = significance; *SEM* = standard error mean.

As shown in Figure 3, modules with video and audio are perceived to last longer than modules with text alone. The horizontal lines in Figure 3 show the actual module length for short, medium, and long modules.

Persistence Results

As shown in Figure 4, the participants' responses changed from agreeing to the statement "would finish viewing the module" to feeling more neutral toward the statement, as the module length increases from seven to twenty minutes. The ANOVA (see Table 7) showed significant differences in the ratings between the persistence questions for the different module lengths but no significant differences for module format.

Keyword Recall Analysis

There were no significant differences in the number of keywords recalled for the different module formats and length (see Figure 5). On average, participants recalled eleven words for each of the modules, independent of the module format and length.

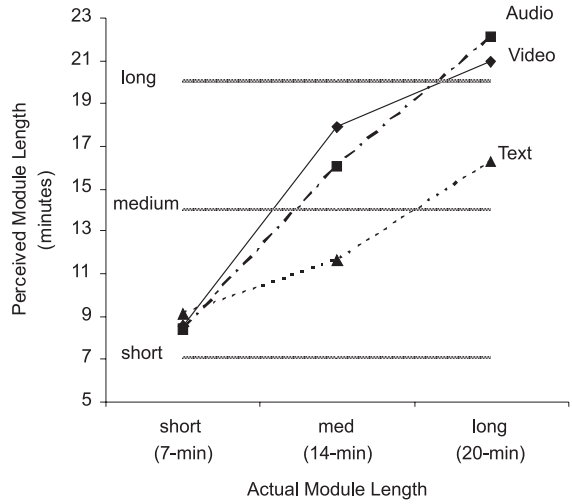

Figure 3. Comparison of Actual Module Length Versus Perceived Module Length for the Three Types of Module Formats

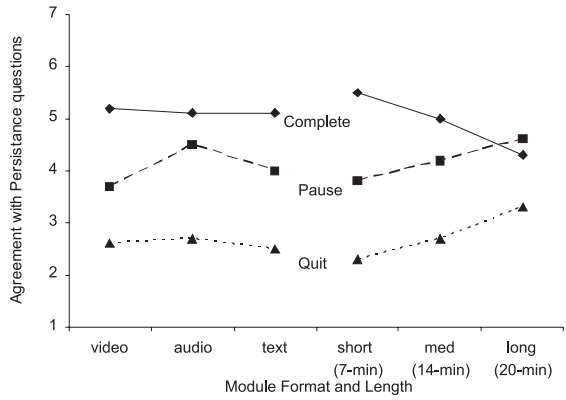

Figure 4. Means for Persistence Questions Based on Module Format and Length

Discussion and Conclusions

The findings provide concrete evidence that neither performance nor visual aesthetic/appearance measurement alone is sufficient in predicting or evaluating the effectiveness of a WBDL design.

One specific finding is that the subjects showed no performance differences (number of keywords recalled) when evaluating short, medium, or long modules but gave lower aesthetic/attractiveness ratings to long modules. As module length increased, participant responses toward persistence changed from agreeing to "finish viewing the modules" to being neutral about the statement. In the same way, as module length increased from seven

Table 7. ANOVA for Persistence Questions

Independent Variable	Dependent Variable	Type III Sum of Squares	*d.f.*	M^2	*F*	Sig.
Module length	Finish/complete the module	29.095	2	14.548	8.429	.000
	Pause and finish later	15.273	2	7.637	3.123	.047
	Do not complete (quit)	23.804	2	11.290	7.216	.001

Note: ANOVA = analysis of variance; Sig. = significance.

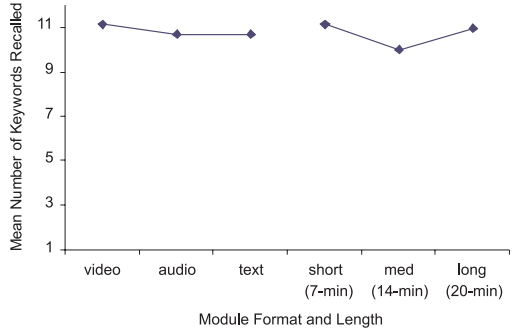

Figure 5. Mean Number of Keywords Recalled as a Function of Module Format and Length

to twenty minutes, the responses showed a trend toward "agreeing" to not finish or pause the Web module. Except for text modules, the tendency was to perceive the length of video and audio modules to last longer than their actual length. This suggests that other than module content, the length of Web modules and their flexibility and quality are important issues to consider when designing WBDL environments (Kumar, Kumar, and Basu 2002; Stewart, Hong, and Strudler 2004). The results showed no significant difference in persistence responses for the different module formats. These results suggest that quitting, pausing, or completing a Web module in one session has more to do with the length of the actual module than with the format the module is designed with. Future studies should explore changes in persistence responses with modules longer than twenty minutes.

