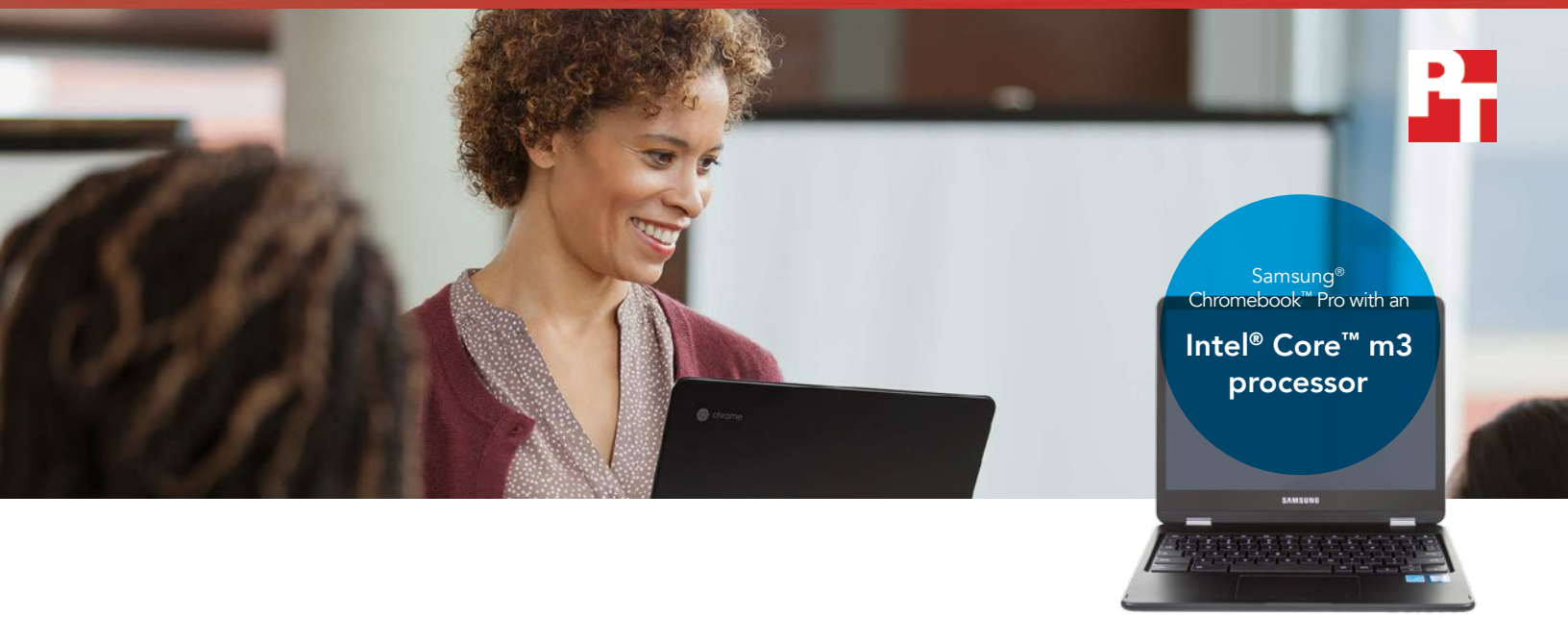

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Stay engaged in your academic work with a Chromebook powered by the Intel Core m3 processor

Tasks in everyday apps took less time to complete than with a Chromebook powered by the Intel Celeron N3150 processor

It's always been a challenge to keep students' attention in the lecture hall—and with the number of devices competing for a pupil's eyes and ears, it's getting even harder. When the technologies students use are fast and responsive, there are fewer opportunities for their minds to wander. And if you're using a Chromebook as an educator, you need a device that can keep up with the speed and volume of your students' work.

At Principled Technologies, we compared how long it took to complete common tasks in popular Android™ apps using two Chromebooks: the Samsung Chromebook Pro powered by the Intel Core m3 processor, and the Acer Chromebook R 11 powered by the Intel Celeron® N3150 processor. The Chromebook powered by the Intel Core m3 processor was faster, which could translate to less waiting for students and educators alike.

The next few pages describe a fictional scenario in which students, professors, and TAs use the Chromebooks we tested for their academic work. Read on to see how a Chromebook powered by the Intel Core m3 processor can add value throughout the day.

