



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> <b>Joseph D. Lou</b>	<b>Project Number</b>  34974
<b>Project Title</b> <b>How Costly Is Multitasking? A Computer-Assisted Quantitative Study of Age and Gender Differences in Switching Costs</b>	
<b>Objectives/Goals</b> It's a widely accepted notion that multitasking has negative impacts on productivity. However, there was no complete quantitative study on age and gender differences in the multitasking costs. The objective of my project was to answer the above question by testing a large sample size of diverse participants. <b>Abstract</b> <b>Methods/Materials</b> I first created a web-based Multitasking Test (MTT) program using JavaScript, a computer programming language. I then wrote a Python program to analyze the collected data. My MTT program allows subjects to conduct 6 playing card pattern matching tasks including 3 simple and 3 complex tasks. Each task contained 20 trials for each subject in order to get more accurate results. The switching costs (SC) in time and accuracy were then measured and analyzed. I had three IVs: (a) age group, (b) gender, and (c) the complex level of the task (simple or complex). <b>Results</b> My MTT program attracted hundreds of participants from 24 states in the US, and even 24 participants from overseas. A total of 607 subjects have completed 3,642 tasks successfully for data analyses. Among all age groups, the 22-25 year old group had the lowest SC in both the simple tasks (428 ms and 0.28 errors) and complex tasks (1,319 ms and 0.76 errors). As for gender differences, males showed more SC (15% increase in time and 6.6% increase in errors) than females when doing the complex tasks. Overall, the complex tasks did increase the SC significantly (175% increase in time and 112% increase in errors) when compared with the simple tasks. <b>Conclusions/Discussion</b> My project has two important discoveries. First, multitasking has switching costs across all ages and genders, which is consistent with the Cognitive Load Theory. The more complex the tasks are, the more the SC are increased. Second, people are not certainly the best at multitasking just because they multitask the most. Even though high schoolers (14-17) are reported to multitask the most, they do not appear to be very good at it. This is because the human brain is not matured until the person is 24 years old, based on neuroscience findings. My results strongly suggest that people, especially teenagers, should stop multitasking and focus more during homework or work to increase their productivity in speed and accuracy. The more complex the tasks are, the more focus is required to do the tasks quickly and correctly.	
<b>Summary Statement</b> I created a web-based program, performed a quantitative study (N=607) of age and gender differences in switching costs during multitasking and found interesting facts that contribute to cognitive studies.	
<b>Help Received</b> Dr. Kimberley Duff, a professor of psychology, gave valuable input on the experimental design. Thanks to my parents for their great support.	