

Open new presentation template 27% faster in Prezi



Export presentation video 38% faster in Explain Everything



Download presentation to local projects 33% faster in Explain Everything

Boost student productivity with Chromebooks™ powered by the Intel® Celeron® N3450 processor

A quad-core device improved wait times for educational tasks, which could help to improve student learning and engagement

Your students deserve access to technologies that enhance the learning process, responsive technologies that minimize frustrating wait times for everyday activities. But fleet purchases are big investments—how do you know which device is right for your school? For many use cases, a device’s processor can help you to understand how the device will perform in day-to-day use. But sometimes, it’s complicated.

At Principled Technologies, we found that two versions of the same Intel Celeron N3450 processor-powered Chromebook performed differently on educational tasks. What was the difference? The number of cores the device’s processor contains. The more cores in a device’s processor, the more computations the device can handle at once. For tasks involving video, audio, and more, we found the quad-core Chromebook was faster than the dual-core version. Read on to see how this small difference can affect student learning.

The following pages describe a fictional scenario in which young students use their Intel processor-powered Chromebooks for classroom projects. Though the story is hypothetical, it's based on PT facts. For more detailed testing information, see the appendices beginning on [page 7](#).

Forging a future with quad-core Intel Celeron N3450 processor-powered Chromebooks

We've reported on how Intel processor-powered Chromebooks can help out in the classroom—but how well do they handle extra-curricular activities? Meet three students who have big plans for their futures, and see how they use quad-core Intel Celeron N3450 processor-powered Chromebooks to help them navigate their paths.

One sunny spring afternoon, a group of parents chat outside a high school. They're waiting for their kids to finish up with their various club activities when one parent mentions the school's new technology initiative. A couple weeks ago, the school bought new quad-core Intel Celeron N3450 processor-powered Chromebooks for all the kids to use. One parent wonders if the new devices are helping the students' academic achievement. Let's find out from the students themselves:



HP Chromebook x360





15%
less time

Render 720p video
in WeVideo

34%
less time

**Encode 720p video
with music track**
in PowerDirector

7%
less time

Merge tracks
in Soundtrap

11%
less time

Open City model
in Tinkercad

Producing videos with a quad-core Intel Celeron N3450 processor-powered Chromebook

Sophomore Alex's YouTube channel is full of funny, weird, engaging videos she makes in her spare time. But today, she's working on a special project for the AV club—the club that kickstarted her love of videography.

With her school's new quad-core Intel Celeron N3450 processor-powered Chromebooks, Alex saves valuable time when exporting drafts of her promo. That speed comes in handy—especially today, as Alex's father texts her that he's on his way to pick her up. Alex hits the export button for her latest creation, and she's out the door well before her father arrives.

Chromebooks in design club

Taylor has been playing with LEGO blocks since infancy, so it's no wonder she decided to join the school's computer-aided design club. With her school's quad-core Intel Celeron N3450 processor-powered Chromebook, Taylor can open 3D models over five seconds faster than the dual-core device. The device's touch screen also offers a more tactile, hands-on approach to envisioning 3D spaces on a computer.

WeVideo

Rating: 4.1/5 stars¹
Users: 5,000,000+¹

Featured on tech journalism sites such as TechCrunch, Wired, CNET, and more, the WeVideo Video Editor enables users to create beautiful videos and sync edits across different devices. In February 2018, the Video Editor app earned the distinction of an Android Excellence App.²

PowerDirector

Rating: 4.5/5 stars³
Installs: 10 million+³

An Editor's Choice app on the Google Play store, PowerDirector enables users to create and edit HD videos and share them on social media sites.

Soundtrap®

Rating: 4.1/5 stars⁴
Users: 100,000+⁴

Soundtrap is a web application for creating digital audio creations such as music, podcasts, language studies, and more. According to Soundtrap, more than 10,000 teachers worldwide trust their educational program.⁵

Tinkercad

Rating: 3.6/5 stars⁶
Users: 380,000+⁶

Tinkercad is a browser-based program for computer-aided design. Common Sense Media gave Tinkercad a 4/5-star rating, praising the app's pedagogical implications.⁷



Open new presentation template
in Prezi

Beginning a future in business with a quad-core Intel processor-powered Chromebook

From the day he learned how to spell entrepreneur, Zakarya knew he wanted to be a business leader. The only problem? He's shy and nervous whenever he gives presentations. That's why Zakarya joined his school's business entrepreneur club. Right now, they're working on business presentations to give at the end of the month.

