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Student Pilot Perceptions of Flight Training

Ronald W. Bishop
Central Queensland University, Australia, bishopr33@gmail.com

Talitha Best Ph.D.
Associate Professor, Central Queensland University, Australia, t.best@cqu.edu.au

Jim Mitchell Ph.D.
University of Western Sydney, Australia, j.mitchell@westernsydney.edu.au

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Student Pilot Perceptions of Mental workload during Flight Training

Ron Bishop, Central Queensland University
Jim Mitchell, University Western Sydney
Talitha Best, Central Queensland University

Background

Proud to be from Florida and ERAU Alumni X3

Operations Superintendent

Mental Workload (MWL) Research

Previous Research

Cockpit design and pilot mental workload primarily in military and civilian transport aircraft (Cain, 2007,Gopher and Donchin, 1986, Hart and Staveland, 1988, Meshtaki, 1988, Reid and Eggemeier, et al. 1982,, Roscoe and Ellis, et al, 1978, Wilson, 2002)

General aviation- Mental Workload during flight training

(Dahlstrom and Nahlinder, 2009, Wilson, 2002, Wright & O'Hare, 2015)

Novice pilots flying glass cockpits during Recreational Aircraft during flight training

(Craig et al., 2005, Dahlstrom and Nahlinder, 2009, Harris et al., 1982)

Methodology/Participants

- Participants
- Location
- Environment

100 years ago

15 Years ago

Now

Recreational Aircraft

Boeing 787

Improvements in cockpit displays and aircraft design are exposing novice pilots to advancements in technology that historically were only available to experienced fighter pilots and civilian transport pilots

- Significance
- Hypothesis
- Research Question

Methods

- 17 Student pilots flew a circuit flight, with an instructor, in Light Sport Aircraft (Sling 2) equipped with a glass cockpit and a General Aviation (Cessna 172) analogue gauge cockpit
- 8 students flew a circuit simulation using a Redbird FMX Simulator configured as a GA analogue aircraft and LSA glass cockpit
- The NASA Task Load Index (NASA-TLX) pre/post circuit flight and simulator
- Interviews

