Not all Chromebooks are Created Equal

Ellie Smith
PT Elementary
Grade 6

Abstract

Every Chromebook claims to be the best, but I think some are better than others. I wanted to figure out which Chromebook was the best choice for my school. I measured performance and battery life on three different Chromebooks using the CrXPRT benchmark. My hypothesis was that each one would perform differently. The results supported my hypothesis. The results showed that each Chromebook scored differently on the CrXPRT tests. They also showed that the battery life varied by up to almost 4 hours. Chromebook B performed better than the other two Chromebooks and its battery could last all day. That makes it the best choice for my school. My tests proved that not all Chromebooks are created equal.

Table of Contents

Question, hypothesis, and variables

Question

Which Chromebook is best for my school?

Hypothesis

If I test three Chromebooks in the same way, each Chromebook will perform differently.

I did two experiments with three variables each:

- **Experiment #1:** Measure the performance of three Chromebooks using CrXPRT
    - Independent Variable: Chromebook
    - Dependent Variable: Performance
    - Controlled Variable: CrXPRT

- **Experiment #2** Measure the battery life of three Chromebooks using CrXPRT
    - Independent Variable: Chromebook
    - Dependent Variable: Battery Life
    - Controlled Variable: CrXPRT

Materials list

- Three different Chromebooks
    - Chromebook A: Samsung Chromebook 2
        - Model number: XE503C12-K02US
        - Processor Name: Samsung Exynos 5 Octa 5420
        - Processor Specs: Quad-core @ 1.9/1.3 GHz
        - Memory Size: 4 GB
        - Storage: 16 GB
        - Resolution: 1366 x 768
        - Battery: 2-cell (30 WHr) Li-Po
    - Chromebook B: Acer C720
        - Model number: 3605
        - Processor Name: Intel Core-i3-4005U
        - Processor Specs: Dual-core @ 1.7 GHz
        - Memory Size: 4 GB
        - Storage: 32 GB
        - Resolution: 1366 x 768
        - Battery: 3-cell (45 WHr) Li-Po
    - Chromebook C: Dell Chromebook 11
        - Model number: CB1C13
        - Processor Name: Intel Celeron 2955U
        - Processor Specs: Dual-core @ 1.40 GHz
        - Memory Size: 2 GB
        - Storage: 16 GB
        - Resolution: 1366 x 768
        - Battery: 4-cell (51WHr) Li-io
- Three identical pairs of headphones
- CrXPRT 2015 benchmark
    - Download available here: https://chrome.google.com/webstore/detail/crxprt/hiajijaeaacmnpjpkcfnhohmaijanjgf

Experimental procedure

1. Install CrXPRT 2015 benchmark on the Chromebooks:
    a. On the Chromebook, open the Chrome App Launcher and select the Web Store icon.
    b. In the Web Store search field, type "CrXPRT."
    c. When CrXPRT appears, click the "+ Free" button to start the installation.
    d. In the Confirm New App window, click Add.
    e. When the installation is complete, the CrXPRT icon will appear in the Chrome App Launcher.
    f. Click the icon in the Chrome App Launcher or click the Launch App button in the Chrome Web Store.

2. Configure the test devices:
    a. Set the display brightness to 200 nits.
    b. Connect a set of ear-fitting headphones to the audio port and set the noise level to 75 dB.
    c. Charge the device battery to 100 percent.
    d. Make sure to close all running apps.
    e. Verify that the device is connected to the Internet.

3. Run the tests:
    a. Click the Chrome App Launcher button in the bottom left-hand corner of the screen.
    b. Click through the App Launcher until you see the CrXPRT icon.
    c. Click on the CrXPRT icon to launch CrXPRT.
    d. CrXPRT will display the Select Test Mode page.
        i. Experiment 1 (Performance):
            1. After launching CrXPRT, click the Performance Test button on the left side of the screen.
            2. Enter a name for your device in the appropriate field.
            3. Click the Start Test button.
        ii. Experiment 2 (Battery Life):
            1. After launching CrXPRT, click the Battery Test button on the right side of the screen.
            2. At step 3 on the Battery Test Start Test page, enter the display brightness in Nits in the empty field.
            3. At step 6 on the Battery Test Start Test page, enter a name for your device in the empty field.