Whether they're using the Prezi web app or the Explain Everything native Chrome app, making new presentations goes quickly. And when it's time to export the presentation video, the quad-core Intel Celeron N3450 processor-powered Chromebook is *really* fast, completing the job nearly two minutes faster than if he'd used the dual-core model.

All that time saved gives Zakarya ample opportunity to practice his public speaking skills for the upcoming presentations. He gives it his all, hardly noticing how much time has gone by before his mom rings his phone.

Prezi
Users: 100 million+⁸

Prezi is a tool that allows students and educators to create engaging animated presentations that enhance the learning process. In a 2017 study published in PLOS One, users rated Prezi presentations as "more organized, engaging, and persuasive" than presentations delivered without visuals or via Microsoft PowerPoint.⁹

Explain Everything
Users: 6,000,000+¹⁰

Explain Everything is an interactive whiteboard app where teachers and students can collaborate in real time. According to Tech Crunch, the Los Angeles public school district installed it on 70,000 educational tablets. The software can also be found on 50 percent of all educational iPads in the UK.¹¹



Launch app
Explain Everything



Open local presentation
in Explain Everything



Download presentation to local projects
in Explain Everything



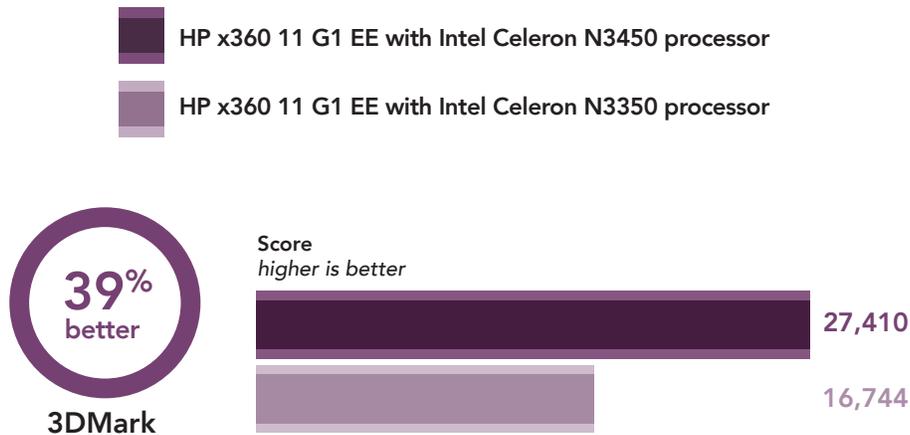
Export presentation video
in Explain Everything



Benchmark results

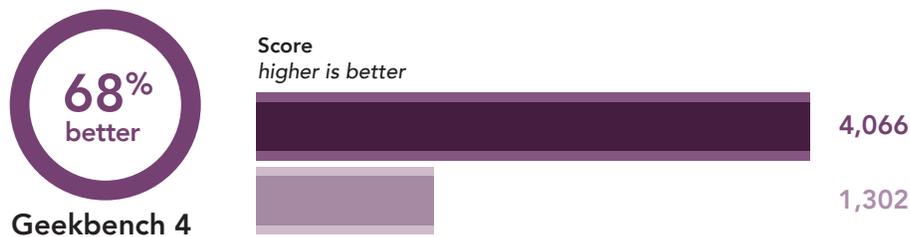
3DMark

Often used to assess performance on gaming devices, 3DMark tests the 3D graphics capabilities of smartphones, tablets, notebooks and more. In an academic setting, 3DMark can inform users on how well their device can render items such as CAD models.¹²



Geekbench 4

Because of its processor, the quad-core Intel Celeron N3450 processor-powered Chromebook scored 68 percent higher on the multicore Geekbench 4 test.





Conclusion

It pays to mind the model of processor in your school's Chromebook devices, but sometimes delving just a little deeper can save headache in the long run. We tested two Chromebooks with the same processor, and found that differences in the number of processor cores can have a broad effect on device speed: In our education-based tests, a Chromebook powered by quad-core Intel Celeron N3450 processors was faster than a dual-core version. As you continue your search for the perfect Chromebook, keep in mind how a quad-core Intel Celeron processor-powered device could improve user experience.