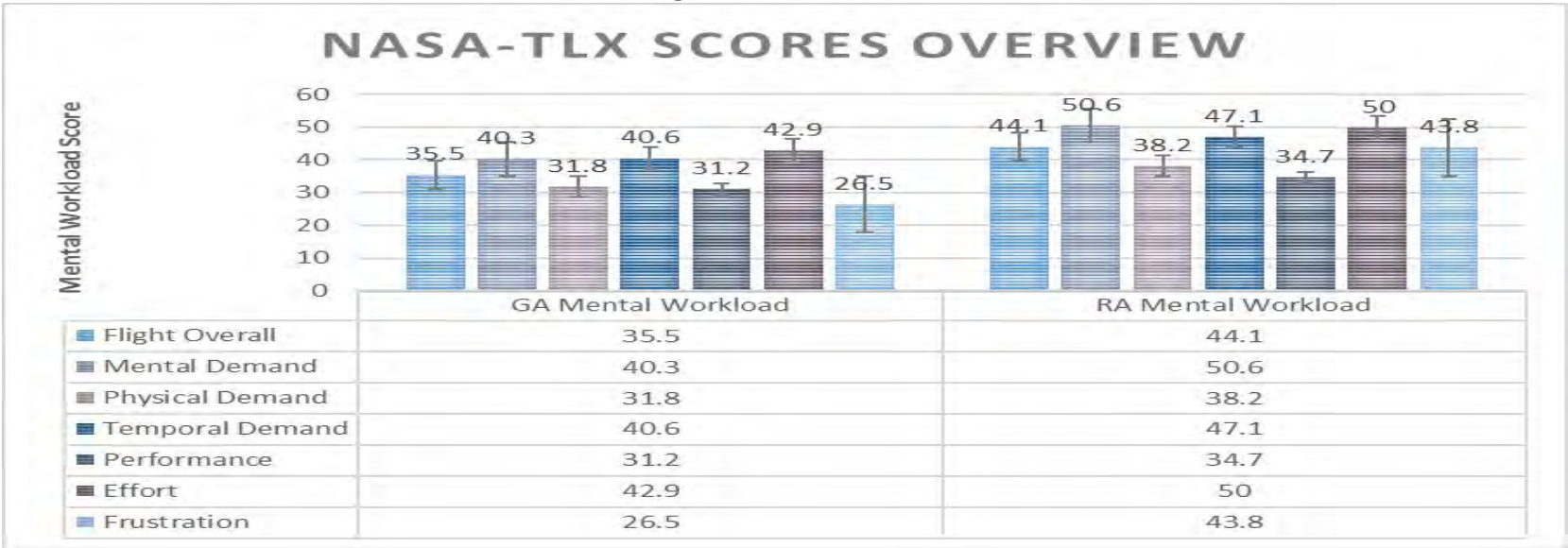
Results

- Recreational Aircraft (RA) MWL is 24% higher
- ‘Frustration’ 65% higher in RA during flight
- GA and RA Pair Sample t-test

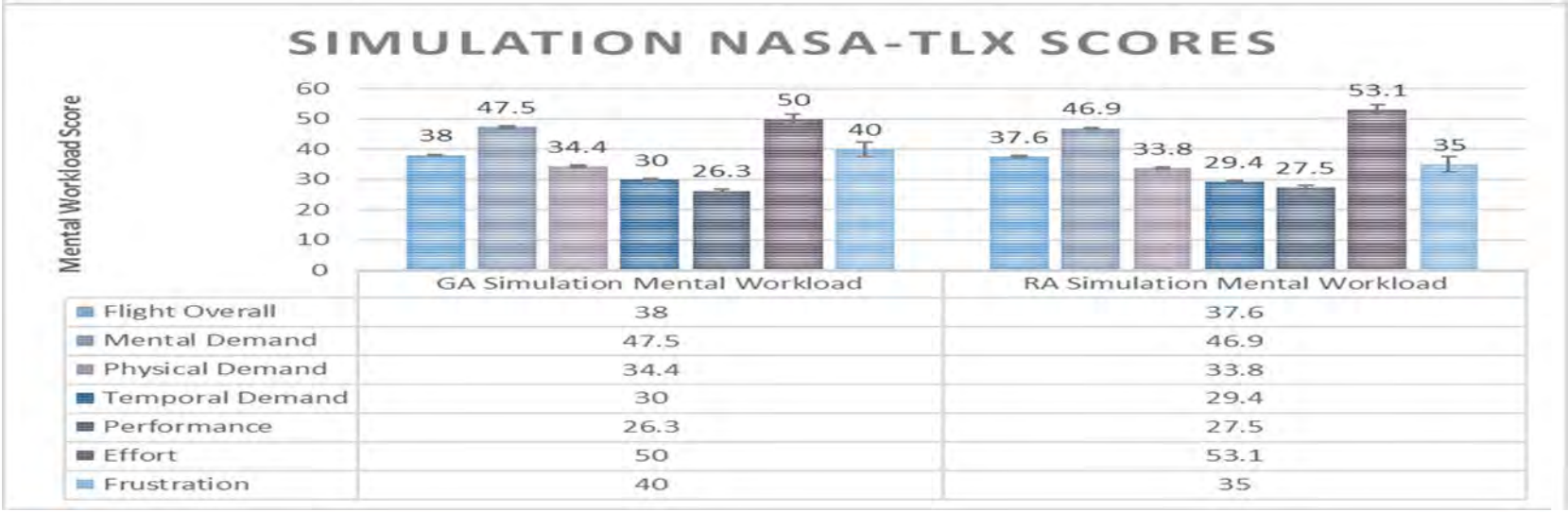
One way Anova

- Age
- Gender
- Flight Experience

Flight Results



	GA Mental Workload	RA Mental Workload
Flight Overall	35.5	44.1
Mental Demand	40.3	50.6
Physical Demand	31.8	38.2
Temporal Demand	40.6	47.1
Performance	31.2	34.7
Effort	42.9	50
Frustration	26.5	43.8



