# Is using electroencephalography intrusive to computer assisted multitasking performance?

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## Short Description

This study aimed to investigate the effect of electroencephalography use on retention among computer-based multitaskers. Subjects were 380 undergraduate students at a state university who were exposed to concurrent multitasking, sequential multitasking and no multitasking scenarios. Those who used EEG helmets (n: 129) were compared with those who were exposed to the same intervention without an EEG helmet (n: 246). Findings revealed that retention levels of EEG users and non-users were not significantly different.

## Abstract

Conducting multiple tasks simultaneously has been a common phenomenon which is observed in different parts of our lives. Referred to as multitasking, this phenomenon is sometimes observed as a virtue of the digital natives. That is, some scholars claim that current generations who are growing up with emerging information and communication technologies are more adequate and cognitively ready for multitasking activities. On the other hand, some scholars criticizes the digital nativity assumptions and advantages pertaining to digital natives. They maintain that multitasking interferes with effective information processing, reduces reaction time, increases error rate and performance. Such different approaches require further empirical studies on the issue.

Previous research has implemented electroencephalography helmets to measure cognitive load (e.g., Antonenko, Paas, Grabner & van Gog, 2010). While this approach is considered both objective and direct, employing intrusive physical devices during an instructional intervention is considered unnatural by many. Thus, a factorial experimental design was conducted to investigate the potential intrusive effect of electroencephalography helmet use on retention of computer-based multitaskers. Multitasking scenarios involved sequential-distractive, simultaneous-distractive, and no multitasking situations. While participants in study 1 involved 246 multitaskers in a computer laboratory session, participants in study 2 involved 129 multitaskers who provided the same data while wearing EEG helmets.

The data was collected through a web interface. All scales were adapted to the participants and permissions were received for each measure. IRB permissions were also granted for both studies. Demographic information pertaining to participants was received through a background questionnaire. For pre- and post-measurement of achievement, the achievement scale developed by Dindar and Akbulut (2016) was administered. In addition, two working memory components were investigated. That is, the Computation Span Test was used to measure the phonological loop capacity, and the Dot Matrix Test was used to measure the visuo-spatial sketchpad capacity. The first measure was developed by Ackerman, Beier and Boyle (2002). The second one was developed by Miyake, Friedman, Shah and Hegharty (2001). Both were adapted for computer environment by Colom, Martinez-Molina, Shih and Santacreu (2010). Finally, Emotiv Epoc+ EEG headsets were used in half of the participants to investigate cognitive load and EEG devices' intrusive effect on retention. Video recordings of the experimental settings, researcher observation forms, and interviews were also used to sustain data reliability.

Preliminary analyses through relevant parametric tests (e.g., t-test and analysis of variance) revealed that the difference between EEG-users and non-users were not significant. It is expected that the findings of the current study may contribute to the theoretical framework on multitasking performance and physiological measure use during computer-assisted instruction experiments. In addition, suggestions will be made towards the design of learning environments in a way to facilitate ideal achievement. In this regard, the topic and the current empirical study are in line with the third conference theme 'learning'.

**Keywords:** Multitasking, working memory capacity, retention, electroencephalography

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