



Dell Chromebook™ 3100 powered by an Intel® Celeron N4000 processor

Teachers:
Up to 62% less
time to finish
instructional
tasks*

Students:
Up to 40%
less time to
perform coding
tasks*

Students:
Up to 77% less
time to finish
multimedia
tasks*

Provide your students and faculty with faster Chromebooks

A Dell Chromebook powered by an Intel Celeron N4000 processor completed tasks in education apps faster than a Chromebook with an AMD processor as well as one with a MediaTek processor*

At Principled Technologies, we performed tasks in educational apps using three different Chromebooks:

- Dell Chromebook 3100 powered by an Intel Celeron N4000 processor
- HP Chromebook 11A G6 EE with an AMD A4-9120C processor
- Lenovo 100e Chromebook (2nd Gen) with a MediaTek 8173C processor

We found that the Intel Celeron N4000 processor-powered Dell Chromebook 3100 saved time during several tasks. We also found that the Dell Chromebook 3100 had a longer battery life than either of the other Chromebooks.*

Time is a precious resource for teachers and students alike. Teachers must plan for upwards of seven classes and keep up with the progress of dozens of students each day. Students have their work cut out for them too—having to take those classes and complete hours of in-class assignments and homework each day. Because they have so much to do, teachers and students would greatly benefit from technology that saves them time.

*See the science behind this report for detailed system configurations and benchmark results.

Teachers: Complete planning tasks in less time

With limited (and sometimes nonexistent) planning periods, teachers need to make the most of the time they have for creating lesson plans and class materials. Teachers that use faster technologies may be more productive in this regard. In our tests, the Dell Chromebook 3100 powered by an Intel Celeron N4000 processor saved time on tasks in the popular classroom instruction app Explain Everything. For example, when exporting a presentation video, the Dell Chromebook saved 1 minute, 17 seconds over an HP Chromebook powered by an AMD A4-9120C processor and 46 seconds over a MediaTek processor-powered Chromebook from Lenovo.*



In this report, text in light violet sections like this one represent fictional scenarios based on the results of PT testing.

Open presentation with Explain Everything

Time (sec) | lower is better



up to **48%** less time*

Export presentation video with Explain Everything

Time (sec) | lower is better



up to **62%** less time*

Chromebooks in the computer science classroom

Lovelace Middle School recently invested in new Dell Chromebook 3100 devices powered by Intel Celeron N4000 processors, and Amy Sands' digital technology classes are among the first to try them out. Ms. Sands has the perfect use in mind—a huge class project that will teach the kids tons about coding and multimedia applications, with the potential to help change the school for the better.

Today, Ms. Sands is putting the finishing touches on her class materials, grateful for the school's new Dell Chromebook 3100 fleet. As her weekly planning session draws to a close, Ms. Sands exports the video presentation explaining the new project and manages to put away her Chromebook just in time for class.

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- Lenovo Chromebook (2nd Gen) 11A G6 EE with a MediaTek 8173C processor

Explain Everything

Explain Everything is an interactive whiteboard app where teachers and students can collaborate in real time.¹ According to Tech Crunch, the Los Angeles public school district installed it on 70,000 educational tablets. In 2014, the software could be found on 50 percent of all educational iPads in the UK.²

*See the science behind this report for detailed system configurations and benchmark results.



Open a lesson with Trinket

Time (sec) | lower is better



up to **21%** less time*

Open the Switch Case Challenge with Trinket

Time (sec) | lower is better



up to **26%** less time*

Open the Java editor with Repl.it

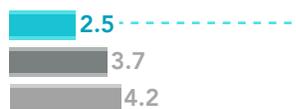
Time (sec) | lower is better



up to **27%** less time*

Render a video with VidCode

Time (sec) | lower is better



up to **40%** less time*

Trinket

Trinket allows users to create, run, and share code from their device and browser of choice. The company offers free support for educators who wish to use the web application for classroom instruction.⁴

*See [the science behind this report](#) for detailed system configurations and benchmark results.

