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Assessing Subjective Workload using the Multiple Resources Questionnaire (MRQ): Current Use and Directions for Future Research

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Assessing Subjective Workload using the Multiple Resources Questionnaire (MRQ): Current Use and Directions for Future Research

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1. Introduction

- Measurement of human workload when completing a task is important because it can help identify how difficult a task is, why it is difficult, and what can be changed to reduce workload
- There are various questionnaires that assess an individual's subjective workload when performing a task or set of tasks.
- The most common measure to assess a participant's workload is the NASA-Task Load Index (NASA-TLX), but this measure has some limitations (e.g., poor diagnosticity with respect to the specific mental processes involved in a task).
- Due to these limitations, the Multiple Resources Questionnaire (MRQ) emerged.
- In reviewing studies using the MRQ, there are substantial differences in how people have used the MRQ, which makes it difficult for those new to the measure knowing which approaches work best
- This poster will provide an overview of the MRQ research, the literature review method, the findings, comparative studies and recommendations for MRQ use, and future research need

2. Overview of the Multiple Resources Questionnaire

- Boles and Adair (2001a) developed the MRQ to address limitations of previous subjective workload assessments.
- The MRQ is based on Multiple Resource Theory.
- It was initially created as a 17-item questionnaire that helps identifies specific cognitive, perceptual, and response resources that are used in completing a task or set of tasks.
- The questionnaire can be easily administered via either pen-and-paper or using a computer.
- Participants respond to each item by, rating how much they use each resource from "No Usage" (0) to "Extreme Usage" (4)
- The items used vary across different modalities (e.g., audio, tactile) and cognitive processes (e.g., attention, categorization)
- Example items:
 - Auditory emotional process** - Required judgment of emotion (e.g., tone of voice or musical mood) presented through the sense of hearing
 - Facial motive process** - Required movement of your own face muscles, unconnected to speech or the expression of emotion
 - Short-term memory process** - Required remembering of information for a period of time ranging from a couple of seconds to half a minute

MULTIPLE RESOURCE QUESTIONNAIRE for task _____

The purpose of this questionnaire is to characterize the nature of the mental processes used in the task with which you have become familiar. Below are the names and descriptions of several mental processes. Please read each carefully so that you understand the nature of the process. Then rate the task on the extent to which it uses each process, using the following scale.

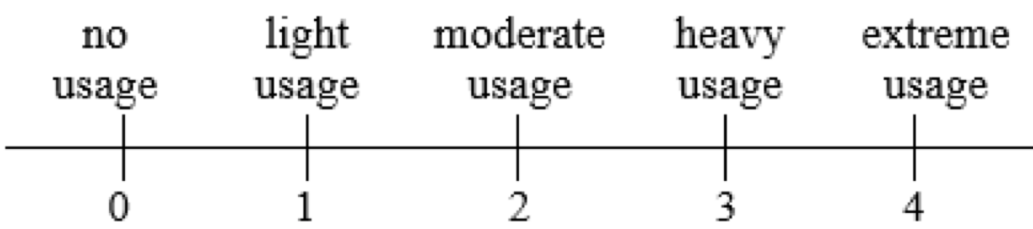


Figure 1. MRQ Instructions and Response Scale

3. Method

- For this literature review, Google Scholar was used to identify relevant literature
- The time frame for all literature searches was: 2001-2018
- Multiple word parameters were used to produce several distinct searches such as:
 - "Multiple Resource Questionnaire" and "workload"
 - "Multiple Resource Questionnaire" and "perceive workload"
 - "Multiple Resource Questionnaire" and "subjective workload"
- For example, a screenshot of one of the search parameters that were used in this literature review:

