

## **Research Question**

*Is NASA-TLX a Valid and Reliable Instrument for Measuring Cognitive Load in Individual and Group Nursing Simulations?* 

# Background

- National Aeronautics & Space Administration Task Load Index
- Quantifies perceived workload/cognitive load
- CL = mental effort to process information
- Originally designed for the aviation industry
- 6-item Likert-type scale
- Participants rate each item 0 100 in 5-point increments
- Total raw score = global cognitive load
- Adopted across disciplines such as aviation, engineering, psychology, and medicine
- Cannot assume NASA-TLX will perform similarly in nursing students as it does with professional pilots

## Methods

## Sample

- Secondary analysis of 488 NASA-TLX surveys
- 300 surveys collected from 2 individual simulations (n=150)
- 188 surveys collected from 1 group simulation (n=188)
- All participants were pre-licensure nursing students enrolled in a simulation course at TCU

## Analysis

- Paired samples t-test and ANOVA used to compare global CL means
- Principal component analysis, average scale correlation, and inter-item correlations
- Cronbach's alpha

# **Psychometric Testing of NASA-TLX For Measuring Learners' Cognitive Load in Individual and Group Nursing Simulations** Jeremy W. Hutson, PhD, RN, Texas Christian University



### **Measurement Tool**

#### NASA Task Load Index

Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

Name	Task	Date		
Mental Demand	How mentally dem	nanding was the task?		
Very Low		Very High		
Physical Demand How physically demanding was the task?				
Very Low		Very High		
Temporal Demand	How hurried or rushed was	the pace of the task?		
Very Low		very riigh		
Performance How successful were you in accomplishing what you were asked to do?				
Perfect		Failure		
Effort	How hard did you have to v your level of performance?	work to accomplish		
Very Low		Very High		
Frustration	How insecure, discouraged and annoyed wereyou?	d, irritated, stressed,		
Very Low		Very High		

**Statistics** 

Factor Loading			
	Model A		Model B
	Component		Component
	Cognitive	Emotional	Cognitive
Mental	.801	-	.796
Physical	.672		.693
Temporal	.770		.807
Effort	.793		.706
Frustration	.476	.700	.645
Performance	-	.888	
Explained	45.08	20.81	52.52

*Note.* Model A, Includes original 6 items, Varimax orthogonal rotation with Kaise normalization; Model B, Performance item removed for low MSA, no rotation. (-) represents values less than 0.3.

NASA-TLX Inter-item Correlations						
	Mental	Physical	Temporal	Effort	Frustration	Performance
Mental	1.00	.409	.541	.537	.368	.067
Physical		1.00	.423	.342	.396	.019
Temporal			1.00	.478	.456	.116
Effort				1.00	.209	098
Frustration					1.00	.373
Performance				*		1.00

#### NASA-TLX Descriptives by Time

	Time 1		Time	2
Item	Mean (SD)	Range	Mean (SD)	Range
Mental	12.16 (4.19)	2-21	11.96 (3.92)	1-21
Physical	5.64 (4.17)	0-16	6.44 (3.93)	0-18
Temporal	11.57 (4.69)	2-21	12.00 (4.86)	1-21
Effort	13.38 (4.11)	2-21	13.36 (4.10)	0-21
Frustration	11.31 (5.89)	0-21	9.60 (5.71)	0-21
Performance	11.23 (4.32)	1-21	10.44 (3.90)	0-19
Total	65.28 (18.02)	12-121	63.80 (16.96)	14-104

# Results

# **Individual Simulation**

• There was a statistically significant increase in physical demand between Time 1 (M=5.64, ±4.17) and Time 2 (M=6.44, ±3.93),  $t_{149}$ = -2.77, p= 0.006; representing a small effect, Cohen's d = .047.

• Frustration scores decreased between Time 1 (M=11.31, SD  $\pm$  5.89) and Time 2 (M=9.6, SD  $\pm$  5.71), t149=3.08, p=.002 with small effect Cohen's d=.251

• Average scale correlation (M=.309, range=.639) suggests reasonable homogeneity among scale items

- Cronbach's alpha T1 = 0.729; T2 = 0.702
- PCA 2 component model

# <u>Group Simulation</u>

- No significant differences in global CL between R1, R2, R3
- Global alpha = 0.702
- R1 alpha = 0.684
- R2 alpha = 0.678
- R3 alpha = 0.802

# Conclusions

- NASA-TLX is valid and reliable for use with novice nurses in individual simulation
- More investigation is needed to determine reliability and validity using group simulations
- Frustration item related to the cognitive and emotional component
- Performance item not related to cognitive or emotional components

Article









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