Less time to complete coding tasks

According to a 2014 national survey from University of Phoenix, middle school students taking five classes in a semester could expect to have 3.2 hours of homework to complete each night.³ Students who take care of their homework while juggling extra-curricular activities and their social lives will appreciate a device that respects their time. The Dell Chromebook 3100 enabled us to complete four coding tasks in three apps faster than either competing device.*



Ms. Sands opens class and reveals the next big assignment: The students will group together and create a simple app that staff can use to track various aspects of the school's carbon footprint. Their new Dell Chromebooks mean less waiting during their coding process.

The computer science class will also collaborate with Ms. Sands' multimedia class to develop videos that showcase the app and highlight the school's sustainability efforts in an effort to enact real change at the school—read on to see how new Chromebooks help these students as well.

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Repl.it

Repl.it is an online programming environment that allows users to create applications, tools, and more all from within their browser.⁵ According to TechCrunch, Repl.it supports "virtually every programming language you can think of," and has over 200,000 active weekly users.⁶

VidCode

VidCode is a coding platform focused on creativity and learning. The company positions VidCode as "a Computer Science classroom in a box with creativity at the core," and allows student to get a feel for basic programming by teaching them to create video effects, photo filters, and more.⁷

Complete tasks in multimedia apps in less time

Multimedia applications are often among the most resource-intensive computing tasks. For students or faculty who need to edit video and audio, or explore and create 3D models, investing in an Intel Celeron N4000 processor-powered Dell Chromebook 3100 could present significant time savings. For example, the Dell Chromebook saved nearly three minutes on rendering a one-minute video compared to the MediaTek 8173C processor-powered Chromebook from Lenovo, and it saved more than 30 seconds compared to the AMD A4-9120C processor-powered Chromebook from HP.*

Students in the multimedia class are excited to work with the computer science students on their sustainability project. The apps they use for class, such as Soundtrap, WeVideo Video Editor, and Tinkercad all run quickly, enabling the students to iterate on their video drafts frequently and with minimal hassle.

WeVideo Video Editor

Featured on tech journalism sites such as TechCrunch, Wired, CNET, and more, the WeVideo Video Editor enables users to create beautiful videos and share them with the world.⁵ In February 2018, the Video Editor app earned the distinction of an Android Excellence App.⁹

Soundtrap®

Soundtrap is a web application for creating digital audio works such as music, podcasts, language studies, and more.¹⁰ According to Soundtrap, more than 10,000 teachers worldwide trust their educational program.¹¹

Tinkercad

Tinkercad is a browser-based program for computer-aided design.¹² Common Sense Education® gave Tinkercad a 4/5-star rating, enthusiastic about the app's pedagogical implications.¹³

View a project from the gallery with WeVideo

Time (sec) | lower is better



up to
77%
less time*

Load the design gallery with Tinkercad

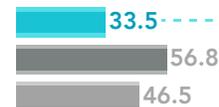
Time (sec) | lower is better



up to
55%
less time*

Open the city model with Tinkercad

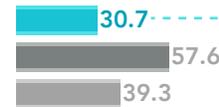
Time (sec) | lower is better



up to
41%
less time*

Merge tracks with Soundtrap

Time (sec) | lower is better



up to
47%
less time*



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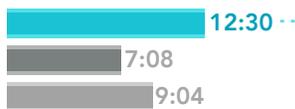


Battery life

We used the power_LoadTest extension from Google to estimate the battery life for the three Chromebook systems in this report. In our tests, the Intel Celeron N4000 processor-powered Dell Chromebook 3100 had a significantly longer battery life at an estimated 12 hours, 30 minutes compared to 7 hours, 8 minutes for the AMD A4-9120C processor-powered Chromebook and 9 hours, 4 minutes for the MediaTek 8173C processor-powered Chromebook.* The amount of time you can go between charges can vary based on a number of factors, but our results suggest students would be able to get more mileage out of their Dell Chromebook 3100 devices. This could be useful for outdoor classroom activities or field trips where power outlets are in short supply.

