

## **October 1**

Today I chose my science fair topic: how monolingual, bilingual, and multilingual brains process information differently. I didn't start researching yet, but I wrote down why I care about this topic and what I want to learn. I want to understand how language experience affects memory, attention, and the way the brain handles conflict. I also saved a few articles that I planned to read later.

## **October 10**

I did a small amount of background reading just to get familiar with the topic. I learned basic definitions like monolingual, bilingual, multilingual, and cognition. I wrote down that cognition is "how your brain thinks, learns and understands the world around you." I didn't go deep yet, but this helped me understand the vocabulary I would see later.

## **October 25**

I didn't do much research this month, but I collected sources I wanted to read later. I bookmarked the fMRI study, the reaction-time study, and articles about bilingualism, brain structure, and cognitive reserve. I knew November would be my real research month.

## **November 2**

I started reading the scientific studies I saved. I began with the 2007 fMRI study by Kovelman et al. This study compared monolinguals and bilinguals while they completed sentence-judgment tasks. I learned that bilinguals showed stronger activation in the left inferior frontal cortex, while monolinguals used different regions when processing language. This was the first clear evidence I saw that bilingual and monolingual brains actually work differently.

## **November 5**

I continued analyzing the fMRI study and wrote down the accuracy data: bilinguals scored 92% in English and 90% in Spanish, while monolinguals scored 95% in English. I also wrote down the reaction times: bilinguals took 1.4 seconds for complex sentences and 1.2 seconds for simple ones, while monolinguals took 1.2 seconds and 1.0 seconds. Even though monolinguals were slightly faster, bilinguals showed more flexible activation patterns, which is important for attention and conflict control.

## **November 10**

I read the 2022 reaction-time experiment that tested global and local tasks. This study showed that bilinguals were less affected by conflict and recovered faster after difficult trials. I wrote: “The important part isn’t the height of the bars, it’s the gap.” The gap between neutral and incongruent trials was much smaller for bilinguals, which means their brains handle interference more efficiently.

## **November 16**

I researched Canadian bilingualism data. I learned that Quebec increased bilingualism by 5.6% since 2001, while other provinces decreased due to immigration patterns. I also noted that the data only includes English–French bilingualism, which means it doesn’t capture multilingual immigrants who speak other languages.

## **November 22**

I organized all my research into categories: brain structure, cognitive advantages, language and perception, reaction-time studies, and bilingualism statistics. I realized that many studies agreed that bilinguals have stronger attention networks and better conflict control, even if their reaction times aren’t always faster.

## **November 30**

I reviewed all my November notes and highlighted the most important findings: bilinguals activate different brain regions, recover from conflict faster, and show more flexible processing strategies. This month was when most of my core research actually happened.

## **December 3**

I researched how bilingualism affects brain structure. I learned that bilinguals have denser grey matter and stronger white matter connections, especially in areas related to attention and language control. This matched the fMRI study, which showed stronger activation in the left inferior frontal gyrus for bilinguals.

## **December 7**

I read more about cognitive reserve and brain aging. Many studies showed that bilingual or multilingual people may have a reduced risk of dementia or Mild Cognitive Impairment because their brains build stronger networks from managing multiple

languages. I wrote that bilingualism can delay dementia symptoms by several years because the brain has more “backup pathways.”

### **December 12**

I studied Lera Boroditsky’s work on how language shapes thought. I added examples like how English speakers see all shades of blue as “blue,” while Russian speakers have different names for different shades, which changes how they perceive color. I also wrote about how some languages use direction words instead of left and right, which affects spatial awareness.

### **December 18**

I reviewed studies that disagreed with the bilingual advantage. I noticed that many of these articles had bias or weak evidence, such as small sample sizes or poorly designed tasks. I wrote that while not all studies agree, the majority of high-quality research supports the idea that multilingualism enhances cognitive abilities.

### **December 22**

I organized all my December research and started outlining how I would use it in my report. I now had enough information to explain how multilingualism affects brain structure, attention, memory, conflict control, and even perception.

### **January 5**

I started turning all my research into written sections. I wrote the method section, explaining that my project is based on analyzing scientific studies, including fMRI experiments, reaction-time tasks, and cognitive research articles.

### **January 9**

I added the reaction-time study into my writing. I explained that bilinguals were less affected by conflict and recovered faster after incongruent trials. I included the idea that “the important part isn’t the height of the bars, it’s the gap.”

### **January 12**

I wrote the language and perception section using Boroditsky’s examples. I explained how different languages categorize color, time, and direction differently, which affects how speakers think.

## **January 16**

I worked on visuals for my trifold. I sketched diagrams showing bilingual brain activation patterns and reaction-time differences.

## **January 20**

I wrote the brain aging section. I explained that bilingualism can delay dementia symptoms because bilingual brains build stronger cognitive reserve. I used my own sentence: "Cognitive reserve is like having extra pathways and shortcuts in the brain."

## **January 25**

I drafted the discussion section comparing monolinguals, bilinguals, and multilinguals.

## **January 30**

I edited everything for clarity and flow.

## **February 1**

I reread all my studies to prepare for writing my speech. I highlighted the most important findings.

## **February 3**

I wrote my speech using my research sentences, including the fMRI activation patterns and reaction-time gaps.

## **February 5**

I added metaphors like "mental juggling" and "brain workout" to make my speech more engaging.

## **February 7**

I practiced my speech out loud and fixed confusing parts.

## **February 10**

I created my graphs: global bilingualism, reaction-time, and Canadian bilingualism.

## **February 18**

I finished writing my conclusion and finalized my trifold layout.

## **February 20**

Today was the biggest day of my project so far. I officially finished every part of my science fair project: the research, the writing, the trifold, the graphs, the visuals, and my speech. This was also the day of the interschool science fair, where I presented my project for the first time.

## **March 1**

I reviewed all my research again to make sure everything was accurate.

## **March 5**

I updated my speech with clearer explanations of the fMRI activation patterns.

## **March 10**

I practiced presenting to friends. They said the Boroditsky examples made the project easier to understand.

## **March 15**

I edited my trifold for clarity and neatness.

## **March 20**

I prepared all my materials for the University Fair.

## **March 25**

I checked all my citations and references one last time.

## **March 30**

I completed the final edits on my report.

## **April 1**

I rehearsed my full presentation with visuals.

**April 4**

I finalized my logbook entries.

**April 7**

I packed everything for the fair.