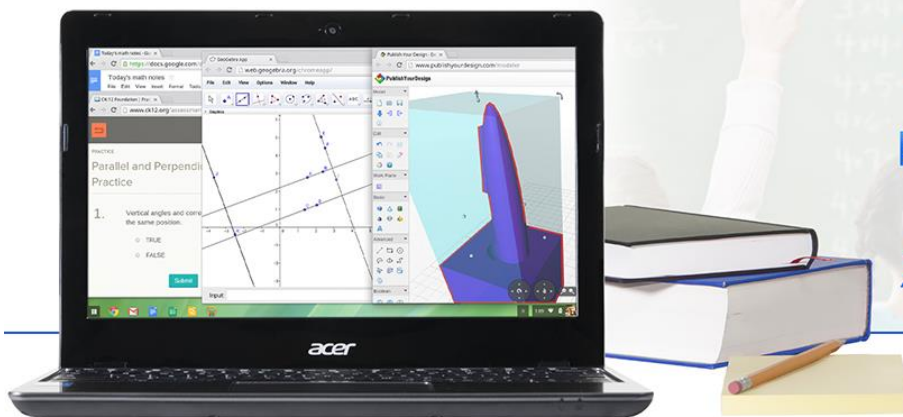


Spend less time *waiting*, more time *learning*

with the Intel®-powered Chromebook™, which was faster than the ARM®-based model in every scenario we tested



 **57% longer battery life**
while Web browsing

 **46% less waiting to read**
a textbook and take notes online

 **47% less waiting to do math**
homework online

 **50% less waiting to create**
an English presentation

 **46% less waiting to team up**
in science class

Today's students want fast, responsive electronic devices with long battery life—if the device they use to do school work takes too long to load something and forces them to constantly worry about battery life, it can be hard to keep them focused and engaged. They want to pick up their device, get going right away, and move from one thing to another quickly and easily. Teachers want this, too — the less time their students spend waiting for their devices to open an app or document, the sooner they can start learning and the more likely they are to be engaged and stay engaged instead of distracted or frustrated.

As more Chromebook models enter the market, it's becoming harder for schools to choose the right one. We put on our student hats, and put two representative Chromebooks through scenarios that included tasks such as watching a TED-Ed video and taking notes. We also looked at how long the two Chromebooks could keep running without a charge.

Which Chromebook is the better choice? We found that only the Intel® processor-powered Chromebook aced the test, lasting over 57 percent longer unplugged than the ARM processor-based Chromebook while also delivering up to 50 percent less waiting in four student scenarios. With the Intel processor-powered Chromebook, students spend less time waiting and more time learning.

LESS WAITING AND MORE LEARNING WITH THE RIGHT CHROMEBOOK

As more Chromebook models enter the market, it becomes more difficult for schools to choose the model that is best for learning. We looked at two available Chromebooks, one with an Intel processor and one with an ARM processor, by putting them through a series of tasks that real students would perform regularly while learning. We also looked at how long each Chromebook could keep going without a charge while lightly browsing the Internet. For more on how we tested, see [Appendix B](#). For detailed results, see [Appendix C](#).

We chose two systems that were as comparable as possible, and these systems share the same display size and the same amount of memory and storage. In addition to the processor, they differ in battery size, as the Intel processor-powered Chromebook has a 3-cell rather than a 2-cell battery. The Intel processor-powered Chromebook also has a list price that is almost \$50 less than that of the ARM processor-based model. For more on the representative systems, see [Appendix A](#).

BATTERY LIFE WHILE BROWSING

Battery life is important – who wants to worry about outlets and charging stations? We found that the Intel processor-powered Chromebook lasted 57 percent longer than the ARM processor-based Chromebook while lightly browsing the Internet—an additional 4 hours and 5 minutes without a charge (see Figure 1).



57% LONGER BATTERY LIFE

Figure 1: The amount of the time the two Chromebooks lasted unplugged while lightly browsing the Internet.

READING A TEXTBOOK AND TAKING NOTES ONLINE

Mateo opens his Chromebook and powers it on to do some homework. He opens Chrome™ and goes to his Kno™ online textbook, and then opens a new document in Google Docs to take notes. He reads and takes notes for a while, and then comes

upon something he doesn't know, so he searches Wikipedia for it. Then he goes back to reading his textbook and taking notes. He opens the BioDigital Human app to work with a 3D model. When he reaches a stopping point, he plays a Khan Academy video his teacher shared with the class. Toward the end of the video, Mateo remembers something a friend told him about earlier in the day, so he opens the New York Times app to read about it.