Intro: A student rivalry

Samara and Asa have been classroom rivals since the fifth grade. They're always trying to outdo each other—like when they both signed up for the hardest chemistry course at their university. Or when both of them bought Chromebooks for college. Samara chose the Intel Core m3 processor-powered Samsung Chromebook Pro, while Asa chose the Acer Chromebook R 11. Both students suspect their Chromebook is faster than the other's, but which one is right?

Samara

Samsung Chromebook Pro with Intel Core m3

Asa

Acer Chromebook R 11 with Intel Celeron N3150

Android apps for Chromebooks

Google is rolling out support for Android apps on many Chromebook devices. Being able to install apps from the Google Play store opens your Chromebook to new possibilities and functionality you can't get with older or unsupported models.

To learn more about Android apps and the Chromebooks that support them, visit https://sites.google.com/a/chromium.org/dev/chromium-os/chrome-os-systems-supporting-android-apps.

Students: Excel in the laboratory

Samara and Asa's chemistry professor is tough but fair. She created a detailed virtual lab manual as well as an Excel workbook loaded with guidance on capturing and analyzing data for their weekly experiments.

As the TA gives a brief overview of the day's experiment, Asa and Samara follow along in the lab manual and the workbook. Because Samara's Chromebook uses an Intel Core m3 processor, she previews their Excel workbook 17 seconds faster than Asa, who scrambles to catch up with the TA when his workbook finally loads.

It's the same story with starting and finishing the experiment: Samara can begin recording her data faster than Asa. And even though the two finish the experiment at the same time, Samara saves her work fast enough to take a leisurely stroll to the TA's desk to get her work checked, while Asa fumes at his Acer Chromebook from his workbench.

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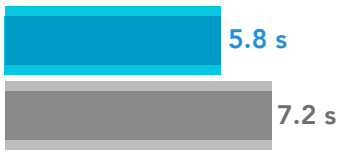

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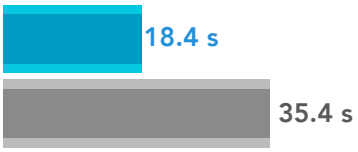

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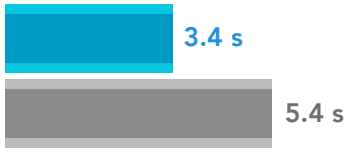

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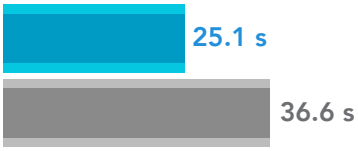
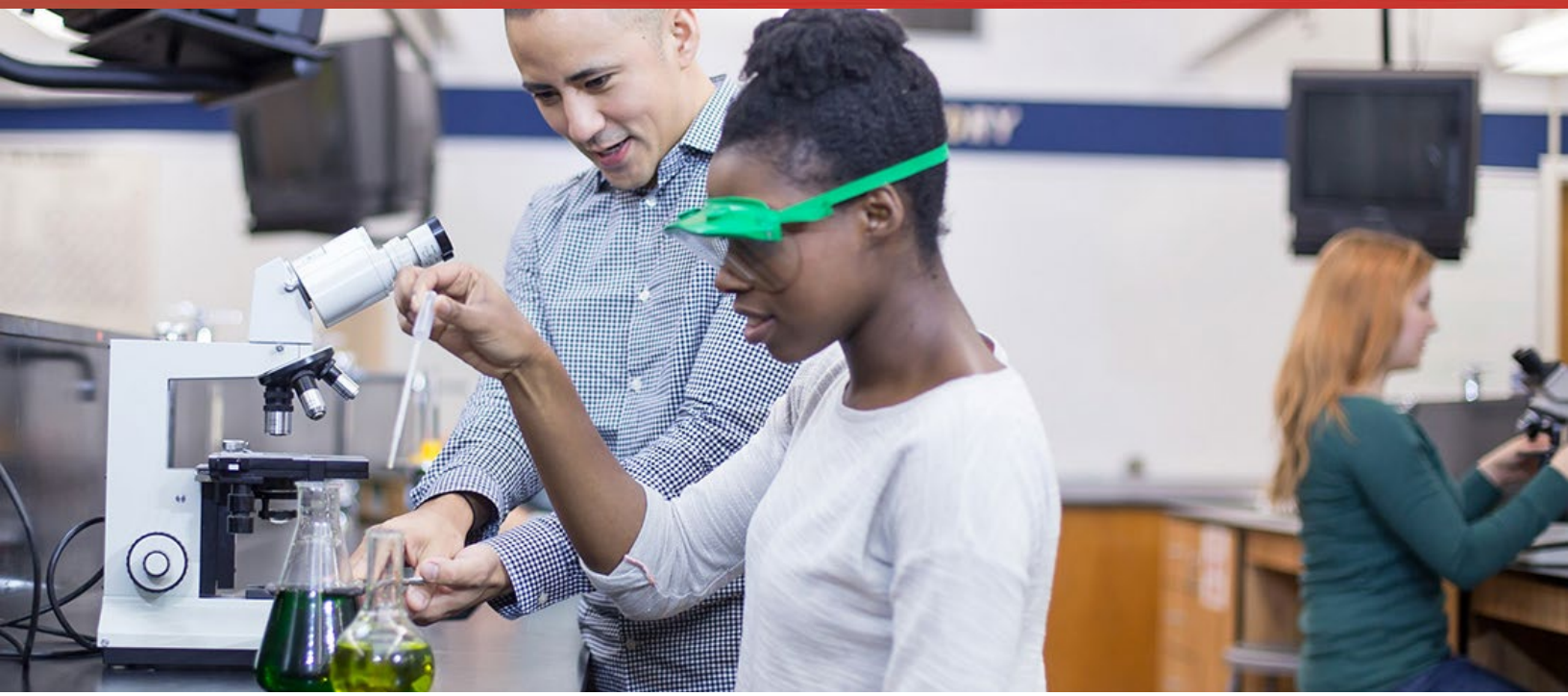


