

# THE EFFICACY OF KNOWLEDGE MAP IN OBJECT-ORIENTED SOFTWARE TRAINING: ADO.NET COMPONENTS

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## Abstract

An experimental study examined effects of knowledge map-based learning, a form of computer assisted instruction (CAI), on assisting novice users in acquiring software knowledge and skills. Fifty five subjects participated in this experimental study. Two classes of students in a webpage development course were randomly chosen to receive different treatments. Twenty four students received the knowledge map-based training, while thirty one students received the traditional face-to-face training. Target software acquired by students in this study is ASP.NET. This study focuses on the data-access component ADO.NET (ActiveX Data Objects) of this target software. ADO.NET is a database access component and allows users to interact with database systems from browsers. A pre-test and post-test was administered to assess the effect of knowledge map-based learning on learning outcomes, with the traditional F2F training group as a controllable group. Results showed that students who receive the knowledge map-based training slightly outperformed those students who receive the traditional face-to-face training. Statistical evidences show that both training approaches are effective to help students acquire object-oriented software, such as ADO.NET, based on the mean scores of pre- and post-tests. Recommendations were made to instructor and practitioners to improve the efficacy of knowledge map-based training.

**Keywords:** Knowledge Map, Knowledge Objects, Learning, Computer Assisted Learning, Information Retrieval

## REFERENCES

- Acton, W. H., Johnson, P. J. and Goldsmith, T. E. (1994). Structural Knowledge Assessment: Comparison of Referent Structures. *Journal of Educational Psychology*, 86(303-311).
- Anderson, J. R. (1983). *The Architecture of Cognition*. Cambridge, MA: Harvard University Press.
- Armstrong, D. (2006), The quarks of object-oriented development, *Communications of the ACM* 49(2), pp.123-128.
- Ausubel, D. P. (1963). *The Psychology of Meaningful Verbal Learning*. New York Grune and Stratton.
- Bostrom, R. P., Olfman, L. and Sein, M. K. (1990). The Importance of Learning Style in End-User Training. *MIS Quarterly*, 14(1), pp. 101-119.
- Briscoe, C. and LaMaster, S. U. (1991). Meaningful Learning in College Biology through Concept Mapping. *American Biology Teacher*, 53, pp. 214-219.

- Browne, G., Curley, S. and Benson, P. (1997). Evoking Information in Probability Assessment: Knowledge Maps and Reasoning-based Directed Questions. *Management Science* 43(1), pp. 1-14.
- Bruner, J. (1966). *Toward a Theory of Instruction*. Cambridge, MA: Harvard University Press.
- Cegielski, C. G. and Hall, D. J. (2006). What Makes a Good Programmer? *Communications of the ACM*, 49(10), pp. 73.
- Chan, K. and Liebowitz, J. (2006). The Synergy of Social Network Analysis and Knowledge Mapping: A Case Study. *International Journal of Management & Decision Making* 7(1), pp. 19.
- Chmeilewski, T., Dansereau, D. and Moreland, J. (1998). Using common region in node-link displays: the role of field dependence/independence. *Journal of Experimental Education* 66(3), pp. 192-207.
- Chmeilewski, T. C. and Dansereau, D. F. (1998). Enhancing the Recall of Text: Knowledge Mapping Training Promotes Implicit Transfer. *Journal of Educational Psychology* 90(3), pp. 407-413.
- Chung, W., Chen, H. and Nunamaker Jr., J. F. (2005). A Visual Framework for Knowledge Discovery on the Web: An Empirical Study of Business Intelligence Exploration. *Journal of Management Information Systems*, 21(4), pp. 57.
- Crampes, M., Ranwez, S., Villerd, J., Velickovski, F., et al. (2006). Concept Maps for Designing Adaptive Knowledge Maps. *Information Visualization* 5(3), pp. 211.
- Davis, D. L. and Davis, D. F. (1990). The Effect of Training Techniques and Personal Characteristics on Training End Users of Information Systems. *Journal of Management Information Systems*, 7(2), pp. 93-110.
- DeBord, K. A., Aruguete, M. S. and Muhlig, J. (2005). Are Computer-Assisted Teaching Methods Effective? *Teaching of Psychology*, 31(1), pp. 65-68.
- Eppler, M. J. (2006). A comparison between concept maps, mind maps, conceptual diagrams, and visual metaphors as complementary tools for knowledge construction and sharing. *Information Visualization*, 5(3), pp. 202.
- Evans, G. E. and Simkin, M. G. (1989). What best predicts computer proficiency? *Communications of the ACM*, 32(11), pp. 1322-1327.
- Forsyth, D. R. and Archer, C. R. (1997). Technologically Assisted Instruction and Student Mastery, Motivation, and Matriculation. *Teaching of Psychology*, 24(207-212).
- Hall, R. H., Dansereau, D. F. and Skaggs, L. P. (1990). The Cooperative Learner. *Learning and Individual Differences*, 2, pp. 327-336.
- Katz D & Kahn R L. *The social psychology of organizations*. New York: Wiley, 1978. 489 p.
- Kerka, S. 1997, *Developing Collaborative Partnerships*. ERIC Clearinghouse on Adult, Career and Vocational Education, Columbus, OH.
- Kolb, D. A. (1984). *Experimental Learning: Experience as the Source of Learning and Development*. Englewood Cliffs: NJ: Prentice-Hall.
- Laffey, J. M. and Singer, J. (1997). Using Mapping for Cognitive Assessment in Project-based Science. *Journal of Interactive Learning Research*, 8(3/4), pp. 363-387.
- Lambiotte, J. G., Dansereau, D. F., Cross, D. R. and Reynolds, S. B. (1989). Multirelational Semantic Maps *Educational Psychology Review*, 1(331-367).