Battery life

Time (min:sec) | higher is better



up to
43%
more*



Ms. Sands takes her multimedia class on a trip around the school to help the students scout locations for their sustainability videos. Even though some of the Chromebooks haven't gotten a chance to recharge since last period, she's confident the long battery life of the Intel Celeron N4000 processor-powered Dell Chromebooks will get them through the day.



- Dell Chromebook 3100 with an Intel Celeron N4000 processor
- HP Chromebook 11A G6 EE with an AMD A4-9120C processor
- Lenovo Chromebook (2nd Gen) 11A G6 EE with a MediaTek 8173C processor

Dell Chromebook 3100 powered by an Intel Celeron N4000 processor

*See the science behind this report for detailed system configurations and benchmark results.



Two months later and the projects are in! Each group of students presents their app and video in class, where the school's principal sits to admire all the hard work that went into the sustainability apps. It's clear that the Intel Celeron N4000 processor-powered Dell Chromebooks were a great investment. And after each group has presented, the students have made a case for investing in the school's sustainability efforts as well.

Conclusion

Investing in student success means supplying classrooms with resources they need to work and create efficiently. In our tests, an Intel Celeron N4000 processor-powered Dell Chromebook 3100 completed tasks in several education apps faster than two Chromebooks based on the AMD A4-9120C processor and the MediaTek 8173C processor.* We also found that the Dell Chromebook 3100 had a significantly longer battery life compared to the other devices at an estimated 12 hours and 30 minutes of normal use.*

*See the science behind this report for detailed system configurations and benchmark results.

- 1 "Explain Everything | Interactive Whiteboard With Real-Time Communication," accessed June 10, 2019
<https://explaineverything.com/>
- 2 John Biggs, "Explain Everything, the digital whiteboard, raises \$3.7 million to bring learning to the iPad," accessed June 10, 2019
<https://techcrunch.com/2016/12/15/explaineverything-the-digital-whiteboard-raises-3-7-million-to-bring-learning-to-the-ipad/>
- 3 University of Phoenix College of Education, "Homework Anxiety: Survey Reveals How Much Homework K-12 Students Are Assigned and Why Teachers Deem It Beneficial," accessed June 10, 2019
<https://www.marketwatch.com/press-release/homework-anxiety-survey-reveals-how-much-homework-k-12-students-are-assigned-and-why-teachers-deem-it-beneficial-2014-02-25>
- 4 "Trinket," accessed June 10, 2019
<https://trinket.io/>
- 5 "Repl.it – The world's leading online coding platform," accessed June 10, 2019
<https://repl.it/>
- 6 Frederic Lardinois, "Repl.it lets you program in your browser," accessed June 10, 2019
<https://techcrunch.com/2018/03/15/repl-it-lets-you-program-in-your-browser/>
- 7 "VidCode: Creative coding in every school," accessed June 10, 2019
<https://vidcode.com>
- 8 "Video Editor – Apps on Google Play," accessed June 10, 2019
<https://play.google.com/store/apps/details?id=com.wevideo.mobile.android>
- 9 "WeVideo Awarded as Android Excellence App by Google," accessed June 10, 2019
<https://www.wevideo.com/news/WeVideo-Awarded-as-Android-Excellence-App-by-Google>
- 10 "Soundtrap – Make Music Online – Google Play Store," accessed April 25, 2018,
<https://play.google.com/store/apps/details?id=com.soundtrap.studioapp>
- 11 "Soundtrap – Make Music Online," accessed May 7, 2018
<https://www.soundtrap.com/edu/>
- 12 "Tinkercad – Chrome Web Store," accessed April 25, 2018
<https://chrome.google.com/webstore/detail/tinkercad/bhggmehigifnplipbkdfcjjacpcgidn>
- 13 "Tinkercad Review for Teachers | Common Sense Education," accessed April 25, 2018,
<https://www.commonsense.org/education/website/tinkercad>

We concluded our hands-on testing on June 10, 2019. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on May 29, 2019 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

The table below presents our findings in detail.