Intel Core m3 processor
(Samsung Chromebook Pro)

Intel Celeron N3150 processor
(Acer Chromebook R 11)

G Suite

Colleges and universities use G Suite to give students and faculty access to fast, intuitive productivity apps that promote a collaborative learning experience. Besides the apps we used in our tests, Google offers a whole host of others you can use to connect to colleagues, organize your life, and access your files from a central location. To learn more about G Suite, visit https://gsuite.google.com. To see how the apps work in action, visit the Google Play store and give them a spin.



TAs: Grading student work

After the students finish the experiment and save their data, the TA opens their spreadsheets to check for completion before heading home to grade their calculations. At the beginning of the year, this was no problem. But now, each student's workbook is a huge file that takes him longer and longer to preview from his Intel Celeron N3150 processor-powered Acer Chromebook R 11.

When Samara approaches the TA, he smiles, but has to make awkward conversation while he waits for his Chromebook to load a preview of her work.

"I got it—just, give me a minute. Or two."

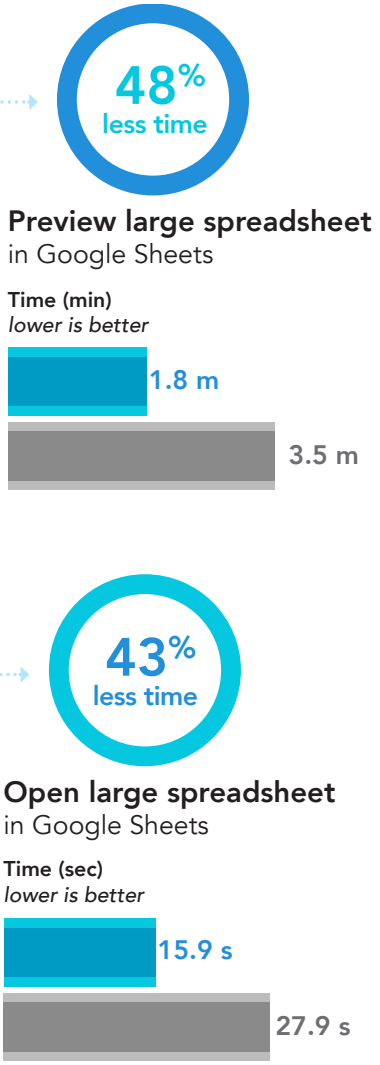
Three minutes later, still nothing. The TA frowns.

Asa saves his work and waits in line behind Samara. He wonders what's taking so long—but when he sees the TA's Chromebook, he understands, and sets in for the wait.

One by one, the students queue up before the TA's desk. He looks at the growing line and sighs. Previewing all their documents on his Chromebook will take forever, and the lab period is ending soon. He panics.

"Uh…if you sent me your data already, you can go. I'll just…grade these later."

