



**CALIFORNIA STATE SCIENCE FAIR  
2008 PROJECT SUMMARY**

<b>Name(s)</b> Lacey L. Nelson	<b>Project Number</b> <b>J1123</b>
<b>Project Title</b> <b>The Physics of the Front Handspring Vault</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> My objective was to find out how kinetic energy affects the quality of a front handspring vault—a move in gymnastics where you run, punch a springboard, flip to a handstand on top of the vault table, and then immediately "pop" off the vault table to return to your feet on the ground. The quality of the vault was measured by looking at air time, the time from which your hands leave the vault table to when your feet touch the ground. My objective was to also look for any relationship between the board-vault time (the time from when your feet touch the springboard to when your hands touch the vault) and the air time.</p> <p><b>Methods/Materials</b> Gymnasts were weighed then video-taped as they performed vaults. After, I digitized all the video footage and broke down the videos into stop frames of 1/30th of a second. By counting the number of stop frames from different start and end points during the vault, I determined the final velocity, board-vault time, and air time for every vault video taped, and I also converted the number of frames into units of time. In order to find out every gymnast's kinetic energy I used the kinetic energy equation (<math>\frac{1}{2}mv^2</math>) and plugged in their weight and velocity. To get my final results, I graphed board-vault time and kinetic energy against air time to determine the linear relationships between these variables.</p> <p><b>Results</b> My results showed that the more kinetic energy you had, the longer your air time would be and the better the quality of your vault would be. Also, the linear relationship between board-vault time and air time was negative, showing that the shorter the board-vault time, the longer your air time would be, improving the quality of the vault.</p> <p><b>Conclusions/Discussion</b> All my results supported my hypothesis. The information from this experiment helps break down the important aspects of the front handspring vault, and also will help gymnasts understand how to improve the quality of their front handspring vault and why those specific corrections work. A key point such as increasing your kinetic energy increases your air time, suggests to gymnasts performing the move that they would need to run faster in order to perform a better vault because having a higher velocity would mean having more kinetic energy, which results in a longer air time and a better vault.</p>	
<b>Summary Statement</b> My project was about looking at the physics of how kinetic energy affects the quality of a front handspring vault.	
<b>Help Received</b> Mom proofread report; Used Gymtowne Gymnastics facility and video-taped gymnasts working out there; Neighbor taught me how to use digitizing software	