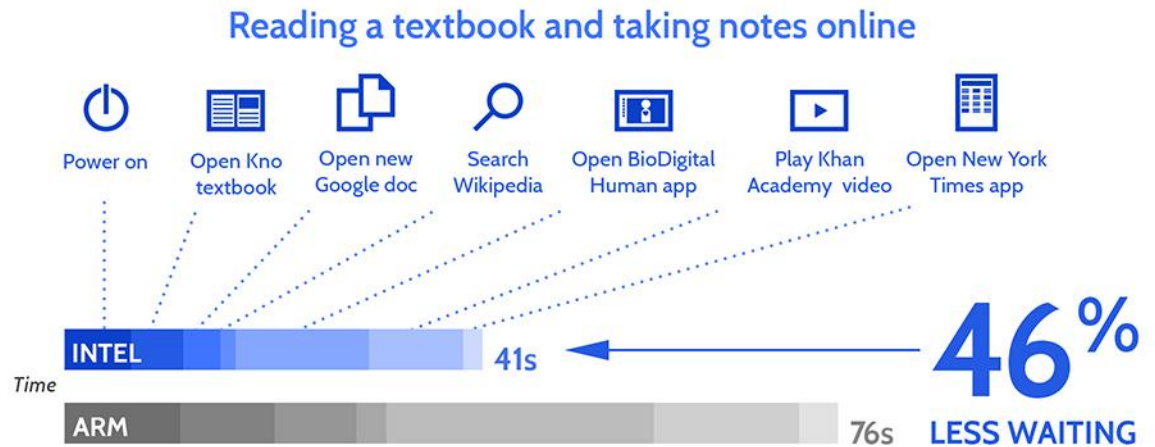


Figure 2: The amount of time spent waiting by the two Chromebooks in seven tasks when reading a textbook and taking notes online.

Mateo wouldn't want to wait 13 seconds longer for the BioDigital Human app to open on the ARM processor-based Chromebook.

As Figure 2 shows, the Intel processor-powered Chromebook required 46 percent less waiting than the ARM processor-based Chromebook. This means that if Mateo were using the Intel processor-powered Chromebook, he would spend only about half as much time waiting on his Chromebook. Instead of waiting longer for his system to turn on, he could be up and running and on his way to reading his biology textbook. Mateo wouldn't want to wait 13 seconds longer for the BioDigital Human app to open on the ARM processor-based Chromebook.

DOING MATH HOMEWORK ONLINE

Madison gets home from school and turns on her Chromebook to do her math homework. She opens the GeoGebra app and then opens her math notes that she has saved in a Google Docs document. She also opens the Design Something app to work with a 3D model. To prepare for her test the next day, she opens the CK-12 Parallel and Perpendicular Lines assessment. Then, Madison takes a break to watch a TED-Ed video her friend sent her.

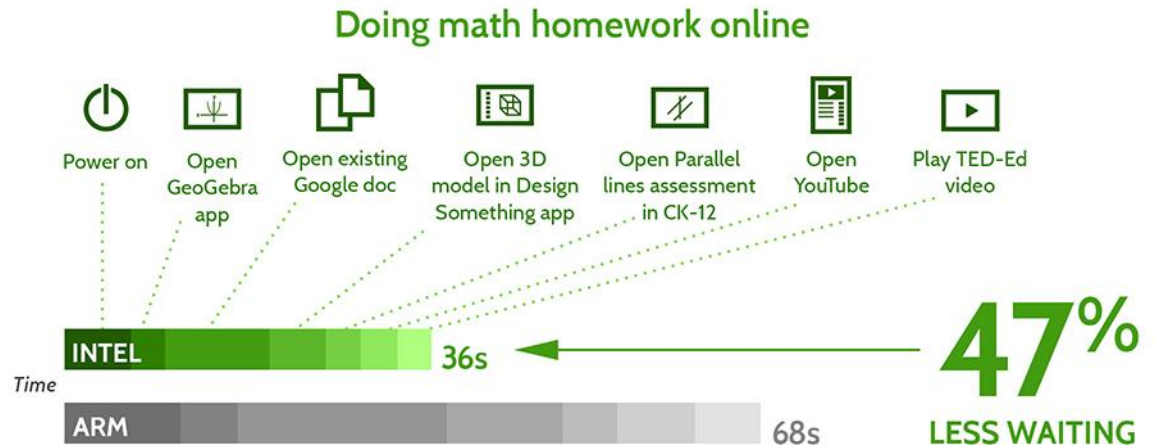


Figure 3: The amount of time spent waiting by the two Chromebooks in seven tasks when doing math homework online.

