



Dynamic vs. Static Visualizations for Learning Procedural and Declarative Information



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INTRODUCTION

- Previous research has not produced a consensus on when dynamic and static visualizations are most effective for learning (Mayer, Hegarty, Mayer, & Campbell, 2005; Hegarty, 2004).
- A review by Tversky, Morrison, Betrancourt (2002) concluded that animations (dynamic visualizations) are not superior to static diagrams in facilitating learning of complex systems.
- A meta-analysis by Höffler & Leutner (2007) showed an overall superior effect for animations (dynamic visualizations), with a marked advantage for the acquisition of procedural-motor knowledge.
- Inconsistencies in the literature on the relative superiority of static vs. dynamic visualizations may be attributable to the fact that studies did not distinguish between learning procedural and declarative information.
- Differences between learning procedural and declarative information force the question: are different types of instructional visualizations more appropriate for procedural versus declarative learning?

HYPOTHESES

H1: We predict that for learning procedural information, dynamic visualizations will have higher learning outcomes than static visualizations.

H2: We predict that for learning declarative information, static visualizations will have higher learning outcomes than dynamic visualizations.

DESIGN

2-visualization (dynamic vs. static) x 2-type of information (declarative vs. procedural) partial within-subjects factorial design with pre- and post-test

	Procedural-Declarative	Declarative-Procedural
Dynamic	27	28
Static	28	27

MATERIALS

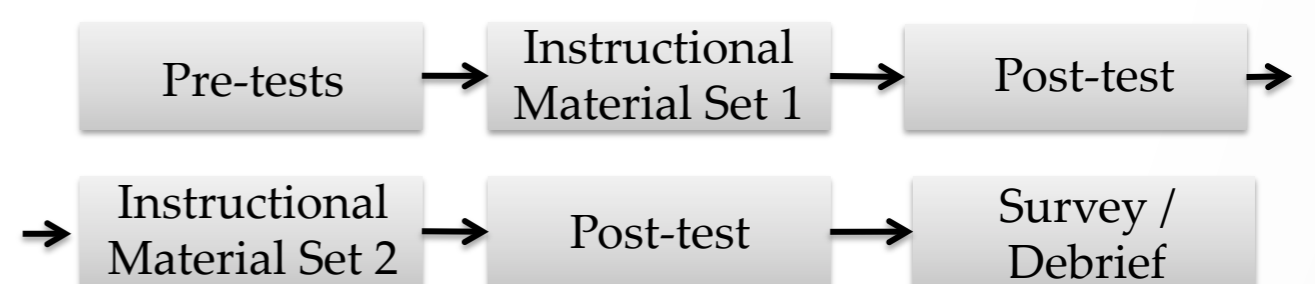
	Procedural Materials	Declarative Materials
Topic	How to set up a basic computer network	Facts about the components of a basic computer network
Tests	Set-up of a computer network in a simulation program (14 steps)	18 open-ended questions about the components of a basic computer network
Dynamic Visuals		
Static Visuals		

AIM OF THE STUDY

To determine the impact of dynamic vs. static visualizations for learning procedural and declarative information within the topic domain of computer networking.

Participants: 110 Computer Science & Psychology students from California State University.