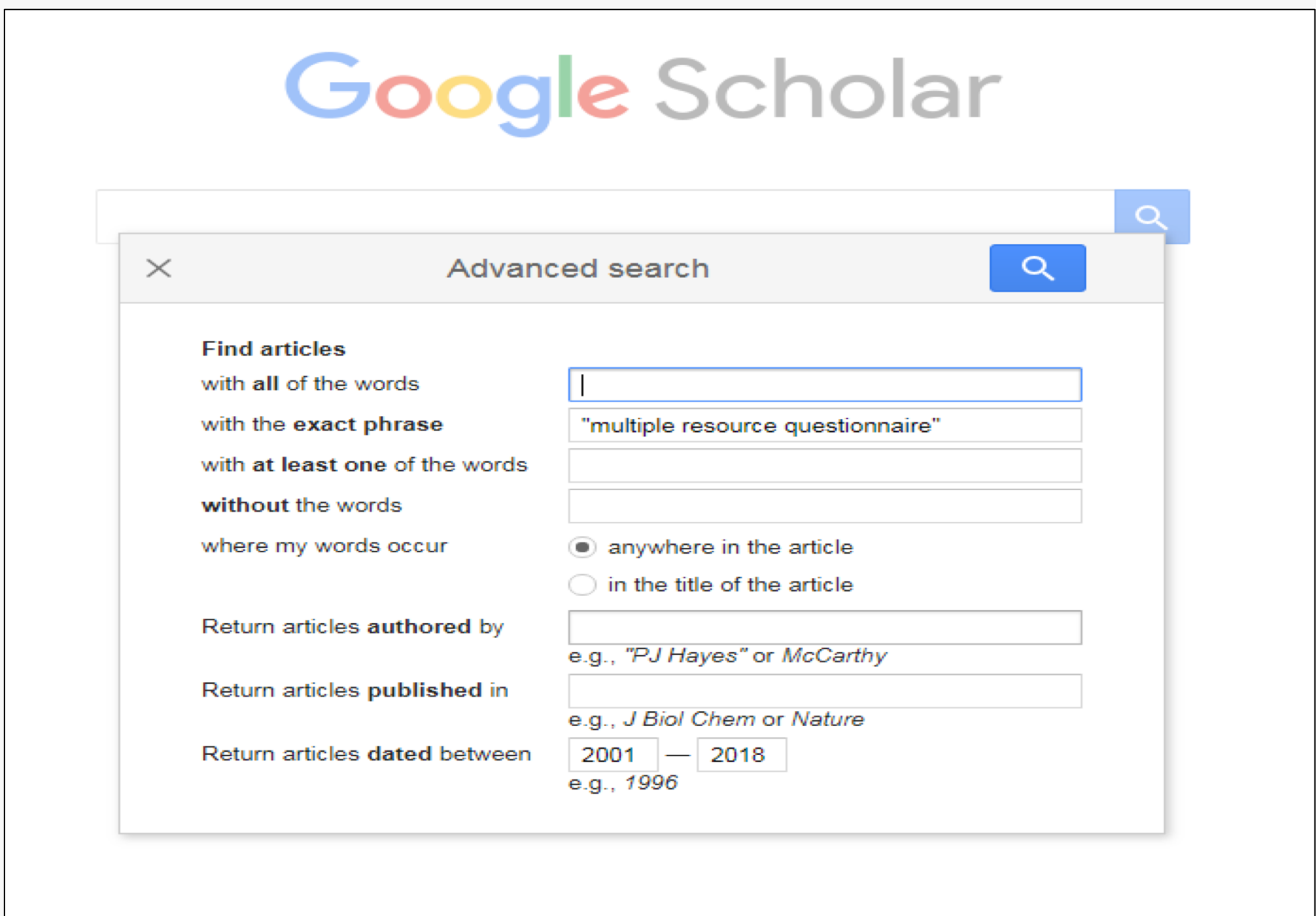


Figure 2. Example Google Scholar search

4. Findings

Findings	References
Item Selection	
Researchers tend to remove resources because the task does not involve those resources.	(Abich, 2013) (Krehl & Bafle, 2014)
Resources are altered based on the environment and the audience.	(Abich, 2013) (Krehl & Bafle, 2014)
Administration	
The rating scale used is either: 0 (No usage) to 4 (Extreme Usage) <-- Original scale 0 (No Usage) to 100 (Extreme Usage)	(Abich, 2013) (Finomore et. al, 2006) (Finomore et al, 2008)
Researchers either administer the MRQ in either pencil/pen-and-paper form, computerized version, or even oral administration	(Abich, 2013) (Carswell et al., 2010)
Researchers often use multiple subjective questionnaires in addition to the MRQ to add more sensitivity to the results	(Abich, 2013) (Fincannon et al., 2010) (Fincannon et al., 2009)
Scoring/Analysis	
Some researchers grouped specific resources together for analysis depending on the type of task	(Abich, 2013) (Fincannon et al., 2009) (Finomore, 2006)
When analyzing the MRQ data, some researchers remove resources due to insignificant results or if multiple participants rate the resource as 'no usage'	(Abich, 2013) (Carswell et al., 2010)