As students shrug and leave, the TA thinks about how long it'll take to preview all these spreadsheets—let alone grade them afterwards! With all the other work he has to do, the TA is in for a long night.



Professors: Plan lectures and catch up with administrative duties

That night, the chemistry professor takes an hour to manage her research projects. The work goes by quickly, thanks to her Intel Core m3 processor-powered Samsung Chromebook Pro. When she's just about finished, she sees a message from a TA who works in her lab group:

Robert:
Results from the latest GC runs are up! By the way, grading the student work is gonna take a while. Sorry in advance!

Later on, the professor turns her attention to tomorrow's lecture. She queues up the images she'll use in her presentation, then edits and saves them all in turn. Next, she reviews a PDF handout before printing copies for her students to use in class.

With time to spare, she emails her TA to ask about the students' lab grades before closing her Chromebook to attend to her non-academic life.

31% less time

Open file
in Google Docs™

Time (sec)
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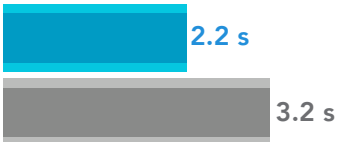

35% less time

Open PDF
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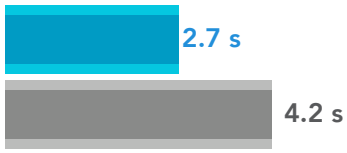

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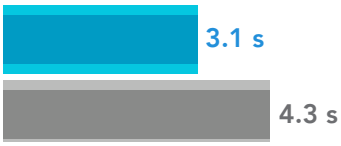

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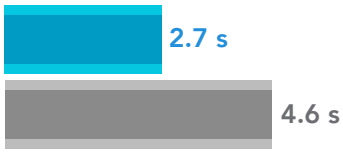


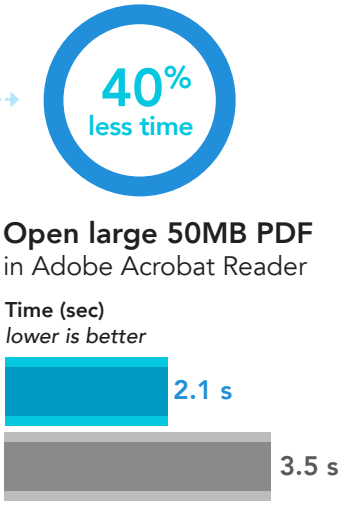
The next day's lecture: Start learning sooner

Samara arrives 10 minutes early to class and finds Asa smirking at her from the front row. He got there 20 minutes ago; if only his Chromebook were just as fast!

The professor sidles into class to explain what today's lecture is all about. She pauses to make an aside:

"We were going to review your lab data from yesterday, but it's taking a little longer than expected to grade…"

The professor asks her class to open their textbooks to page 394 as she begins the lecture. Samara and Asa both have virtual copies of the textbook, and double-click the 50MB PDF at the same time. Which Chromebook do you think loaded the textbook faster?



Conclusion

Educators and their students work diligently with their documents every day—so their Chromebooks should facilitate the work they do instead of getting in the way. Our tests demonstrated that a Chromebook powered by the Intel Core m3 processor was faster at many of these tasks than a Chromebook powered by the Intel Celeron N3150 processor, which could allow students to devote more time to projects, stay on task, and stay engaged longer. Educators could reap these time-saving benefits too, as they review student work and create class content for effective education. Though our scenario focused on a chemistry classroom, Chromebooks powered by an Intel Core m3 processor could keep any student or professor waiting less so they can focus on their education and career.

On June 12, 2017, we finalized the hardware and software configurations we tested. Updates for current and recently released hardware and software appear often, so unavoidably these configurations may not represent the latest versions available when this report appears. For older systems, we chose configurations representative of typical purchases of those systems. We concluded hands-on testing on June 13, 2017.