Task	Dell Chromebook 3100 with an Intel Celeron N4000 processor	HP Chromebook 11A G6 EE with an AMD A4-9120C processor	Lenovo Chromebook (2nd Gen) 11A G6 EE with a MediaTek 8173C processor	Percentage win
Explain Everything				
Open presentation	1.9	3.7	3.0	up to 48%
Export presentation video	47.5	125.4	93.6	up to 62%
Trinket				
Open a lesson	5.2	6.6	6.3	up to 21%
Open the Switch Case Challenge	4.0	5.5	6.5	up to 26%
Repl.it				
Open the Java editor	4.9	6.7	6.5	up to 27%
VidCode				
Render a video	2.5	3.7	4.2	up to 40%
WeVideo				
View a project from the gallery	50.0	83.2	219.6	up to 77%
Tinkercad				
Load the design gallery	3.8	8.5	5.9	up to 55%
Open the city model	33.5	56.8	46.5	up to 41%
Soundtrap				
Merge tracks	30.7	57.6	39.3	up to 47%

Battery life results

Devices	Time	Percentage win
Dell Chromebook 3100 with an Intel Celeron N4000 processor	12:30	N/A
HP Chromebook 11A G6 EE with an AMD A4-9120C processor	7:08	43%
Lenovo Chromebook (2nd Gen) 11A G6 EE with a MediaTek8173C processor	9:04	27%

System configuration information

The table below presents detailed information on the systems we tested.

Device configuration information	Dell Chromebook 3100 with an Intel Celeron N4000 processor	HP Chromebook 11A G6 EE with an AMD A4-9120C processor	Lenovo Chromebook (2nd Gen) 11A G6 EE with a MediaTek 8173C processor
Operating system			
OS name and version/build number	Chrome OS 74.0.3729.159	Chrome OS 74.0.3729.159	Chrome OS 74.0.3729.159
Build/firmware version	Google_Fleex.11297.29.0	Google_Grunt.11031.44.0	Google_Hana.8438.170.0
Processor			
Vendor and model	Intel Celeron N4000	AMD A4-9120C	MediaTek 8173C
Core count (per processor)	2	2	4
Core frequency (GHz)	2.6	1.6	2.1
Miscellaneous			
Memory (GB)	4	4	4
Storage (GB)	16	16	32
Bluetooth	5.0	4.2	4.1
USB	2x USB 3.1 Gen1, 2x USB Type C	2x USB 2.0, 2x USB Type C	1x USB 3.0, 1x USB Type C
Battery type	Lithium-Ion	Lithium-Ion	Lithium-Ion
Battery capacity (Wh)	42	47	42
Display	11.6" 1366x768	11.6" 1366x768	11.6" 1366x768
System Weight (lbs.)	2.85	2.80	2.68

How we tested

Creating the background workload

To simulate typical Chromebook use, we ran a combination of news, email, chat, music, document viewing, 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.
3. Select Open a specific page or set of pages.
4. Insert the following URLs, and click OK.
 - Forbes.com
 - Markets.ft.com/data
 - Arstechnica.com
 - mail.google.com
 - slack.com (logged into Slack chat, #general channel)
 - drive.google.com
 - docs.google.com (viewing document)
 - youtube.com/feed/music
 - drive.google.com (viewing document)
 - sheets.google.com (viewing spreadsheet)
 - twitter.com
 - facebook.com
5. Restart the Chromebook. Before testing, navigate through each tab to ensure that both devices have fully loaded the same content.