Madison would get frustrated waiting over 10 seconds longer to open her Google Docs document on the ARM processor-based Chromebook.

As Figure 3 shows, the Intel processor-powered Chromebook required 47 percent less waiting than the ARM processor-based Chromebook. Instead of getting frustrated waiting 10 seconds longer for the Google Docs document to open on her ARM processor-based Chromebook, Madison could be learning about parallel and perpendicular lines on her Intel processor-powered Chromebook. Madison’s teacher wouldn’t want her to wait almost 6 seconds longer just to open a 3D model on the ARM processor-based Chromebook.

CREATING AN ENGLISH PRESENTATION

Ethan has an English project to present on the use of metaphor in Romeo and Juliet. He turns on his Chromebook and searches for the TED-Ed video on Shakespearean Dating Tips. While watching the video, he opens Google Keep™ and takes some notes. He also goes to Wikipedia to search for some information on Shakespeare’s life and work. He then opens a new presentation in Google Slides and starts making slides. To talk about the metaphor of stars as eyes, he opens the Planetarium app and looks at some constellations. He also opens Google Maps™ and searches for Verona to look at the city in Street View™. When finished, Ethan rehearses to make sure he’s ready to present, going to Google Drive and opening his presentation to practice.

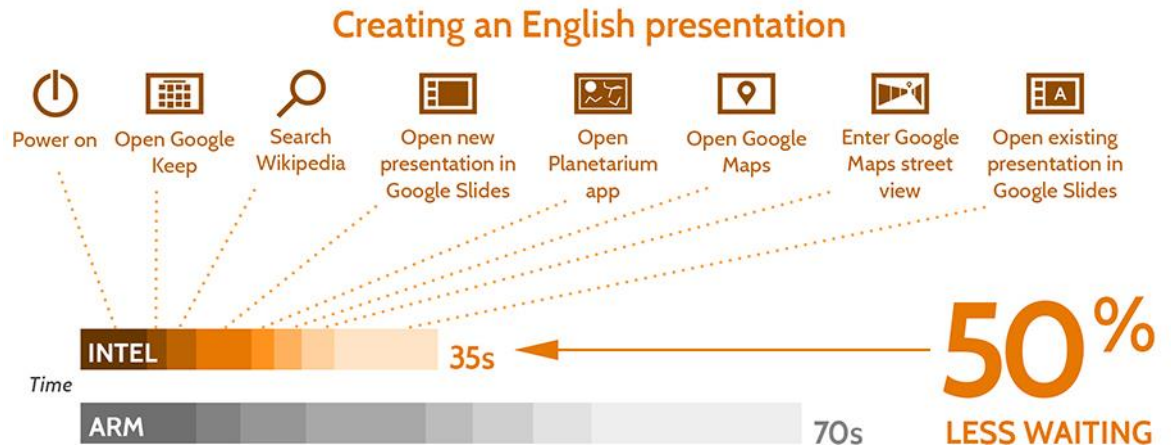


Figure 4: The amount of time spent waiting by the two Chromebooks in eight tasks when creating an English presentation.

Ethan would save 10 seconds when opening his presentation on the Intel processor-powered Chromebook.

As Figure 4 shows, the Intel processor-powered Chromebook required 50 percent less waiting than the ARM processor-based Chromebook. If Ethan were using the Intel processor-powered Chromebook, he wouldn't have to wait over 10 seconds longer each time he opens his Google Slides presentation, both at home when he's practicing or in class when he's presenting. Each app he would use to create his presentation – Google Keep, Planetarium, Google Maps—would take less time on the Intel processor-powered Chromebook.

TEAMING UP IN SCIENCE CLASS

Jada is working on a project in her third-period science class. She opens her spreadsheet in Google Sheets to prepare for their group lab later in the period. She also opens a new document in Google Docs to take notes that she can share with her group. She opens the PhET Build an Atom simulation and opens the Useful Periodic Table app to help her with the simulation. Eventually, the whole class gets stuck on a tough problem, and her teacher suggests that they all watch a Crash Course video on the nucleus. Jada searches for the video, and then plays it on the TV via Chromecast™.

