

# Dental Postgraduates Prefer Hypertutorial Statistics Lessons In Randomized Web Course Comparisons

Craig W. Johnson, Ph.D.  
University of Texas-Houston Health Science Center

**Background.** Web-based hypertutorials have achieved a variety of superior learning outcomes when compared with conventional Web-based instruction or lectures in several previous randomized controlled studies in intact classrooms with health informatics or medical students in statistics or research courses (Johnson<sup>1</sup>; Johnson<sup>2</sup>; Johnson, Oser & Abedor<sup>4</sup>). Hypertutorials effectively implement five features -- presentation, learner control, practice, feedback, and elaborative learning resources -- following principles well grounded in the theoretical and empirical research literature. Much previous research (cited in Johnson & Grover<sup>3</sup>) shows that each feature, by itself, facilitates learning. Hypertutorials integrate all five features within one learning environment. This report describes a series of Web-administered randomized comparisons of hypertutorial and conventional "Book-on-the-Web" lessons in a graduate level Web-based statistics course with 20 dental postgraduate students.

**System Implementation.** *Essential Research Statistics for the Health and Behavioral Sciences* unobtrusively implements randomized controlled comparisons within intact groups (see Johnson<sup>3</sup>). The system randomly assigned the first of 22 successive treatment pairs of Web browser-administered HTML/JavaScript lessons to two groups. As the course advanced, it successively alternated lesson-pair assignments, lesson by lesson. Each lesson-pair contained the same presentation text and graphics, but differed in the presence or absence of learning resources, practice, feedback, and learner control (features operationalized as hyperlinks and embedded practice exercises providing immediate feedback). Students' responses were scored and stored immediately during each lesson as they were entered, without Java servlets or CGI, via a small, client-side, JDBC applet. Data was stored in a Microsoft SQL Server database, physically separate from the Web-server, and redundantly via E-mail. Students used Netscape Navigator or Microsoft Internet Explorer on computers having either direct or dial-up Web access and located in the Dental School computer lab, homes, workplaces, or other locations. All 20 students (summer, 2000) voluntarily participated.

**Results.** Sixteen (80%) of the 20 students preferred the hypertutorial lessons (Binomial Test,  $p < .012$ ) at

the conclusion of the course. The other four expressed no preference. Students consistently cited hypertutorial features as the reasons: (a) Embedded questions with, (b) immediate feedback, and (c) hyperlinks to (d) elaborative information. No human subjects methodological problems were encountered.

**Conclusions.** Dental postgraduates significantly and overwhelmingly preferred Web-based hypertutorial statistics lessons to conventional Web-based lessons. Web-browsers unobtrusively implemented randomized controlled comparisons that totally automated instructional delivery, immediate feedback, scoring and remote data storage via the Internet. Results extend preference for hypertutorial instruction to dental postgraduate statistics education and to more generalized Internet environments. Methodologies employed provide models and templates for further use of the Web to advance "evidence-based teaching" via random assignment of Web-based treatments to groups anywhere on the Web.

## References

1. Johnson, CW., Health Informatics Research and Evaluation Design Students Overwhelmingly Prefer Hypertutorial Web-Based Instruction in Randomized Comparison, *Converging Information, Technology & Healthcare – Proceedings of Annual Conference of the American Medical Informatics Association*, Los Angeles, 2000.
2. Johnson, CW. Web-browser implements unobtrusive randomized comparisons of instruction in Health Informatics classroom, *Transforming health care through informatics: Cornerstones for a new information management program - Proceedings of the Annual Conference of the American Medical Informatics Association*, Washington, D.C., 1999.
3. Johnson, CW., Grover, PA. Hypertutor therapy for interactive instruction. *Educational Technology*, 1993; 33(1): 5-16.
4. Johnson, CW., Oser, G. & Abedor, AJ. Web browser as medical educator/researcher using HTML & JavaScript [D004915] A paradigm shift in health care information systems: Clinical infrastructures for the 21<sup>st</sup> century - *Proceedings of the Annual Conference of the American Medical Informatics Association*, Orlando, 1998.