Application testing

Explain Everything

Opening a local presentation

1. From the Google Play store, install Explain Everything. Pin the app to the shelf.
2. Launch the Explain Everything app from the shelf.
3. Simultaneously start the timer and click the test project.
4. When the test project fully loads, stop the timer.
5. Exporting a presentation as a project
6. From the shelf, launch the Explain Everything app.
7. Click the test project.
8. Click Share, then click Export.
9. On the Export project screen, select Project.
10. For the source, click Local storage.
11. Simultaneously start the timer and click Export.
12. When the Export successful message appears, stop the timer.

Trinket

Opening the “From Block to Code” lesson

1. From the Chrome browser, navigate to <https://trinket.io>.
2. Sign in with your Google account.
3. Click Learn.
4. Simultaneously start the timer and click Let’s Go under From Blocks to Code.
5. When the project editor fully loads, stop the timer.

Opening the Switch Case Challenge

1. From the Chrome browser, navigate to <https://trinket.io>.
2. Sign in with your Google account.
3. Click Learn.
4. Simultaneously start the timer and click Switch Case Challenge.
5. When the project editor fully loads, stop the timer.

Repl.it

Opening the Java editor

1. From the Chrome browser, navigate to <https://repl.it>.
2. Sign in with your Google account.
3. Click the red plus icon, and select All languages.
4. Simultaneously start the timer and click Java.
5. When the project editor fully loads, stop the timer.

VidCode

Viewing a project from the gallery

1. From the Chrome browser, navigate to <https://app.vidcode.io>.
2. Click Gallery.
3. Simultaneously start the timer and click the Eclipse 2017 project.
4. When video playback begins, stop the timer.

WeVideo Video Editor

Rendering a 720p video

1. From the Google Play store, install WeVideo. Pin the app to the shelf.
2. Launch the WeVideo app from the shelf.
3. Click the green plus icon.
4. Delete the six-second title text.
5. Click the blue plus 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. When the video fully renders, stop the timer.

Tinkercad

Loading the design gallery

1. From the Chrome browser, navigate to tinkercad.com.
2. Simultaneously start the timer and click Gallery.
3. When the page fully loads, stop the timer.

Opening the City model

1. From the Chrome browser, navigate to tinkercad.com.
2. Click Gallery.
3. Click the City design.
4. Simultaneously start the timer and click Duplicate and Tinker.
5. When the model fully loads, stop the timer.

SoundTrap

Merging two tracks

1. From the Google Play store, install SoundTrap. Pin the app to the shelf.
2. Launch the SoundTrap app from the shelf.
3. From the template selection screen, click Dubstep DEMO.
4. From the horizontal dropdown menu, click Settings, and click Merge Tracks...
5. Select all of the instrument tracks.
6. Simultaneously start the timer and click Merge.
7. Stop the timer when merging completes.

Battery Life Testing

We used Google's power_LoadTest Chrome extension to estimate battery life. After installing the extension, we charged each device to 100% battery, and clicked the extension icon to begin the test. After an hour passed and the test completed, we recorded the battery life. To calculate the estimated battery life, we used the following formula: $100 / (\text{battery_}\%_{\text{start}} - \text{battery_}\%_{\text{end}})$. We performed the following steps to complete testing:

1. Download the power_LoadTest extension and untar the package to a folder on the Chromebook: https://chromium.googlesource.com/chromiumos/third_party/autotest+/refs/heads/master/client/site_tests/power_LoadTest/README.md
2. Navigate to chrome://extensions and enable Developer mode.
3. Click Load unpacked extension.
4. Choose the power_LoadTest extension folder.
5. Restart each device.
6. Wait until each device is fully charged. Before testing, unplug the devices.
7. Open a Chrome browser, and click the power_LoadTest extension icon to start the test.
8. When the test completes, note the percent charge remaining.

FTC disclaimer

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations, and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information, visit www.intel.com/benchmarks.

Estimated results disclosure

Results have been estimated or simulated using internal Principled Technologies analysis or architecture simulation or modeling, and provided to you for informational purposes. Any differences in software or configuration may affect your actual performance.

General technology disclaimer

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This project was commissioned by Intel.



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