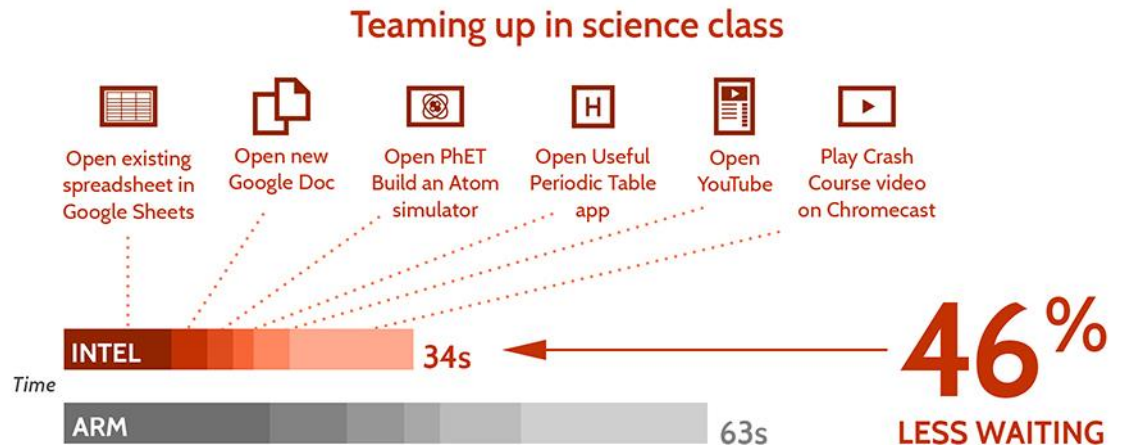


Figure 5: The amount of time spent waiting by the two Chromebooks in six tasks when teaming up in science class.

Jada’s teacher would lose almost 11 seconds opening YouTube and playing the video for the class when using the ARM processor-based Chromebook.

As Figure 5 shows, the Intel processor-powered Chromebook required 46 percent less time than the ARM processor-based Chromebook. This means that if Jada were using the Intel processor-powered Chromebook, she could be figuring out the structure of an atom instead of waiting for her spreadsheet to open. With the ARM processor-based Chromebook, she would be spending valuable class time waiting instead of learning. Jada’s teacher would lose almost 11 seconds opening YouTube and playing the video for the class when using the ARM processor-based Chromebook.

THE BOTTOM LINE

Which model is the best for students and teachers? The longer students must wait for apps or documents to open, the more opportunities there are for distractions like chatting and doodling, and the longer it takes to get to learning in the classroom or at home. We put two Chromebook models to the test, and found that the Intel processor-powered Chromebook required significantly less waiting than the ARM processor-based Chromebook, while also lasting significantly longer without a charge while lightly browsing the Internet. On top of that, the Intel processor-powered Chromebook has a list price of almost \$50 less than the ARM processor-based model.

The report card is clear: With the Intel processor-powered Chromebook, students can get to learning faster, waste less time waiting, and stay learning longer. Clearly, the Intel processor-powered Chromebook is the better choice for schools.

APPENDIX A: DETAILED SYSTEM CONFIGURATION

Figure 6 presents detailed information on the two Chromebooks we tested.

| System | Intel processor-powered Chromebook | ARM processor-based Chromebook |
|---------------------------|---|--------------------------------|
| Vendor and model | Acer® C720 Chromebook | Samsung® Chromebook |
| Processor | Intel Celeron® Processor 2955U (Haswell microarchitecture) | Samsung Exynos 5 Dual |
| Processor frequency (GHz) | 1.4 | 1.7 |
| Processor cores | 2 | 2 |
| Memory | 2GB DDR3L SDRAM | 2GB DDR3L SDRAM |
| Storage | 16GB SSD | 16GB SSD |
| Battery type | 3-cell Li-Polymer | 2 cell Li-Polymer |
| Battery capacity | 45 Wh | 30 Wh |
| Display | 11.6" (1,366 x 768) | 11.6" (1,366 x 768) |
| Wireless | 802.11 a/b/g/n | 802.11 a/b/g/n |
| Bluetooth | Bluetooth 4.0 compatible | Bluetooth 3.0 compatible |
| USB ports | 1 x USB 3.0 1 x USB 2.0 | 1 x USB 3.0 1 x USB 2.0 |
| System weight | 2.76 lbs. | 2.42 lbs. |
| OS | Chrome OS version 31.0.1650.61 | Chrome OS version 31.0.1650.61 |
| Firmware | Google_Peppy.4389.81.0 | Google_Snow.2695.117.0 |
| List Price | \$199.99 ¹ | \$249.00 ² |

Figure 6: Detailed configuration information for the two Chromebooks.

