



Skipping Science: An Experiment in Jump Rope Lengths

Areas of Science	Sports Science (http://www.sciencebuddies.org/science-fair-projects/project-ideas/sports-science) Science With Your Smartphone (http://www.sciencebuddies.org/science-fair-projects/project-ideas/science-with-your-smartphone)
Difficulty	
Time Required	Short (2-5 days)
Prerequisites	Know how to jump rope or be willing to learn
Material Availability	Readily available
Cost	Low (\$20 - \$50)
Safety	No issues

Abstract

Did you know that the United States jump rope record (as of 2017) for the greatest number of jumps in a minute is 372? That's mind-blowing! Do you think you can get to that number? If you are going to try to break the record, it might be important to figure out how jump rope length affects your performance. This is the focus of this skipping science fair project and jump-start your chances for a jump rope record. If you have a smartphone available, you can track your progress with Google's Science Journal (<https://goo.gl/wst48K>) app.

Objective

Determine the best length for a jump rope.

Credits

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Edited by Ben Finio, PhD, Science Buddies

This science fair project was inspired by this DragonflyTV podcast:

- TPT. (2006). Double Dutch by Francesca, Precious, and Marnicka. *DragonflyTV, Twin Cities Public Television*. Retrieved <http://pbskids.org/dragonflytv/show/doubledutch.html> (<http://pbskids.org/dragonflytv/show/doubledutch.html>)

Cite This Page

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APA Style

Science Buddies Staff. (2020, January 12). *Skipping Science: An Experiment in Jump Rope Lengths*. Retrieved from https://www.projects/project-ideas/Sports_p051/sports-science/jump-rope-lengths

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Introduction

Did you know that jumping rope is great exercise? Professional boxers do it to improve their **coordination**, which is the ability to involving different body parts, and to improve their **endurance**, which is the length of time for which someone can do a physical a

Plus, jumping rope can be a lot of fun! That's easy to see in the DragonflyTV video on the right, where Francesca, Precious, Marr double-Dutch skills while investigating the science of jumping rope. In double Dutch, there are two jump ropes being turned, by the ropes while doing tricks. One of the hard parts is knowing when the ropes are coming, which made Francesca, Precious, and was hearing the ropes or seeing the ropes that made them able to be successful at double Dutch. What do you think their experir out, and to see all their great jumping tricks!

Click the image to watch this DragonflyTV video, presented by pbskidsgo.org, and see hc Francesca, Precious, and Marnicka investigate which of their senses are important for jump rope.

<https://www.youtube.com/watch?v=UwP5SMF-Gro> (<https://www.youtube.com/watch?v=UwP5SMF-Gro>)

In addition to jump rope tricks, there are also competitions for speed jumping. In 2017, the United States record for the most jump per minute can you make? Do you think that the length of the jump rope might change how many jumps you could make in a min takes to turn it in a full circle. Shorter ropes turn faster, but because the circle is smaller, you might have to jump higher to get ove or cause you to make a mistake. So, to help you get started on your own personal best jumps-per-minute count, in this science fe jump rope length and get a scientific jump on your competition!

Terms and Concepts

- Coordination
- Endurance

Optional terms for students using Google's Science Journal to collect data:

- Velocity
- Periodic
- Acceleration
- Accelerometer
- Period

Questions

- Why is jumping rope a good exercise?
- Why does it take more time to complete a full circle when swinging a long jump rope than a short jump rope?

Bibliography

This science fair project was inspired by this DragonflyTV podcast:

- TPT. (2006). Double Dutch by Francesca, Precious, and Marnicka. *DragonflyTV, Twin Cities Public Television*. Retrieved A <http://pbskids.org/dragonflytv/show/doubledutch.html> (<http://pbskids.org/dragonflytv/show/doubledutch.html>)

This document shows US jump rope records in various categories:

- USA Jump Rope (2017). Current 2017 USA Jump Rope National Records. Retrieved August 18, 2017, from <https://usajumprope.org/UserFiles/Records%20and%20Results/2016%20Nationals%20Results/2017%20Current%20Nati> (<https://usajumprope.org/UserFiles/Records%20and%20Results/2016%20Nationals%20Results/2017%20Current%20National%20Records.FINAL2.pdf>)

This website has more information about jump rope as exercise and how to perform different jump rope tricks and skills:

- Skip-Hop. (n.d.). *Learning to Skip*. Retrieved August 18, 2017, from <http://www.skip-hop.co.uk/learning-to-skip-c82.html> (http://www.skip-hop.co.uk/learning-to-skip-c82.html&ref=%2fscience-fair-projects%2fproject-ideas%2fsports_p051%2fsports-science%2fjump-rope-lengths)

For help creating graphs, try this website:

- National Center for Education Statistics. (n.d.). *Create a Graph*. Retrieved October 29, 2008, from <https://nces.ed.gov/nce> (<https://nces.ed.gov/nceskids/CreateAGraph/default.aspx>)

To learn more about Google's Science Journal app, visit the website below:

- Google (n.d.). *Getting Started with Science Journal*. Google Making & Science. Retrieved August 31, 2017 from <https://making-science-journal/activities/activity-getting-started?lang=en#getting-started-with-science-journal> (<https://making-science-journal/activities/activity-getting-started?lang=en#getting-started-with-science-journal>)

Materials and Equipment

- Jump ropes (1 8-foot rope and 1 10-foot rope); available at sporting goods stores and available on Amazon.com ([https://www.amazon.com](https://www.amazon.com/s?ie=UTF8&tag=sciencebuddie-20&url=search-alias%3Daps&field-keywords=jump+rope))
- Volunteers who know how to jump rope (3, including yourself)
- Lab notebook
- Graph paper
- With option 1 in procedure: Stopwatch or watch with a second hand
- With option 2 in procedure: A smartphone to record your data



This project uses Google's Science Journal app, a free app that allows you to gather and record data with a cell phone. Download the app from the [Google Play](https://play.google.com/store/apps/details?id=com.google.sciencejournal) (<https://play.google.com/store/apps/details?id=com.google.sciencejournal>) for Android devices (version 4.4 or newer) or from the [App Store](https://itunes.apple.com/us/app/science-journal-by-google/id1251205555?mt=8&aid=com.google.ScienceJournal&idfa=%7Bidfa%7D&cs=sciencebuddies&cm=activities&anid=admob&hash=md5) (<https://itunes.apple.com/us/app/science-journal-by-google/id1251205555?mt=8&aid=com.google.ScienceJournal&idfa=%7Bidfa%7D&cs=sciencebuddies&cm=activities&anid=admob&hash=md5>) for iOS.

- See the [option 2](#) (#gsj-procedure) section at the end of the procedure for instructions to use the phone in this project.



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https://www.sciencebuddies.org/science-fair-projects/project-ideas/Sports_p051/sports-science/jump-rope-lengths ([http://www.sciencebuddies.org/science-fair-projects/project-ideas/Sports_p051/sports-science/jump-rope-lengths](https://www.sciencebuddies.org/science-fair-projects/project-ideas/Sports_p051/sports-science/jump-rope-lengths))

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Experimental Procedure

Note: In this project, you will determine what length jump rope allows people to jump the fastest by measuring their jumps per minute. In one method, you can have someone count your jumps using a stopwatch. In the second method, you can use a phone (<https://goo.gl/wst48K>) app to make a graph of your jumping motion, and count the number of peaks in the graph. You can find the instru

Option 1: Using the Stopwatch

- To start this project, you will need to find three people who know how to jump rope. You will each be jumping rope by yourself during the experiment.
 - You can include yourself as one of the three people.
 - If you or one of your friends would like to take part in the experiment but do not know how to jump rope, check out the [Background \(#background\)](#) section for some methods you could use.
- Fold the 8-foot-long jump rope in half to find the midway point. Have the jumper stand on this point with both feet, put a hand straight up along his or her sides. Have a helper shorten the jump rope, using the following directions, until the handles are at the jumper's armpits. This is the *short* jump rope length.
 - To make the jump rope shorter, the helper should tie knots just beneath the handles. Try to tie the same number of knots as needed to make the rope the right length.
 - If the 8-foot jump rope is too short to reach midway between the jumper's belly button and armpits, use the 10-foot-long jump rope.
- When the jump rope is at the right length and the jumper is ready to begin jumping, three things need to happen:
 - The jumper should yell "Go!" and begin jumping.
 - As soon as the jumper says "Go!", a second person should start the stopwatch.
 - A third person should count the number of successful jumps over the rope the jumper makes.
- The jumper should continue to jump rope for 1 minute, at which point the person with the stopwatch should yell "Stop!" so the jumper knows to stop their tasks.
 - If the jumper "messes up," the stopwatch should not stop. The jumper should continue jumping rope, time continues to count up instead of restarting the count. For example, if after 10 successful jumps, the rope hits the jumper's foot, the person should count the next successful jump as number 11.
- Record the number of successful jumps in a data table like Table 1 in your lab notebook.