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<https://play.google.com/store/apps/details?id=com.wevideo.mobile.android>
- 2 WeVideo Awarded as Android Excellence App by Google," accessed April 25, 2018.
<http://www.prweb.com/releases/2018/02/prweb15220090.htm>
- 3 "PowerDirector Video Editor App: 4K, Slow Mo & More," Accessed May 7, 2018
https://play.google.com/store/apps/details?id=com.cyberlink.powerdirector.DRA140225_01
- 4 "Soundtrap –Make Music Online –Google Play Store," accessed April 25, 2018
<https://play.google.com/store/apps/details?id=com.soundtrap.studioapp>
- 5 "Soundtrap –Make Music Online," accessed May 7, 2018 <https://www.soundtrap.com/edu/>
- 6 "Tinkercad –Chrome Web Store," accessed April 25, 2018
<https://chrome.google.com/webstore/detail/tinkercad/bhggmehigifnplipbkdfcjjacpgidn>
- 7 "Tinkercad Review for Teachers | Common Sense Education," accessed April 25, 2018
<https://www.commonsense.org/education/website/tinkercad>
- 8 "Presentation Software | Online Presentation Tools | Prezi," accessed May 7, 2018 <https://prezi.com/>
- 9 Moulton ST, Türkay S, Kosslyn SM, "Does a presentation's medium affect its message? PowerPoint, Prezi, and oral presentations." PLoS ONE 12(7): e0178774. Accessed May 7, 2018
<https://doi.org/10.1371/journal.pone.0178774>
- 10 "Explain Everything | Interactive Whiteboard App," accessed April 25, 2018 <https://explaineverything.com/>
- 11 John Biggs, "Explain Everything, the digital whiteboard, raises \$3.7 million to bring learning to the iPad," accessed April 25, 2018 <https://techcrunch.com/2016/12/15/explaineverything-the-digital-whiteboard-raises-3-7-million-to-bring-learning-to-the-ipad/>
- 12 Ed Lopategui, "Benchmarks: time to put your CAD workstation to the test," accessed April 26, 2018
<https://blog.grabcad.com/blog/2016/03/16/benchmarks-cad-workstation/>

On April 20, 2018, 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 April 30, 2018.

Appendix A: System configuration information

System configuration information	HP Chromebook x360 11 G1 EE (dual core)	HP Chromebook x360 11 G1 EE (quad core)
Processor	Intel Celeron N3350	Intel Celeron N3450
Processor frequency (GHz)	1.10 - 2.40	1.10 – 2.20
Processor cores	2	4
Memory (GB)	4	4
Storage (GB)	32	32
Wireless	802.11 a/b/g/n/ac	802.11 a/b/g/n/ac
Bluetooth	4.2	4.2
USB	2x USB 3.1 Type C, 2x USB 3.1	2x USB 3.1 Type C, 2x USB 3.1
Battery type	Lithium-Ion	Lithium-Ion
Battery capacity (Wh)	47.36	47.36
Display	11.6" 1366x768	11.6" 1366x768
OS (version)	65.0.3325.209	65.3325.209
Build/firmware	Snappy.9042.167.0	Snappy.9042.167.0
System Weight (lbs.)	3.17	3.17

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.
 - a. reddit.com/r/pics
 - b. instagram.com/intel
 - c. simple.wikipedia.org
 - d. mail.google.com
 - e. slack.com
 - f. drive.google.com
 - g. docs.google.com
 - h. youtube.com/feed/music
 - i. sheets.google.com
 - j. twitter.com
 - k. facebook.com
4. Restart the Chromebook. Before testing, navigate through each tab to ensure that both devices have fully loaded all the same content.

Application testing

WeVideo Video Editor

Render a 720p video for free

1. Install WeVideo from the Google Play Store and pin the app to the shelf.
2. Launch the app from the shelf.
3. Click the green plus icon.
4. Delete the six-second title text.
5. Click the blue + icon.
6. Click Gallery.
7. Click Allow to enable access to device media storage.
8. From the folder browser, select the test footage, and click the green checkmark icon.
9. Click the paper airplane icon.
10. Simultaneously start the timer and click Save with watermark.
11. Stop the timer when the video fully renders.

SoundTrap

Merge tracks

1. From the Chrome browser, navigate to soundtrap.com.
2. Sign in with the test account.
3. From the landing page, click Enter Studio.
4. From the template selection screen, click Dubstep DEMO.
5. Click Settings from the horizontal dropdown menu, and click Merge Tracks...
6. Check each instrument track to be merged.
7. With all tracks selected, simultaneously start the timer and click Merge.
8. Stop the timer when merging completes.