¹ As of 12/17/13 on Amazon.com.

² As of 12/17/13 on Amazon.com.

APPENDIX B: DETAILED TEST METHODOLOGY

Battery life while browsing

Setting up the test

1. Make sure the display will not automatically turn off during the test.
 - a. Install the Keep Awake extension.
 - b. Click the icon in the top-right corner of the Chrome browser to switch to the sun icon.
2. Click to open Google Chrome from the shelf, and bookmark the msn.com Web site.
3. Set the displays to as close as possible to 70 nits.
4. Plug the Chromebook chargers into a power strip.
5. Make sure the batteries are all 100 percent charged.
6. Place both Chromebooks next to the clock.

Running the test

1. Start the video camera.
2. Click to open Google Chrome, and go to the bookmarked Web site.
3. Turn the power strip off, and note the time.
4. After both Chromebooks have fully discharged, review the video to determine when each Chromebook powers off.
5. Fully charge the Chromebooks.
6. Repeat steps 1 through 5 two more times.

Reading a textbook and taking notes online

1. Simultaneously start the timer and press the power button.
2. Stop the timer when the login window appears, and record the result.
3. Enter the password, and press enter.
4. Click to open Chrome from the shelf.
5. Type `kno.com`, and press enter.
6. Select Course Manager.
7. Simultaneously start the timer and select the Campbell Biology textbook under My Stuff.
8. Stop the timer when the textbook is fully displayed, and record the result.
9. Simultaneously start the timer and select Google Docs from the shelf to open a new document.
10. Stop the timer when the document is fully displayed, and record the result.
11. Press `ctrl+t` to open a new Chrome tab.
12. Type `Wikipedia.org` and press enter.
13. Type `muscles`, and simultaneously start the timer and press enter.
14. Stop the timer when the Wikipedia page is fully displayed, and record the result.
15. Click to open the Chrome tab for the Kno textbook.
16. Click to open the Chrome tab for the document in Google Docs.
17. Click the apps list button, and simultaneously start the timer and click to open the BioDigital Human app.
18. Stop the timer when the BioDigital Human app is fully displayed, and record the result.
19. Click the apps list button, and simultaneously start the timer and click to open YouTube.
20. Click Watch Later.

21. Click to play the Khan Academy video.
22. Stop the timer when the video begins playing, and record the result.
23. Click the apps list button, and simultaneously start the timer and click to open the New York Times App.
24. Stop the timer when the New York Times App is fully displayed, and record the result.
25. Repeat steps 1 through 24 two more times.

Doing math homework online

1. Simultaneously start the timer and press the power button.
2. Stop the timer when the login window appears, and record the result.
3. Enter the password, and press enter.
4. Click the apps list button, and simultaneously start the timer and click to open the GeoGebra app.
5. Stop the timer when the GeoGebra app is fully displayed, and record the result.
6. Click the apps list button, and simultaneously start the timer and click to open Google Drive.
7. Click to open the existing document.
8. Stop the timer when the document is fully displayed, and record the result.
9. Click to open the Chrome tab for the GeoGebra app.
10. Click the apps list button, and click to open the Design Something app.
11. Simultaneously start the timer and click to open the pen holder model under Recent Models.
12. Stop the timer when the model is fully displayed, and record the result.
13. Press ctrl+t to open a new Chrome tab.
14. Type `ck12.org/geometry` and press enter.
15. Click to open the Parallel and Perpendicular Lines concept, and click on Assessments.
16. Simultaneously start the timer and select Parallel and Perpendicular Lines Practice.
17. Stop the timer when the assessment fully loads, and record the result.
18. Click the apps list button, and simultaneously start the timer and click to open YouTube.
19. Stop the timer when YouTube is fully displayed, and record the result.
20. Click Watch Later.
21. Simultaneously start the timer and click to play the TED-Ed video.
22. Stop the timer when the video begins playing, and record the result.
23. Repeat steps 1 through 22 two more times.