4. Verify that the current battery is charged to 100 percent.
5. Unplug the system's power adapter and click Start Test.

4. Record results:
    a. On the end-of-test results page, click the Click to See Details link.
    b. On the Result Details page, click the arrow button next to Click to Download Result.
    c. Select the file destination, rename the file as needed, and click Save.

Data analysis

Table 1 describes the CrXPRT performance and battery life workloads. The battery life test includes all seven workloads from the performance test, plus video playback, audio playback, HTML5 gaming, and wait time components.

Workload	Category	Description	Performance Test	Battery-life Test
Photo Effects	HTML5 Canvas, Canvas 2D, and JavaScript	Measures the time to apply three effects (Sharpen, Emboss, and Glow) to two photos each, a set of six photos total.	✓	✓
Face Detection JS	HTML5 Canvas Canvas 2D, and JavaScript	Measures the time it takes to check for human faces in a set of five photos (low resolution).	✓	✓
Offline Notes	HTML5 Local Storage, JavaScript, and AES encryption	Measures the time it takes to encrypt, store, and display notes from local storage.	✓	✓
Stock Portfolio Dashboard	HTML5 Canvas, SVG, and JavaScript	Measures the time it takes to calculate and display different graphical views of a stock portfolio.	✓	✓
DNA Sequence Analysis	HTML5 Web Worker and JavaScript	Measures the time it takes to process eight DNA sequences for ORFs and amino acids.	✓	✓
3D Shapes with WebGL	WebGL-based	Measures the time it takes to generate equation-based 3D shapes and display them with WebGL.	✓	✓
Photo Collage using PNaCl	PNaCl-based	Measures the time it takes to apply the Sharpen effect to four photos and combine them into a collage (high resolution).	✓	✓
Video Player	Browser-based video playback	Plays a 2-minute 1080p H.264 video clip in a browser from the local system.	-	✓

Workload	Category	Description	Performance Test	Battery-life Test
Music Player	Browser-based audio playback	Plays an audio clip for 3 minutes.	-	✓
HTML5-based game	HTML5 Canvas, Canvas 2D, and JavaScript	An impact.js-based game runs for about 2 minutes.	-	✓
Wait time	N/A	Device displays a wait page for the rest of the 30 minute cycle.	-	✓

Table 1: CrXPRT performance and battery life test workloads.

Results:

CHROMEBOOK A:
Estimated Battery Life: 5.95 Hours
Performance Score: 31

CHROMEBOOK B:
Estimated Battery Life: 8.05 Hours
Performance Score: 120

CHROMEBOOK C:
Estimated Battery Life: 9.53 Hours
Performance Score: 98

Conclusion

Not all Chromebooks are created equal.

Chromebook B is the best choice for my school. Chromebook B performed better than the other two Chromebooks and, while Chromebook C's battery life is longer, Chromebook B's battery still lasts all day.

CrXPRT was easy to use.

An interesting future project would be to test even more Chromebooks.

Acknowledgements

Ellie is a fictional character, but her results are real.

See Ellie's CrXPRT results for: Samsung Chromebook 2, Acer C720, and Dell Chromebook 11.

This fictional report accompanies a video, available at http://youtu.be/WBMqxUwJi_c. To make sure the video did not misrepresent the truth or exaggerate the ease of CrXPRT testing and capabilities, we asked Jacob Ketring, a 10-year-old, to download, install, and run CrXPRT.

Principled Technologies invented Ellie and wrote this report.

We would also like to thank the Science Buddies website for all of the helpful report writing information.