	Short Jump Rope Length				Medium Jump Rope Length				Trial #1
	Trial #1	Trial #2	Trial #3	Average	Trial #1	Trial #2	Trial #3	Average	
Jumper #1									
Jumper #2									
Jumper #3									

Table 1. In your lab notebook, make a data table like this one to record your results in.

- Once the jumper has rested long enough to catch his or her breath, he or she should repeat steps 3–5 twice more for a total of three trials.
- Using the same method as in step 2, re-adjust the jump rope length so that the tips of the handles are now just barely brushing the jumper's armpits. This is the *medium* jump rope length.
- The jumper should repeat steps 3–6 using the medium jump rope length. Record the number of successful jumps in the data table.

9. Now, using the same method as in step 2, re-adjust the jump rope length so that the tips of the handles just barely brush the rope length.
10. The jumper should repeat steps 3-6 using the long jump rope length. Record the number of successful jumps in the data table.
11. Repeat the whole procedure (steps 2-11) for the other two jumpers. Remember to record the number of successful jumps.
12. For each jumper, calculate the average number of successful jumps for each jump rope length.
 - a. For example, to calculate the average number of successful jumps that jumper #1 made using the short jump rope, divide the number of successful jumps by the total number of trials (which is 3).
13. Using the graph paper, make three bar graphs, one for each jumper, showing the average number of successful jumps for each rope length.
 - a. Label each bar so you know what it represents.
 - b. If you prefer to make your bar chart on the computer, try using [Create a Graph](https://nces.ed.gov/nceskids/CreateAGraph/default) (https://nces.ed.gov/nceskids/CreateAGraph/default).
14. Look at your graphs. For each jumper, which jump rope length resulted in the most successful jumps over the rope in 1 minute? Was it the same for each jumper?

Option 2: Using the Science Journal App

What if you wanted to take a more scientific measurement of your jumping motion? What could you measure? One thing scientists measure is **velocity**, or their speed and direction. When you jump up and down, your velocity changes over and over again as you slow down and speed up. This type of repetitive motion is **periodic**. A change in velocity is called **acceleration**. Sometimes it is easier to measure acceleration using a device called an **accelerometer**. Accelerometers are built in to many smartphones and video game controllers. Some video game controllers allow games to respond to motion when you tilt or shake the controller.

You can use an app called Science Journal to record data with your phone's accelerometer. To learn how to measure acceleration with the Science Journal app, review the relevant tutorials on this [Science Journal tutorial page](http://www.sciencebuddies.org/blog/science-journal-app) (http://www.sciencebuddies.org/blog/science-journal-app). Then, try out this procedure.

1. Figure out how to mount the phone to your waist, hip, or torso while jumping rope. You could put the phone in your back pocket. The phone should be tightly held to your body so it does not slide or bounce around.
2. Depending on how the phone is attached to your body, open either the X or Y accelerometer. You want to measure up-and-down motion. So, for example, if the phone is vertical in your back pocket, you should use the Y accelerometer. If the phone is horizontal, you should use the X accelerometer.
3. Practice recording acceleration while jumping. You will need to press the record button, attach the phone to your body, jump rope, detach the phone, and press the record button again to stop recording.
4. Use the "crop" feature to shorten your data to a length of exactly one minute, while you were jumping rope. Make sure you crop the end of the data while you were handling the phone, which may look irregular or spiky on the graph. You only want to keep the data from when you were jumping, which should show a regular pattern like in Figure 1.

