Logbook:

Note: bpm/beats per minute is measuring the heart rate, NOT how fast the music is.
Note: all averages are rounded DOWN to the nearest whole EXCEPT distance cycled or ran.

January 23, 2025

I started thinking about my project and was thinking about doing noise exposure to plants. I decided to not do that because I do not have a big home for 2 plants, one without music and one with music.

Instead, I decided to see how music affects exercise. I have researched a bit about it and all sources say that music positively affects music. I want to see if music affects how many calories they burn, and how tired they feel after the exercise, increasing your heart rate, and more.

I decided to choose this topic because I have seen many people listening to music during exercises and wanted to know if it helps exercise or not.

My official question is: Does music affect exercise output?

My hypothesis is: I predict that music will positively affect exercise by increasing your heart rate, burning more calories, and more.

January 25, 2025
I sent my science fair proposal to my uncle and aunt and they said yes. They agreed to workout 4 days of workout – 2 days with music, 2 days without. The workouts are 15 minutes and MUST be the same workout every single time.

I decided to track how many calories they burned, how far they ran/cycled, and, on a scale of 1 to 10, how tired they felt after the workout. I have read that music reduces pain and fatigue during a workout. I have also read that your heart rate adjusts to the music. I want to see if their heart rate changes during the workout with music. I want to see if they burned more calories. If they did, then that would show that they exerted more energy.

January 30, 2025

I filled out my safety form. My parents, my mentors, and my science teacher will be supervising my project. My only safety concern is that the volunteers do not overexert themselves by doing too much workout or trying too hard.

February 2, 2025
Two of my volunteers today gave me their data after they worked out. They both are doing without music. They are both doing different workouts. One of the volunteers is doing outdoor running and the other volunteer is doing indoor cycling.

Volunteer 1 that is doing outdoor running had an average heart rate of 153 beats per minute (bpm), burned 178 calories, ran 1.46 miles, and felt 70% (7/10) energized after the workout.

Volunteer 2 that is doing indoor cycling has an average heart rate of 103 bpm, burned 79 calories, cycled 3.34 miles, and felt 60% (6/10) energized after the workout.

February 3, 2025

Volunteer 1 (outdoor running) has given me data for musical exercise (exercising with music). They had an average heart rate of 161 bpm, burned 185 calories, ran 1.57 miles, and felt 70% (7/10) energized after the workout. Their average heart rate increased by 8 bpm than before. They ran 0.11 miles more than before. They burned 7 more calories than they did before.

Even though all of their outputs increased, they still felt the same after the workout, 70% energized. Just by comparing these two exercises, I can see that music probably reduces fatigue/tiredness.

February 3, 2025

My other two volunteers completed their first day running with music. They are both doing outdoor running.

Volunteer 3 burned 124 calories, had an average heart rate of 169 bpm, ran 1.24 miles, and felt 100% (10/10) energized after the workout.

Volunteer 4 burned 119 calories, had an average heart rate of 156 bpm, ran 1.13 miles, and felt 90% (9/10) energized.

February 4, 2025

Volunteer 4 did their second day of musical exercise. This time, they had an average heart rate of 171 bpm, burned 129 calories, ran 1.22 miles, and felt 90% (9/10) energized after the workout.

Now, I can get the average heart rate, calories burned, and distance run by adding the 2 days' values and dividing by 2 ((**#** + **#**) / number of **#**s). So, volunteer 4 has an, overall, average heart rate of 163 bpm, burned 126 calories, ran 1.175 miles, and felt an average of 90% energized after the workouts.

February 5, 2025

Volunteer 3 did their second day with musical exercise. This time, volunteer 3 burned 169 calories, had an average heart rate of 171 bpm, ran 1.73 miles, and felt 100% (10/10) energized.

Since I have both workouts and their outputs, I can now create an average of both of them. Volunteer 3 has (overall) burned an average of 146 calories, has an average heart rate of 170 bpm, ran an average of 1.485 miles, and felt an average of 95% energized after the workouts.

February 6, 2025

I have filled out the safety form for the science fair and made sure my project adhered to all the rules. I have written a research plan that describes the question I am trying to answer and the procedure. I have read the extra safety rules for projects with humans and my project adheres to all of the rules. I have also reviewed the rubric for the science fair projects and my project looks pretty good.

I researched a bit more about if music affects and found out that it can improve your endurance and mentality. It can also improve your mood. I have seen on many websites that music decreases your chances of fatigue.

Volunteer 1 has completed another musical exercise. This time, they got an average heart rate of 154 bpm, burned 181 calories, ran 1.57 miles, and felt 80% (8/10) energized. Now that volunteer 1 has done both musical days, I can get the average of all the outputs. So, volunteer 1 has an, overall, heart rate of 157 bpm, burned 171 calories, ran 1.57 miles, and felt around 75% energized.