Explain Everything

Launch App

1. Install Explain Everything from the Chrome Web Store, and pin the app to the shelf.
2. Start the timer and click the app icon from the shelf.
3. Stop the timer when the app fully loads.

Download presentation to local projects

1. Click the app icon from the shelf to open the Explain Everything application.
2. Click Dismiss to dismiss the "Switch to the Google Play Version" notification.
3. Click the telescope icon on the vertical sidebar on the left.
4. Select the Immune System Respons... project.
5. Click the blue Get icon.
6. Start the timer and click Download to local projects.
7. Stop the timer when the presentation downloads and fully opens.

Open immune system local presentation

1. Click the app icon from the shelf to open the Explain Everything application.
2. Start the timer and click on the Immune System Respons... project in Local Projects.
3. Stop the timer when the presentation fully loads.

Export presentation video

1. Click the app icon from the shelf to open the Explain Everything application.
2. Click the telescope icon on the vertical sidebar on the left.
3. Select the Could Mars Have Been H... project.
4. Click the blue Get icon.
5. Click Download to local projects.
6. When the project opens, click the up arrow on the horizontal task bar on the top of the page.
7. Click the Video tab.
8. Start the timer and click Save as...
9. Stop the timer when Compression fully completes.

PowerDirector

Encoding a 720p video with a music track

1. Install PowerDirector from the Google Play store and pin the app to the shelf.
2. Launch the app from the shelf and select Allow to enable access to device media storage.
3. Click the New Project icon and enter a name for the test project.
4. Click the Download folder and click the test footage to insert the footage onto the timeline.
5. Return to the main editing screen and press the layers icon.
6. Select the text icon to insert a title into the beginning of the clip. Name the title "Test HD Video."
7. Click the film and music icon on the main editing screen and then click the music note icon.
8. Click the Download folder and click the test music to insert the music onto the timeline.
9. Click the Export icon and click Produce video.
10. Click More Output Options.
11. With HD video resolution selected, start the timer and click Next.
12. When the video share screen appears, stop the timer.

Prezi

Open a new presentation template

1. From the Chrome browser, navigate to prezi.com.
2. Sign in with the test account.
3. Click New Presentation.
4. Click on the Sales & Marketing Proposal – Digital template.
5. Start the timer and click Use this template.
6. Stop the timer when all the presentation components fully load.

Tinkercad

Open city model

1. From the Chrome browser, navigate to tinkercad.com.
2. Click Gallery.
3. Click the City design.
4. Start the timer and click Duplicate and Tinker.
5. Stop the timer when the model fully loads.

Benchmark tests

Speedometer 2.0

1. From the Chrome browser, navigate to mozilla.github.io/arewefastyet-speedometer/2.0/
2. Click Start Test.
3. Record the result once benchmark is complete.

3DMark - The Gamer's Benchmark

1. Install 3DMark – The Gamer's Benchmark from the Google Play Store.
2. Open 3DMark and click OK to give permission to the app to run the benchmarks.
3. Click Allow to allow 3DMark to access photos, and other media on the device.
4. Click Skip to skip the tutorial.
5. Navigate to Ice Storm and click the download icon to install the benchmark.
6. Press the play icon to run the benchmark.
7. Record the result once benchmark is complete.

Geekbench 4 CPU and Compute Benchmark

1. Install Geekbench 4 from the Google Play Store.
2. Open Geekbench 4 and click Accept to agree to the license terms.
3. Click Run CPU Benchmark.
4. Record the results once benchmark is complete.
5. Click the back icon to return to the main screen.
6. Click Compute.
7. Click Run Compute Benchmark.
8. Record the result once benchmark is complete.

Our results

The tables below contain detailed results from our testing. All times are in seconds.

Task	HP Chromebook x360 11 G1 EE with dual-core Intel Celeron N3350	HP Chromebook x360 11 G1 EE with quad-core Intel Celeron N3450	Percentage difference
WeVideo Video Editor			
Render 720p video for free	189.0	161.2	15%
Soundtrap			
Merge tracks (dubstep demo)	40.9	37.9	7%
Explain Everything			
Launch app	7.6	5.3	30%
Open local presentation (immune system)	21.2	15.3	28%
Download presentation to local projects	72.2	48.5	33%
Export 80-second presentation video	307.7	191.2	38%
PowerDirector			
Encode 720p video with music track	712.1	467.9	34%
Prezi			
Open new presentation template	29.8	21.7	27%
Tinkercad			
Open City model	52.5	46.8	11%

This project was commissioned by Intel Corp.



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