- Lambiotte, J. G. and Dansereau, D. F. (1992). Effects of Knowledge Maps and Prior Knowledge on Recall of Science Lecture Content. *Journal of Experimental Education*, 60, pp. 189-201.
- Lin, F. R. and Lin, S. C. (2001). A Conceptual Model for Virtual Organizational Learning. *Journal of Organizational Computing and Electronic Commerce* 11(3), pp. 155-178.
- McCagg, EC, & Dansereau, DF. (1991). A convergent paradigm for examining knowledge mapping as a learning strategy. *Journal of Educational Research*, 84, 317-324
- Morris, M. G., Speier, C. and Hoffer, J. A. (1999). An examination of procedural and object-oriented systems analysis methods: Does prior experience help or hinder performance? *Decision Sciences*, 30(1), pp. 107-136.
- Najjar, L. J. (1998). Principles of Educational Multimedia User Interface Design. *Human Factors* 40(2), pp. 311-323.
- Newbern, D., and Dansereau, D.F., 1995. Knowledge maps for knowledge management. In K. Wiig (Ed.), *Knowledge Management Methods* (pp. 157-180). Arlington, TX: Schema Press.
- Newby, T. J., Stepich, D. A., Lehman, J. D. and Russell, J. D. (2000). *Instructional Technology for Teaching and Learning: Designing Instruction, Integrating Computers, and Using Media*. New Jersey: Prentice-Hall.
- Novak, J. D. and Gowin, D. B. (1984). *Learning How to Learn*. Cambridge London: Cambridge University Press.
- Novak, J. D. (1985). Concept Mapping as An Educational Tool. . *New Horizons for Learning's On The Beam* 5(2), pp. 4-5.
- Novak, J. D. (1991). Clarify with Concept Maps: A Tool for Students and Teachers Alike. *The Science Teacher* 58(7), pp. 45-49.
- Paolucci, R. (1998). The Effects of Cognitive Style and Knowledge Structure on Performance Using a Hypermedia Learning System. *Journal of Educational Multimedia and Hypermedia*, 7, pp. 123-150.
- Patterson, M. E., Dansereau, D. F. and Newborn, D. (1992). Effects of Communication Aids and Strategies on Cooperative Teaching *Journal of Educational Psychology*, 84, pp. 453 - 461.
- Ramsden, P. (Ed.). (1988). *Context and Strategy: Situational Influences on Learning. Learning Strategies and Learning Styles*. New York: Plenum Press.
- Reynolds, S., Dansereau, D. (1990), The knowledge hypermap: An alternative to hypertext, *Computers & Education* 14(5), pp 409-416.
- Ritzhaupt, A. D. and Zucker, R. J. (2006). Teaching Object-Oriented Programming Concepts Using Visual Basic .NET. *Journal of Information Systems Education*, 17(2), pp. 163-169.
- Ruiz-Primo, M. A. and Schavelson, R. J. (1996). Problems and Issues in the Use of Concept Maps in Science Assessment. *Journal of Research in Science Teaching* 33(6), pp. 569-600.
- Sebastiani, F. (2002). Machine Learning in Automated Text Categorization. *ACM Computing Survey*, 34(1), pp. 1-47.
- Siau, K. and Loo, P. (2006). Identifying Difficulties in Learning UML. *Information Systems Management*, 23 (3), pp. 43-51.
- Sweller, J. (1999). *Instructional Design in Technical Areas*. Camberwell, Victoria: ACER Press.
- Taba, H. (1963). Learning by discovery: Psychological and educational rationale. *The Elementary School Journal*, 63(6), 308-316.

Wexler, M. N. (2001). The who, what and why of knowledge mapping. *Journal of Knowledge Management*, 5(3), pp. 249-263.

Wislock, R. F. (Ed.). (1993). *What Are Perceptual Modalities and How Do They Contribute to Learning? Applying Cognitive Learning Theory to Adult Learning* (Vol. 59). San Francisco: Jossey-Bass Publishers.