	GA Simulation Mental Workload	RA Simulation Mental Workload
Flight Overall	38	37.6
Mental Demand	47.5	46.9
Physical Demand	34.4	33.8
Temporal Demand	30	29.4
Performance	26.3	27.5
Effort	50	53.1
Frustration	40	35

Interview Theme Analysis

Flight Most important theme of each question analysis		
Question	**GA**	**RA**
Flight Assessment	Easy	Aircraft
Pilot MWL	Airplanes (aircraft)	Sling (aircraft)
Effects of MWL	Better	Instruments (glass cockpit)
Most MWL Phase	Downwind	Plane (aircraft)
Main Effect of Most MWL	Effect	Flying
Least MWL Phase	Base	Downwind
Main Effect of Least MWL	Relaxed	Figure
Suggestions/Improvement	Flight	Cockpit (glass cockpit)
Simulation Most important theme of each question analysis		
Question	**GA**	**RA**
Flight Assessment	Stressful	Cockpit
Pilot MWL	During	Cockpit
Effects of MWL	Airplane	Cockpit
Most MWL Phase	Gives	Caused
Main Effect of Most MWL	Doing	Completely
Least MWL Phase	Gave	Downwind
Main Effect of Least MWL	Re-focus	Flying
Suggestions/Improvement	Flight	Cockpit

Implications and Conclusions

- More MWL in RA Flight
- Glass Cockpit
- Interviews identified differences in themes and provided context
- Simulation

Conclusion

- More research
- Physiological measures
- Replication in RA, increased sample size, and other student year levels

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References

- Cain, B., 2007. *A review of the mental workload literature*. Defence Research And Development Toronto (Canada).
- Craig, P.A., Bertrand, J.E., Dornan, W. and Gossett, S., 2005. Ab Initio Training in the Glass Cockpit Era: New Technology Meets New Pilots: A Preliminary Descriptive Analysis. In *2005 International Symposium on Aviation Psychology* (p. 153).
- Dahlstrom, N. and Nahlinder, S., 2009. Mental workload in aircraft and simulator during basic civil aviation training. *The International journal of aviation psychology*, *19*(4), pp.309-325.
- Gopher, D. and Donchin, E., 1986. Workload: An examination of the concept.
- Harris Sr, R.L., Tole, J.R., Ephrath, A.R. and Stephens, A.T., 1982, October. How a new instrument affects pilots' mental workload. In *Proceedings of the Human Factors Society Annual Meeting* (Vol. 26, No. 11, pp. 1010-1013). Sage CA: Los Angeles, CA: SAGE Publications.
- Hart, S.G. and Staveland, L.E., 1988. Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. In *Advances in psychology* (Vol. 52, pp. 139-183). North-Holland.
- Meshkati, N., 1988. Heart rate variability and mental workload assessment. In *Advances in psychology* (Vol. 52, pp. 101-115). North-Holland.
- Reid, G.B., Eggemeier, F.T. and Nygren, T.E., 1982, October. An individual differences approach to SWAT scale development. In *Proceedings of the Human Factors Society Annual Meeting* (Vol. 26, No. 7, pp. 639-642). Sage CA: Los Angeles, CA: SAGE Publications.
- Roscoe, A.H. and Ellis, G.A., 1978. Assessing pilot workload. *AGARD (Advisory Group for Aerospace Research and Development)*, (233).
- Wilson, G.F., 2002. An analysis of mental workload in pilots during flight using multiple psychophysiological measures. *The International Journal of Aviation Psychology*, *12*(1), pp.3-18.
- Wright, S. and O'Hare, D., 2015. Can a glass cockpit display help (or hinder) performance of novices in simulated flight training?. *Applied ergonomics*, *47*, pp.292-299.