Volunteer 4 has also completed a non-musical exercise today. They got an average of 164 bpm, burned 122 calories, ran 1.20 miles, and felt 90% (9/10) energized after the workout.

February 8, 2025

Volunteers 3 and 4 have completed another exercise. This time they exercised without music. This is volunteer 4’s last day of exercise, so I will be able to compare the results today.

This time, volunteer 3 got an average heart rate of 166 bpm, burned 98 calories, ran 1 mile, and felt 90% (9/10) energized.

Volunteer 4 got an average heart rate of 157 bpm, burned 108 calories, ran 1.06 miles, and felt 10% (1/10) energized.

Now, I can get volunteer 4’s the average heart rate, calories burned, miles ran, and how they felt. So, volunteer 4 has an, overall, average heart rate of 160 bpm, burned 115 calories, ran 1.13 miles, and felt 50% energized after running.

Volunteer 4’s musical exercise average heart rate was 3 bpm more than non-musical exercise. They burned an average of 11 more calories in musical exercise than

non-musical exercise. They ran an average of 0.045 more miles in musical exercise than non-musical exercise. They felt 90% energized in musical exercise compared to 50% energized in non-musical exercise.

This is yet another reason why my results correspond with my hypothesis. They burned more calories, their heart rate went up, they ran more, and they felt more energized after all these workouts.

February 9, 2025

Volunteer 2 has completed his first day of musical exercise. This time, they got an average heart rate of 120 bpm, burned 106 calories, cycled 3.98 miles, and felt 90% (9/10) energized.

If I compare the results with volunteer 2's first non-musical exercise, their average heart rate increased by 17 bpm, they burned 22 more calories, cycled 0.68 miles more, and felt significantly better because they were 60% energized with non-musical exercise but 90% with musical exercise.

This is more evidence that music decreases chances of fatigue. With volunteer 1, the same thing happened, they ran and burned more calories, but still felt good. However, volunteer 2 felt more tired after not having music in their exercise.

February 12, 2025

Volunteer 2 has completed their last day of non-musical exercise. This time they got an average heart rate of 99 bpm, burned 70 calories, cycled 2.98 miles, and felt 70% (7/10) energized after the workout.

Since this is the last day of non-musical exercise so now I can get the, overall, average heart rate, burned calories, distance cycled, and how good they felt. Overall, volunteer 2 had an average heart rate of 101 bpm, burned 74 calories, cycled 3.16 miles, and felt 65% energized after the workouts.

February 16, 2025

Volunteer 2 has completed their last day of exercise. Their last day is musical exercise. This time they got an average of 112 bpm, burned 95 calories, cycled 3.93 miles, and felt 90% (9/10) energized.

Since this is the last day of all their exercises, I can compare the two results. But first I need to get the average of the musical exercises. Overall, volunteer 2 had an average heart rate of 116 bpm, burned 100 calories, cycled 3.9 miles, and felt 90% energized.

Volunteer 2's average heart rate was 15 bpm more in musical exercise than non-musical exercise. In musical exercise, they burned 26 more calories than

non-musical exercise. They cycled 0.74 miles more in musical exercise than non-musical exercise. And lastly, they felt way better after the musical workout than the non-musical workout – 90% to 65%.

This is even more evidence that music helps exercise. Just like the previous volunteers, volunteer 2 felt better and improved after the musical workouts than the non-musical workouts. It also shows that music decreases fatigue, again. They out-performed themselves with musical exercises than non-musical and felt significantly better.

February 21, 2025

Today, volunteer 1 has completed their last day of exercise which happens to be non-musical. After I record today's data, I can get the average of non-musical exercise outputs and compare them with the musical exercise outputs. They got an average heart rate of 153 bpm, burned 169 calories, ran 1.50 miles, and felt 70% (7/10) energized.

So, overall, volunteer 1 got an average heart rate of 153 bpm, burned 173 calories, ran 1.535 miles, and felt 70% energized after the workouts.

Volunteer 1's heart rate was 3 bpm higher in musical exercise than non-musical exercise. They burned 2 less calories in musical exercise than non-musical exercise. They ran 0.165 miles more in musical exercise than non-musical exercise. And finally, they felt better after musical exercise than non-musical exercise – 75% to 70%.

February 23, 2025

Volunteer 3 has completed their last day of exercise. Their last day was non-musical exercise. This time, volunteer 3 got an average heart rate of 181 bpm, burned 144 calories, ran 1.44 miles, and felt 90% (9/10) energized. Now I can get the overall average heart rate, calories burned, distance ran, and how they feel. So, volunteer 3, overall, got an average heart rate of 173 bpm, burned 121 calories, ran 1.22 miles and felt around 95% energized after the workouts.