Creating an English presentation

1. Simultaneously start the timer and press the power button.
2. Stop the timer when the login window appears, and record the result.
3. Enter the password, and press enter.
4. Click the apps list button, and click to open YouTube.
5. Type `TED-Ed Shakespearean dating tips` and press enter.
6. Click the link for the TED-Ed video.
7. Click the apps list button, and simultaneously start the timer and open Google Keep.
8. Stop the timer when Google Keep is fully displayed, and record the result.
9. Click to open the Chrome tab for the TED-Ed video.
10. Press ctrl+t to open a new Chrome tab.

11. Type `Wikipedia.org` and press enter.
12. Type `Shakespeare`, and simultaneously start the timer and press enter.
13. Stop the timer when the Wikipedia page is fully displayed, and record the result.
14. Click to open the Chrome tab for the document.
15. Simultaneously start the timer and select Google Slides from the shelf to open a new presentation.
16. Stop the timer when the Presentation choose a theme screen is fully displayed, and record the result.
17. Select the Simple Light theme.
18. Click the apps list button, and simultaneously start the timer and click to open the Planetarium app.
19. Stop the timer when the Planetarium app is fully displayed, and record the result.
20. Click to open the Chrome tab for the presentation.
21. Click the apps list button, and simultaneously start the timer and click to open the Google Maps.
22. Stop the timer when Google Maps is fully displayed, and record the result.
23. Type `Verona, Italy` and press enter.
24. Drag the yellow pegman to the center of the city.
25. Simultaneously start the timer and release the pegman to enter Street View.
26. Stop the timer when Street View is fully displayed, and record the result.
27. Click to open the Chrome tab for the presentation.
28. Close the Chrome tab for the presentation.
29. Click to open the Chrome tab for the document in Google Docs.
30. Simultaneously start the timer and click Open Google Drive.
31. Click to open the existing presentation.
32. Stop the timer when the presentation is fully displayed, and record the result.
33. Repeat steps 1 through 32 two more times.

Teaming up in science class

1. Open the lid to resume from sleep.
2. Click the apps list button, and simultaneously start the timer and click to open Google Drive.
3. Click to open the existing spreadsheet.
4. Stop the timer when the spreadsheet is fully displayed, and record the result.
5. Simultaneously start the timer and select Google Docs from the shelf to open a new document.
6. Stop the timer when the document is fully displayed, and record the result.
7. Press `ctrl+t` to open a new Chrome tab.
8. Type `phet.colorado.edu/en/simulations/category/html` and press enter.
9. Simultaneously start the timer and click to open the Build an Atom simulation.
10. Stop the timer when the simulation is fully displayed, and record the result.
11. Click the apps list button, and simultaneously start the timer and click to open the Useful Periodic Table app.
12. Stop the timer when the Useful Periodic Table app is fully displayed, and record the result.
13. Click to open the Chrome tab for the simulation.
14. Click the apps list button, and simultaneously start the timer and click to open YouTube.
15. Stop the timer when YouTube is fully displayed, and record the result.
16. Type `Crash Course nucleus` and press enter.
17. Simultaneously start the timer and click the link for the Crash Course chemistry video.

18. Click to view the video on the TV via Chromecast.
19. Stop the timer when the video begins playing on the TV, and record the result.
20. Repeat steps 1 through 19 two more times.

APPENDIX C: DETAILED RESULTS

Figure 7 presents the detailed results for the two Chromebooks. We performed all tasks three times. We have based the findings in the body of this report on the median scores for each task.