Another important point was about the perceived length of text modules. For medium and long modules, text modules were perceived to be shorter than modules with video and audio of the same content. For text modules, the participants were able to read the material at their own pace, so they had more control over the duration of the module and there is a possibility they could have skimmed the text. One of the objectives of the recall question was to measure whether the participants were attentive to the materials and the results showed no difference in the amount of information recalled between module formats. Future studies should measure the time it takes the participants to read text versus the time it takes to observe or listen to the text in audio or video format.

With respect to difficulty, modules with video were perceived to be less difficult and more attractive. This is evidence in support of the learning pref-

erences hypothesis (Mayer 2001), which suggests that as more media channels are included satisfaction will increase. The learning-preferences hypothesis further suggests that different people learn in different ways, so it is best to present information in many different formats. For example, if face-to-face (traditional) instruction is rated highest in satisfaction, then as each channel (e.g., visuals of course material or instructor) is removed, the level of satisfaction would decrease. In this study, modules with more media channels (video) had higher ratings of aesthetic appeal and excitement when compared to audio and text modules. The learning preferences hypothesis was proposed originally on the basis of measures of satisfaction. In this study, our measure was ratings of visual attractiveness and excitement. This suggests that visual appearance could be an aspect of satisfaction.

In our study, the module formats were controlled but the content of the slides in the Web modules was not. Future studies should attempt to control the information presented in the slides to measure the impacts of slide content on attractiveness, persistence, and difficulty.

Acknowledgments

Cristina Pomales-García is now at the University of Puerto Rico at Mayagüez.

We thank David Méndez and Vic Divecha for providing the original Web-based distance learning (WBDL) modules, and Virginia Soto, Rebecca Hamer, and Rod Capps for their assistance in preparing the WBDL modules for use in this study.

References

Bloom, B. S. 1972. *Taxonomy of educational objectives, Handbook I: The cognitive domain.* New York: David McKay.

Boshier, R., M. Mohapi, G. Moulton, A. Qayyum, L. Sadownik, and M. Wilson. 1997. Best and worst dressed Web lessons: Strutting into the 21st century in comfort and style. *Distance Education* 18 (2): 327–349.

Clark, R. C., and R. E. Mayer. 2003. *E-learning and the science of instruction.* San Francisco: Pfeiffer.

Cochran W. G., and G. M. Cox. 1957. *Experimental designs* (2nd ed.). New York: Wiley.

Felder, R. M. 1989. Meet your students: 1. Stan and Nathan. *Chemical Engineering Education* 23 (2): 68–69.

———. 1990. Meet your students: 2. Susan and Glenda. *Chemical Engineering Education* 24 (1): 7–8.

———. 1994. Meet your students: 5. Edward and Irving. *Chemical Engineering Education* 28 (1): 36–37.

Felder, R. M., and B. A. Soloman. 1991. *Index of learning styles.* Available online at http://www.ncsu.edu/felder-public/ILSpage.html

Jennings, M. 2000. What do good designers know that we don't? Web-based instructional learning. In *Instructional and Cognitive Impacts of Web-Based Education,* ed. B. Abbey, 235–241. Hershey, PA: Idea Group.

Kumar, A., P. Kumar, and S. C. Basu. 2002. Student perceptions of virtual education: An exploratory study. In *Instructional and Cognitive Impacts of Web-Based Education,* ed. B. Abbey, 132–141. Hershey, PA: Idea Group.

Liu, Y. 2003a. Engineering aesthetics and aesthetic ergonomics: Theoretical foundations and a dual-process methodology. *Ergonomics* 46:1273–1292.

———. 2003b. The aesthetic and the ethic dimensions of human factors and design. *Ergonomics* 46:1293–1305.

MacDonald, C. J., E. J. Stodel, L. G. Farres, K. Breithaupt, and M. A. Gabriel. 2001. The demand-driven learning model: A framework for Web-based learning. *Internet and Higher Education* 4 (1): 9–30.

Mayer, R. E. 2001. *Multimedia learning.* New York: Cambridge University Press.

Miller, S. M., and K. L. Miller. 2000. Theoretical and practical considerations in the design of Web-based instruction. In *Instructional and Cognitive Impacts of Web-Based Education,* ed. B. Abbey, 156–177. Hershey, PA: Idea Group.

Park, C. 2000. Learning style preferences of southeast Asian students. *Urban Education* 35 (3): 245–268.

Ryan, M. G. 1976. The influence of teleconferencing medium and status on participants' perception of the aestheticism, evaluation, privacy, potency, and activity of the medium. *Human Communication Research* 2:255–261.

Schweizer, H. 1999. Designing and teaching and on-line course: Spinning your Web classroom. Needham Heights, MA: Allyn & Bacon.

Stewart, I., E. Hong, and N. Strudler. 2004. Development and validation of an instrument for student evaluation of the quality of Web-based instruction. *The American Journal of Distance Education* 18 (3): 131–150.