Appendix A: System configuration information

System	Samsung Chromebook Pro	Acer Chromebook R 11
Procesor	Intel Core m3-6Y30	Intel Celeron N3150
Processor freq (GHz)	0.9-2.2	1.6-2.08
Processor cores	2	4
Memory (GB)	4	4
Storage (GB)	32	32
Battery type	Li-Ion	Li-Ion
Battery capacity (Wh)	51	36
Display	12.3" 2,400 x 1,600	11.6" 1,366 x 768
Wireless	802.11 AC	802.11 AC
Bluetooth	4.0	4.0
USB ports	2x USB-C	1x USB 3.0, 1x USB 2
System weight (lbs.)	2.38	2.71
OS (version)	60.0.3112.20 dev (64-bit)	61.0.3129.0 dev (64-bit)
Build/firmware	Caroline.7820.286.0	Cyan.7287.57.100

Appendix B: How we tested

Creating the background workload

To simulate typical Chromebook use, we ran a combination of news, email, chat, document viewing, music, and social media websites in the background. For websites that required accounts, we created test profiles and logged in the users on each device.

1. From the shelf, open Chromebook settings.
2. Navigate to the On Startup section of the settings, and select Open a specific page or set of pages.
3. Select Open a specific page or set of pages, insert the following URLs, and click OK.
   - forbes.com
   - markets.ft.com/data
   - arstechnica.com
   - mail.google.com
   - slack.com
   - drive.google.com
   - docs.google.com
   - youtube.com/feed/music
   - sheets.google.com
   - twitter.com
   - facebook.com
4. Restart the Chromebook. Before testing, navigate through each tab to ensure that both devices have fully loaded all the same content.

Testing each application

Google Sheets

Saving a large Google Sheet as Excel document

1. Install Google Sheets from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf, and click Skip to skip the tutorial.
3. Close the app and reopen it by clicking on the Sheets icon on the shelf.
4. From the recent files screen, click the test Sheet to open it.
5. Click the menu icon from the top navigation bar.
6. Click Share & export, and click Save As…
7. With Excel (.xlsx) selected, start the timer and click OK.
8. When the saving dialog closes, stop the timer.

Preparing a print preview (large document)

1. From the shelf, click the Google Sheets icon to launch the app.
2. From the recent files screen, click the test Sheet to open it.
3. Click the menu icon from the top navigation bar.
4. Click Share & export, start the timer, and click Print.
5. When the print preview fully loads, stop the timer.

Opening a large-sized spreadsheet (Excel)

1. From the shelf, click the Google Sheets icon to launch the app.
2. From the recent files screen, start the timer and click the test Excel sheet to open it.
3. When the Excel sheet fully loads, stop the timer.

Google Photos

Saving an edited image as a copy

1. Install Google Photos from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf, and click Albums.
3. Click to open the Download folder.
4. Click to open the test image.
5. Click the pencil icon to open the editing menu.
6. Click Auto to apply automatic image correction.
7. Click the dropdown menu icon.
8. Start the timer, and click Save copy.
9. When the image finishes saving, stop the timer.

Adobe Acrobat Reader

Opening a downloaded PDF

1. Install Adobe Acrobat Reader from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf, and click the Local tab.
3. Click Allow to enable access to local device storage.
4. Start the timer, and click the test PDF file.
5. When the PDF fully loads, stop the timer.

Google Drive

Opening a Google Docs document

1. Install Google Drive from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf.
3. From the files list, start the timer and click the test Google Doc.
4. When the document fully loads, stop the timer.

Opening an Excel Sheet in Google Sheets

1. Launch the app from the shelf.
2. From the files list, click the dropdown menu icon next to the test Excel sheet.
3. Start the timer, and click Open With.
4. When the sheet fully loads, stop the timer.

Opening an Excel Sheet preview

1. Launch the app from the shelf.
2. From the files list, start the timer, and click the test Excel sheet thumbnail.
3. When the sheet fully loads, stop the timer.

Opening a Word Doc in Google Docs

1. Launch the app from the shelf.
2. From the files list, click the dropdown menu icon next to the test Word document.
3. Start the timer, and click Open With.
4. When the document fully loads, stop the timer.

Loading a print preview for eBook PDF

1. Launch the app from the shelf.
2. From the files list, click the thumbnail for the test PDF.
3. When the PDF loads, click the dropdown menu icon.
4. Start the timer, and click Print.
5. When the print preview fully loads, stop the timer.

Microsoft OneDrive

Printing a PDF

1. Install Microsoft OneDrive from the Google Play Store, and pin the app to the shelf.
2. Launch the app from the shelf.
3. From the Files list, click the test PDF document.
4. When the PDF loads, click the dropdown menu icon.
5. Click Print.
6. From the Print dialog screen, start the timer, and click Print.
7. When the print preview fully loads, stop the timer.

This project was commissioned by Intel Corp.