| | Intel processor-powered Chromebook | ARM processor-based Chromebook |
|--|------------------------------------|--------------------------------|
| Battery life while browsing | | |
| Battery life while lightly browsing the Internet (higher is better) | | |
| Run 1 | 11:17:00.00 | 07:12:00.00 |
| Run 2 | 11:49:00.00 | 07:02:00.00 |
| Run 3 | 10:48:00.00 | 07:13:00.00 |
| Median | 11:17:00.00 | 07:12:00.00 |
| Reading a textbook and taking notes online | | |
| Time to turn on system (lower is better) | | |
| Run 1 | 00:06.50 | 00:11.50 |
| Run 2 | 00:06.50 | 00:11.30 |
| Run 3 | 00:06.50 | 00:11.30 |
| Median | 00:06.50 | 00:11.30 |
| Time to open Kno textbook (lower is better) | | |
| Run 1 | 00:05.00 | 00:09.00 |
| Run 2 | 00:05.20 | 00:09.40 |
| Run 3 | 00:05.10 | 00:09.20 |
| Median | 00:05.10 | 00:09.20 |
| Time to open new document in Google Docs (lower is better) | | |
| Run 1 | 00:03.60 | 00:08.00 |
| Run 2 | 00:03.60 | 00:08.00 |
| Run 3 | 00:03.80 | 00:07.80 |
| Median | 00:03.60 | 00:08.00 |
| Time to search Wikipedia (lower is better) | | |
| Run 1 | 00:01.50 | 00:02.90 |
| Run 2 | 00:01.50 | 00:02.90 |
| Run 3 | 00:01.60 | 00:02.70 |
| Median | 00:01.50 | 00:02.90 |
| Time to open BioDigital Human app (lower is better) | | |
| Run 1 | 00:13.10 | 00:26.40 |
| Run 2 | 00:12.70 | 00:26.10 |
| Run 3 | 00:13.00 | 00:26.10 |
| Median | 00:13.00 | 00:26.10 |
| Time to play Khan Academy video (lower is better) | | |
| Run 1 | 00:09.20 | 00:14.20 |
| Run 2 | 00:09.00 | 00:14.30 |
| Run 3 | 00:09.50 | 00:13.90 |
| Median | 00:09.20 | 00:14.20 |
| Time to open New York Times app (lower is better) | | |
| Run 1 | 00:01.90 | 00:03.80 |
| Run 2 | 00:01.90 | 00:03.80 |
| Run 3 | 00:01.90 | 00:03.90 |
| Median | 00:01.90 | 00:03.80 |
| Total time waiting | 00:40.80 | 01:15.50 |

| | Intel processor-powered Chromebook | ARM processor-based Chromebook |
|---|------------------------------------|--------------------------------|
| Doing math homework online | | |
| Time to turn on system (lower is better) | | |
| Run 1 | 00:06.50 | 00:11.30 |
| Run 2 | 00:06.40 | 00:11.20 |
| Run 3 | 00:06.50 | 00:11.40 |
| Median | 00:06.50 | 00:11.30 |
| Time to open GeoGebra app (lower is better) | | |
| Run 1 | 00:03.40 | 00:05.80 |
| Run 2 | 00:03.30 | 00:05.50 |
| Run 3 | 00:03.30 | 00:05.60 |
| Median | 00:03.30 | 00:05.60 |
| Time to open existing document in Google Docs (lower is better) | | |
| Run 1 | 00:09.90 | 00:20.60 |
| Run 2 | 00:10.20 | 00:20.30 |
| Run 3 | 00:10.30 | 00:20.40 |
| Median | 00:10.20 | 00:20.40 |
| Time to open 3D model in Design Something app (lower is better) | | |
| Run 1 | 00:05.30 | 00:11.10 |
| Run 2 | 00:05.50 | 00:11.30 |
| Run 3 | 00:05.50 | 00:11.50 |
| Median | 00:05.50 | 00:11.30 |
| Time to open CK-12 Parallel and Perpendicular Lines assessment (lower is better) | | |
| Run 1 | 00:03.50 | 00:05.20 |
| Run 2 | 00:03.40 | 00:05.30 |
| Run 3 | 00:03.10 | 00:05.40 |
| Median | 00:03.40 | 00:05.30 |
| Time to open YouTube (lower is better) | | |
| Run 1 | 00:03.50 | 00:07.60 |
| Run 2 | 00:03.60 | 00:07.40 |
| Run 3 | 00:03.70 | 00:07.90 |
| Median | 00:03.60 | 00:07.60 |
| Time play TED-Ed video (lower is better) | | |
| Run 1 | 00:03.30 | 00:06.40 |
| Run 2 | 00:03.40 | 00:06.50 |
| Run 3 | 00:03.30 | 00:06.20 |
| Median | 00:03.30 | 00:06.40 |
| Total time waiting | 00:35.80 | 01:07.90 |
| Creating an English presentation | | |
| Time to turn on system (lower is better) | | |
| Run 1 | 00:06.40 | 00:11.30 |
| Run 2 | 00:06.50 | 00:11.30 |
| Run 3 | 00:06.60 | 00:11.20 |
| Median | 00:06.50 | 00:11.30 |
| Time to open Google Keep (lower is better) | | |
| Run 1 | 00:01.90 | 00:04.30 |
| Run 2 | 00:01.80 | 00:04.50 |
| Run 3 | 00:01.90 | 00:04.20 |