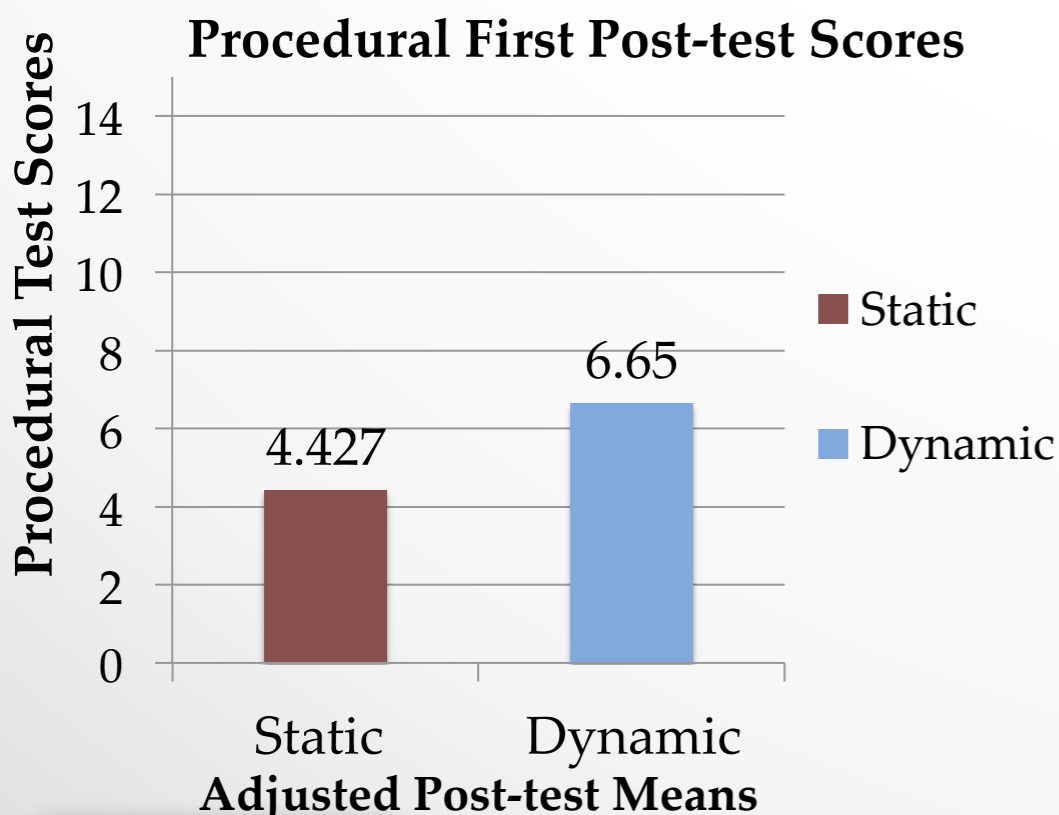
METHOD



RESULTS

An ANCOVA with the pre-test scores as the covariate with one factor visual-medium (static or dynamic) showed a significant effect of visual-medium for participants who saw procedural information first, $F(1,52) = 7.982$, $MS_{err} = 7.759$, $p = .007^*$, $partial \eta^2 = .140$.

An ANCOVA with the pre-test scores as the covariate showed no significant effect of visual-medium for participants who saw declarative information first $F(1,55) = .979$, $MS_{err} = 10.329$, $p = .327$, $partial \eta^2 = .018$.



	Pre-test		Post-test	
	M	SD	M	SD
Declarative information				
Static Graphic	2.04	1.81	7.36	3.27
Dynamic Video	2.13	2.62	7.44	3.03
Procedure				
Static Graphic	1.94	2.67	4.96	3.23
Dynamic Video	2.64	3.15	6.23	3.00

DISCUSSION

- Our results **support H1** that dynamic visualizations are more appropriate for learning a *procedure* than static visualizations: Dynamic visualizations with audio are superior to static graphics with text for learning a *procedure*.
- Our results did not support H2 which did not indicate a difference between static and dynamic visualizations for learning *declarative* information.
- Our results suggest that it is important to consider the type of information to-be learned when choosing a visual medium for instructional materials, and that there is not a one-type visual medium that fits all instructional needs.

Hegarty, M. (2004). Dynamic visualizations and learning: getting to the difficult questions. *Learning and Instruction*, 14, 343-351.

Höffler, T. N., & Leutner, D. (2007). Instructional animation versus static pictures: A meta-analysis. *Learning and Instruction*, 17, 722-738.

Mayer, R. E., Hegarty, M., Mayer, S., & Campbell, J. (2005). When static media promote active learning: annotated illustrations versus narrated animations in multimedia instruction. *Journal of Experimental Psychology: Applied*, 11, 256-265.

Tversky, B., Morrison, J. B., & Betrancourt, M. (2002). Animation: Can it facilitate? *International Journal of Human-Computer Studies*, 57, 247-262.

