

# Validation of Executive Function Classifications within the School Neuropsychological Conceptual Model

## Using Exploratory Factor Analysis in a Mixed Clinical Group Sample

Cristina P. Sevajian, M.A., Angela M. Canas, M. A., Daniel C. Miller, Ph.D., & Denise E. Maricle, Ph.D.  
Texas Woman's University, Denton, Texas

These data were drawn from an archival sample of 956 mixed clinical case studies with imputed data conducted by students in the School Neuropsychology Post-Graduate Certification Program (2001 - 2010).

### School Neuropsychology Conceptual Model of Executive Functions (Miller, 2007, 2010)

#### Concept Recognition and Generation

- Concept Recognition
  - D-KEFS Sorting Test Combined Descriptions
  - D-KEFS 20 Questions Initial Abstraction
  - WISC-IV Similarities
  - WISC-IV Integrated: Similarities Multiple Choice
- Concept Generation
  - D-KEFS Sort Test Confirmed Correct Sort
  - NEPSY-II Animal Sorting Combined

#### Problem Solving, Fluid Reasoning, and Planning

- Verbal Problem Solving, Fluid Reasoning, and Planning
  - D-KEFS: Word Context Total Consecutive Correct
  - WISC-IV: Comprehension
  - WISC-IV Integrated: Comprehension Multiple Choice
  - WISC-IV: Matrix Reasoning
  - WISC-IV: Picture Concepts
- Visual Problem Solving, Fluid Reasoning, and Planning
  - D-KEFS: Tower Total Achievement
  - NEPSY II: Clocks
  - WISC-IV Integrated: Elithorn Mazes
  - WISC-IV Integrated: Elithorn Mazes - No Time Bonus
  - WJIII COG: Concept Formation
  - WJIII COG: Analysis-Synthesis

#### Response Inhibition

- Verbal Response Inhibition
  - D-KEFS: Color-Word Inference Condition 3
  - NEPSY-II: Inhibition (Condition 2) Combined

#### Retrieval Fluency

- Verbal Retrieval Fluency
  - D-KEFS: Verbal Fluency- Condition 1
  - D-KEFS: Verbal Fluency - Condition 2
  - NEPSY- II: Word Generation Semantic Total
  - NEPSY-II: Word Generation Initial Letter Total
  - WJIII COG: Retrieval Fluency
- Visual Retrieval Fluency
  - NEPSY-II: Design Fluency Condition 1
  - NEPSY-II: Design Fluency Condition 2

#### Implications:

- Concept Recognition and Concept Generation are two separate factors; represented by Factors 1 and 3.
- Problem solving, fluid reasoning and planning split into three factors instead of two. Specifically **visual** problem solving, fluid reasoning, and planning split into two separate factors (Factors 2 and 6).
- Retrieval fluency also splits into verbal and nonverbal factors (Factors 4 and 7).
- No factor was found for response inhibition. Likely due to limited variables.
- It is unclear what factors 8 and 10 are measuring.
- For Factor 9, although no variables loaded primarily on this factor, the WISC IV Elithorn Mazes, WISC IV Elithorn Mazes No Time Bonus and D-KEFS Sorting Test Combined Description displayed low to moderate factor loadings suggesting the factor might measure visual problem solving.

Test	Factors and Related Loadings									
	1	2	3	4	5	6	7	8	9	10
Factor 1: Concept Generation										
NEPSY-II: Animal Sorting Combined	.635	.115	.126	.082	.002	.091	.165	.294	.283	.097
WISC-IV: Similarities	.584	.301	-.069	-.033	.362	-.046	-.190	-.030	-.155	.300
NEPSY-II: Inhibition (Condition 2) Combined	.381	.110	-.198	.202	.154	.035	.331	.109	.067	.072
Factor 2: Visual Reasoning										
WISC-IV Integrated: Comprehension Multiple Choice	.046	.805	.010	.101	.101	.010	.061	.099	.004	.038
WISC-IV Integrated: Elithorn Maze - No Time Bonus	.105	.585	.024	-.025	.202	.019	.111	.001	.460	.113
WISC-IV Integrated: Similarities Multiple Choice	.379	.580	.010	.127	.041	-.096	.016	-.162	-.073	.001
WISC-IV Integrated: Elithorn Maze	-.254	.496	.315	.070	.341	.106	.057	.048	.356	-.262
Factor 3: Verbal Concept Recognition										
D-KEFS: Sort Test Confirmed Correct Sort	.124	.044	.813	.110	-.048	.062	-.005	-.191	.096	-.047
D-KEFS: Word Context Total Consecutive Correct	-.053	.061	.693	-.136	.211	.054	.047	.100	-.163	.140
D-KEFS: Sorting Test Combined Description	.429	-.116	.465	.284	.073	.091	-.295	-.199	.331	.057
Factor 4: Nonverbal Retrieval Fluency										
D-KEFS: Design Fluency Condition 1	.070	.083	-.056	.857	.039	.130	-.084	.017	-.018	-.031
D-KEFS: Design Fluency Condition 2	-.205	.126	.096	.787	.111	-.041	.056	-.003	.115	.149
Factor 5: Perceptual Reasoning										
WISC-IV: Picture Concepts	.083	.017	-.008	.150	.711	.027	-.026	-.007	.107	.036
WISC-IV: Matrix Reasoning	.043	.321	.102	-.019	.697	.051	.076	-.025	.023	.073
D-KEFS: Verbal Fluency: Condition 1	-.106	-.120	.345	.269	.387	-.064	.356	.250	.182	.142
Factor 6: Fluid Reasoning										
WJ-III Cog: Concept Formation	.058	-.004	.087	.018	-.012	.835	.061	.028	-.031	.016
WJ-III Cog: Analysis Synthesis	-.026	.059	.079	.033	.014	.757	-.005	.199	.137	.024
WJ-III Cog: Retrieval Fluency	.071	-.188	-.101	.088	.172	.515	.462	-.058	-.044	-.050
Factor 7: Verbal Retrieval Fluency										
NEPSY-II: Word Generation Semantic Total	.075	.194	.044	-.108	-.050	.095	.724	-.138	.011	.064
D-KEFS: Verbal Fluency Condition 2	.044	-.140	.280	.390	.284	-.003	.401	.182	-.144	-.117
NEPSY-II: Word Generation Init Let Total	.292	.271	.225	-.030	-.125	.088	.328	.091	-.101	-.544
Factor 8: Abstraction (?)										
NEPSY-II: Clocks	.261	.034	-.129	-.087	-.035	.135	-.029	.751	.152	.041
D-KEFS: Color Word Test Condition 3 (Inhibition)	-.165	-.155	-.045	.167	.158	.206	-.215	.531	-.141	-.336
D-KEFS: 20 Questions Initial Abstraction	-.148	.208	.384	.228	-.256	.042	.088	.463	-.281	.061
Factor 9: Visual Problem Solving (?)										
Nothing has a primary loading on this factor.										
Factor 10: Strategic Thinking (?)										
WISC-IV: Comprehension	.200	.211	.094	.112	.413	.008	.058	-.089	-.110	.580
D-KEFS: Tower Total Achievement	-.117	.053	.381	.111	-.063	.158	.250	.117	.111	.569
% of the variance explained by factor	7.91%	7.63%	7.63%	6.89%	6.89%	6.14%	5.57%	5.27%	5.12%	4.98%
Cumulative % of variance explained by factor	7.90%	15.54%	23.17%	30.07%	36.95%	43.10%	48.66%	53.93%	59.05%	64.04%