5. Evaluation Studies and Recommendations for Use

Carswell et al.'s Studies (2010)

Focus of Study

Comparing pen-and-paper vs. oral administration/response

Key Finding(s):

- Carswell et al. found that there was less sensitivity when administering the MRQ orally as opposed to the traditional method (pen-and-paper)
- Carswell et al. noted that oral administrated created more time pressure which lead to more errors
- They believe that the loss of sensitivity for oral administration may be due to the difficulty of understanding the MRQ subscales
- Participants who were highly educated tend to have more sensitive results in any administration of the MRQ

Recommendation(s):

- Due the amount of items in the MRQ, the best administration for the MRQ is the pen-and pencil version
- Due to difficulty to understanding the MRQ resources when administrated orally, the participants should be highly educated when administrating the MRQ orally

Boles and Adair's Studies (2001a/b)

Focus of Study

Comparing the validity and reliability of the MRQ

Key Finding(s):

- Boles and Adair noted there are a few reliability issues with the MRQ (e.g., participants counting a resources). With this assessment validity is better than its reliability
- Even if Boles and Adair's whole definition does not apply, they found that there are issues with validity with the assessment of the MRQ,

Recommendation(s):

- Due reliability and validity issues with the MRQ assessment, the best option for research is perform more research to find more reliability and validity when using this assessment

6. Future Research Needs

- There are limitations to the MRQ (e.g., validity and reliability of the MRQ and varying administrating methods)
- Future research should compare the two rating scales, the amount of resources used (e.g., all 17 vs. select resources), the wording used for specific items, and how different scoring methods alter results
- For future research, the researcher should administer more than one questionnaire with the MRQ to compare which questionnaire with the MRQ provides the most significant results or more sensitive results

7. References

- Abich, J. (2013). Investigating the universality and comprehensive ability of measures to assess the state of workload (Doctoral dissertation). University of Central Florida, Orlando.
- Boles, D. B., & Adair, L. P. (2001a, October). The multiple resources questionnaire (MRQ). In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 45, No. 25, pp. 1790-1794). Sage CA: Los Angeles, CA: SAGE Publications.
- Boles, D. B., & Adair, L. P. (2001b, October). Validity of the multiple resources questionnaire (MRQ). In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 45, No. 25, pp. 1795-1799). Sage CA: Los Angeles, CA: SAGE Publications.
- Carswell, C. M., Lio, C. H., Grant, R., Klein, M. I., Clarke, D., Seales, W. B., & Strup, S. (2010). Hands-free administration of subjective workload scales: acceptability in a surgical training environment. *Applied Ergonomics*, 42(1), 138-145.
- Krehl, C., & Bafle, N. (2014). Cognitive workload analysis in rail signalling environments. *Cognition, Technology & Work*, 16(3), 359-371.
- Finomore, V. S., Shaw, T. H., Warm, J. S., Matthews, G., Riley, M. A., Boles, D. B., & Weldon, D. (2008, September). Measuring the Workload of Sustained Attention: Further Evaluation of the Multiple Resources Questionnaire. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 52, No. 18, pp. 1209-1213). Sage CA: Los Angeles, CA: Sage Publications.
- Finomore, V. S., Warm, J. S., Matthews, G., Riley, M. A., Dember, W. N., Shaw, T. H., ... & Scerbo, M. W. (2006, October). Measuring the workload of sustained attention. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 50, No. 16, pp. 1614-1618). Sage CA: Los Angeles, CA: Sage Publications.
- Fincannon, T. D., Evans, A. W., Phillips, E., Jentsch, F., & Keebler, J. (2009, October). The influence of team size and communication modality on team effectiveness with unmanned systems. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 53, No. 5, pp. 419-423). Sage CA: Los Angeles, CA: SAGE Publications.
- Fincannon, T. D., Ososky, S., Jentsch, F., Keebler, J., & Phillips, E. (2010, September). Some good and bad with spatial ability in three person teams that operate multiple unmanned vehicles. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (Vol. 54, No. 19, pp. 1615-1619). Sage CA: Los Angeles, CA: SAGE Publications.