CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34077

Project Title

Effects of String Properties on the Likelihood of Knotting

Abstract

Objectives/Goals

The purpose of this project is to investigate how the length of string affects its likelihood to be knotted. It was hypothesized that strings with longer length had higher knot probability and had more crossings than the strings with shorter length. Also, the likelihood of knotting may be different for different types of strings.

Methods/Materials

An experiment was designed to study the likelihood of knotting by counting the number of crossings (overlaps of string) after the string is dropped into a closed container and tumbled 10 times. This experiment was repeated for four string types of different material and thickness with varying string lengths. A picture was taken of the knotted string. This was repeated with every length of every type of string ten times to account for variability of the results. The pictures of the knots were analyzed and the crossings were counted and recorded into a scientific journal. After the analysis of the first set of data, it was found that the number of crossings did not change with the thin thread when the length was above 90cm. To test if this was true, a longer length of the thin thread of 150cm was added. In addition, the thin string experiments were repeated using the same box whose rough wooden surface was covered by paper.

Results

The experiment resulted in clear results that proved the original hypothesis to be correct. For all four of the string types, the number of crossings increased as the string length increased. However, this relationship is not in a simple linear form. The thin thread had the most number of crossings compared to the other string types, while the elastic string has the least number of crossings. As the string length of the thin thread increased from 120cm to 150cm, there was a significant increase in the number of crossings compared to the shorter string length. It was also found that the crossings of the thin thread with the paper box were less variable and the string did not stick to the sides of the container as much as in the experiment with the rough, wooden box.

Conclusions/Discussion

As the number of crossings increases, there is more variability in the results when the number of crossings is larger. The strings with narrow curves and higher flexibility yielded a higher likelihood to knot than the strings with wider curves.

Summary Statement

This experiment will investigate how the length of a string will affect its knotting ability.

Help Received

Mother helped count crossings