So, volunteer 3 ran 0.265 miles more in musical exercise than non-musical exercise. Their heart rate was 3 bpm higher in musical exercise than non-musical exercise. They burned 25 more calories in musical exercise than non-musical exercise. And finally, they felt the same during both exercises but did more in musical exercise.

February 27, 2025 (Last day of project!)

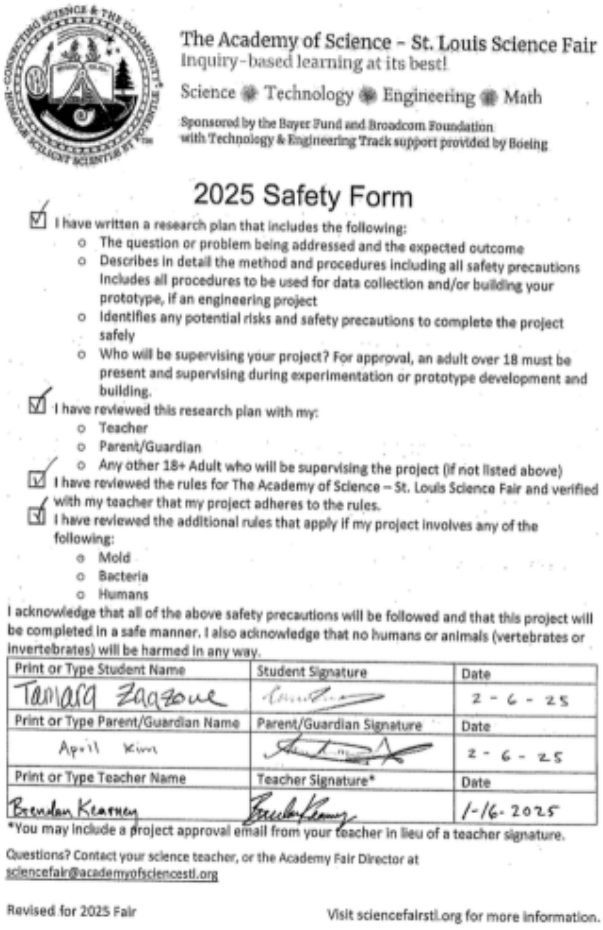
To sum this project all up, I found out that music does help exercise. In some cases, it helps tremendously, but in others, only a little bit. In volunteer 2's case, they cycled 0.84 miles more in musical exercise than non-musical exercise. But in volunteer 4's case, they ran only 0.045 miles more in musical exercise than non-musical exercise. I did not include this in the presentation (because this was qualitative) but I had my volunteers

tell me how energized they felt after the exercise. All of them felt better (or the same) after the workout and they outdid themselves. If I continued this project, I would see what genre of music helps exercise the most (e.g., pop, rock, country, disco, etc.).

Bibliography:

National Center for Biotechnology Information
Scientific American (first section)
National Center for Biotechnology Information (another one)
National Institute for Fitness and Sports

Signed Safety Form:



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2025 Safety Form

- ☑ I have written a research plan that includes the following:
  - The question or problem being addressed and the expected outcome
  - Describes in detail the method and procedures including all safety precautions Includes all procedures to be used for data collection and/or building your prototype, if an engineering project
  - Identifies any potential risks and safety precautions to complete the project safely
  - Who will be supervising your project? For approval, an adult over 18 must be present and supervising during experimentation or prototype development and building.
- ☑ I have reviewed this research plan with my:
  - Teacher
  - Parent/Guardian
  - Any other 18+ Adult who will be supervising the project (if not listed above)
- ☑ I have reviewed the rules for The Academy of Science – St. Louis Science Fair and verified with my teacher that my project adheres to the rules.
- ☑ I have reviewed the additional rules that apply if my project involves any of the following:
  - Mold
  - Bacteria
  - Humans

I acknowledge that all of the above safety precautions will be followed and that this project will be completed in a safe manner. I also acknowledge that no humans or animals (vertebrates or invertebrates) will be harmed in any way.

Print or Type Student Name	Student Signature	Date
Tamara Zagzouk		2-6-25
Print or Type Parent/Guardian Name	Parent/Guardian Signature	Date
April Kim		2-6-25
Print or Type Teacher Name	Teacher Signature*	Date
Brendan Kearney		1-16-2025

*You may include a project approval email from your teacher in lieu of a teacher signature.

Questions? Contact your science teacher, or the Academy Fair Director at sciencefair@academyofsciencestl.org

Revised for 2025 Fair

Visit sciencefairstl.org for more information.