| | Intel processor-powered Chromebook | ARM processor-based Chromebook |
|--|------------------------------------|--------------------------------|
| Median | 00:01.90 | 00:04.30 |
| Time to search Wikipedia (lower is better) | | |
| Run 1 | 00:02.80 | 00:06.20 |
| Run 2 | 00:02.90 | 00:06.40 |
| Run 3 | 00:03.10 | 00:06.60 |
| Median | 00:02.90 | 00:06.40 |
| Time to open new presentation in Google Slides (lower is better) | | |
| Run 1 | 00:05.30 | 00:11.70 |
| Run 2 | 00:05.40 | 00:11.90 |
| Run 3 | 00:05.50 | 00:11.60 |
| Median | 00:05.40 | 00:11.70 |
| Time to open Planetarium app (lower is better) | | |
| Run 1 | 00:02.30 | 00:04.60 |
| Run 2 | 00:02.20 | 00:04.50 |
| Run 3 | 00:02.20 | 00:04.60 |
| Median | 00:02.20 | 00:04.60 |
| Time to open Google Maps (lower is better) | | |
| Run 1 | 00:02.70 | 00:05.90 |
| Run 2 | 00:02.80 | 00:05.60 |
| Run 3 | 00:02.60 | 00:05.90 |
| Median | 00:02.70 | 00:05.90 |
| Time to enter Google Maps Street View (lower is better) | | |
| Run 1 | 00:03.10 | 00:05.70 |
| Run 2 | 00:03.20 | 00:05.90 |
| Run 3 | 00:03.30 | 00:05.50 |
| Median | 00:03.20 | 00:05.70 |
| Time to open existing presentation in Google Slides (lower is better) | | |
| Run 1 | 00:10.10 | 00:20.80 |
| Run 2 | 00:10.00 | 00:20.50 |
| Run 3 | 00:10.30 | 00:20.50 |
| Median | 00:10.10 | 00:20.50 |
| Total time waiting | 00:34.90 | 01:10.40 |
| Teaming up in science class | | |
| Time to open new spreadsheet in Google Sheets (lower is better) | | |
| Run 1 | 00:10.50 | 00:20.10 |
| Run 2 | 00:10.50 | 00:19.80 |
| Run 3 | 00:10.80 | 00:20.20 |
| Median | 00:10.50 | 00:20.10 |
| Time to open new document in Google Docs (lower is better) | | |
| Run 1 | 00:03.40 | 00:07.60 |
| Run 2 | 00:03.50 | 00:07.50 |
| Run 3 | 00:03.50 | 00:07.40 |
| Median | 00:03.50 | 00:07.50 |
| Time to open PhET Build an Atom simulation (lower is better) | | |
| Run 1 | 00:02.50 | 00:05.60 |
| Run 2 | 00:02.50 | 00:05.80 |
| Run 3 | 00:02.50 | 00:05.40 |

| | Intel processor-powered Chromebook | ARM processor-based Chromebook |
|--|------------------------------------|--------------------------------|
| Median | 00:02.50 | 00:05.60 |
| Time to open Useful Periodic Table app (lower is better) | | |
| Run 1 | 00:02.00 | 00:03.60 |
| Run 2 | 00:01.90 | 00:03.50 |
| Run 3 | 00:02.10 | 00:03.40 |
| Median | 00:02.00 | 00:03.50 |
| Time to open YouTube (lower is better) | | |
| Run 1 | 00:03.60 | 00:07.60 |
| Run 2 | 00:03.50 | 00:08.00 |
| Run 3 | 00:03.40 | 00:07.90 |
| Median | 00:03.50 | 00:07.90 |
| Time to play Crash Course video on Chromecast (lower is better) | | |
| Run 1 | 00:12.30 | 00:18.00 |
| Run 2 | 00:12.00 | 00:18.20 |
| Run 3 | 00:12.10 | 00:18.30 |
| Median | 00:12.10 | 00:18.20 |
| Total time waiting | 00:34.10 | 01:02.80 |

Figure 7: Detailed results.

ABOUT PRINCIPLED TECHNOLOGIES



Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.

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