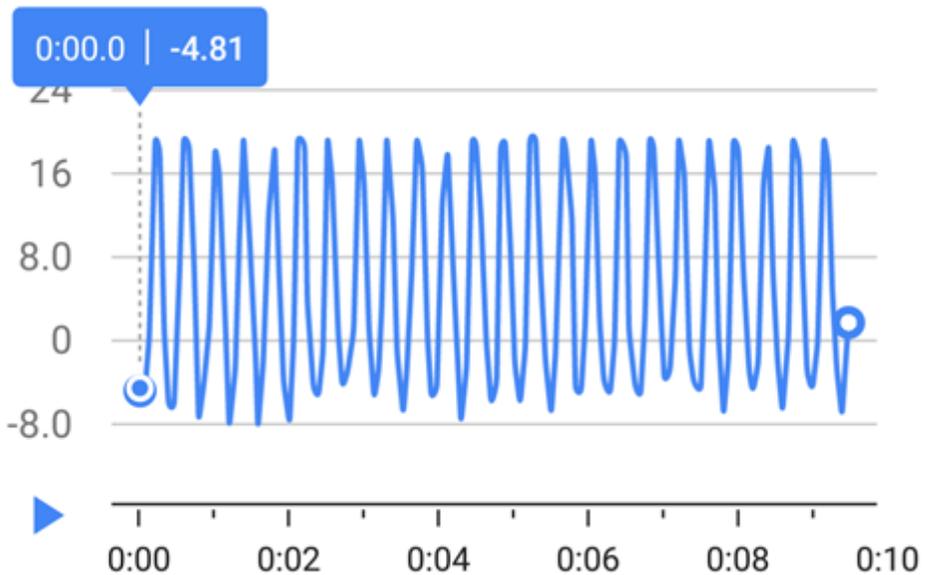


Figure 1. An example graph that shows data recorded with Google's Science Journal while jumping rope. The x-axis of the graph shows time in minutes and seconds. The y-axis shows acceleration in meters per second squared. Each peak in the graph indicates one jump. This graph shows 24 peaks in one minute (24×6=144).

5. Look at the graph of your acceleration. The graph should be periodic (the same pattern repeats over and over). Each repeat represents one complete jump. If you count the number of peaks that occur in one minute on the graph, that will tell you how many jumps you made. You may see smaller bumps or flat parts in the graph if you messed up and had to start over. Only count complete jumps.
6. If it is too difficult to count the number of peaks in a one-minute graph, try recording data for a shorter amount of time. For example, record for 10 seconds, count the peaks, and then multiply by 6 to calculate the equivalent number of jumps per minute.
7. Once you have practiced recording data while jumping rope and counting the number of jumps using the graph, follow the 1" section of this experiment. However, use the graph recorded by the Science Journal app for each trial to count the number of jumps. If you are having a helper use a stopwatch.

If you like this project, you might enjoy exploring these related careers:



(<http://www.sciencebuddies.org/science-engineering-careers/engineering/industrial-engineer>)

Industrial Engineer (<http://www.sciencebuddies.org/science-engineering-careers/engineering/industrial-engineer>)

You've probably heard the expression "build a better mousetrap." Industrial engineers are the people who build better. They find ways that are smarter, faster, safer, and easier, so that companies become more productive and employees have work environments that are safer and more rewarding. You might think that industrial engineers just work for big manufacturing companies, but they are employed in a wide range of industries including shipping, and healthcare fields. For example, nobody likes to wait in a long line to get on a roller coaster at a hospital. Industrial engineers tell companies how to shorten these processes. They try to make doing more with less is their motto. [Read more](http://www.sciencebuddies.org/science-engineering-careers/engineering/industrial-engineer) (<http://www.sciencebuddies.org/science-engineering-careers/engineering/industrial-engineer>)

Variations

- Does jump rope length also affect the number of mess-ups? Keep track of both the successful jumps and the misses and how they are related? *Hint:* a fourth person may be needed to keep track of the number of mess-ups.

- Also try this experiment using different jump rope tricks, instead of just plain jumps over the rope. Does length have more effect on the number of jumps you can make in a minute?
- Design an experiment to find the best jump rope length for double Dutch.
- In the DragonflyTV video in the Introduction, Francesca, Precious, and Marnicka jumped rope to different music with different music, fast music, and no music. Does the music change how many successful jumps you can make in a minute? How about how many jumps you can make in a row without messing up?
- Can jumping rope help you on a spelling test? Randomly assign volunteers to two groups: One group will copy down 10 words on a piece of paper. The other group will work with a partner who will call out the word and the jumper will repeat the word. Test your volunteers the next day with the spelling list (have a word that they practiced the day before) and see which group has the best scores, on average.

Ask an Expert

The Ask an Expert Forum is intended to be a place where students can go to find answers to science questions that they have been asked. If you have specific questions about your science fair project or science fair, our team of volunteer scientists can help. Our Experts can make suggestions, offer guidance, and help you troubleshoot.

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[Try Google's Science Journal App with Five Activities for Physics Exploration](http://www.sciencebuddies.org/news/article?id=375799) (<http://www.sciencebuddies.org/news/article?id=375799>), *Science Buddies Blog*, August 15, 2018

[An App for Science Class](http://www.sciencebuddies.org/news/article?id=375799) (<http://www.sciencebuddies.org/news/article?id=375799>), *Science Buddies Blog*, November 7, 2018

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