



## Handle cutting-edge education apps with new Intel Core processor-powered Chromebooks

### Faster Intel processors in current-gen Chromebooks can let students learn with less time spent waiting on apps

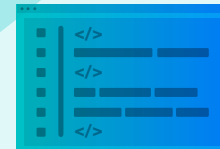
Millions of students around the world use educational apps for an enhanced classroom experience. Newer, more hardware-demanding apps enter the market every day, and existing apps tend to add features and functionality that push the limits of mobile computing power. That means when investing in Chromebooks for classroom use, you shouldn't just pay attention to current needs. While you could purchase less powerful devices at a lower cost, a higher investment could net you a device that's better equipped to handle applications as time goes on.

At Principled Technologies, we compared the app performance and feature sets of two Chromebooks: The Intel Core m3 processor-powered HP Chromebook x2, and the Intel® Celeron® processor-powered Acer Chromebook R 11. While both devices performed well, the HP Chromebook x2 was faster at many tasks in education apps, and offered a more robust feature set that could give students a better learning experience.\*

Read on to see why educators, students, and school decision-makers could all benefit from investing in an Intel Core m3 processor-powered Chromebook.



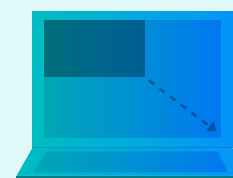
HP Chromebook™ x2 with an Intel® Core™ m3 processor



**Students:**  
Save 25% on coding tasks



**Teachers:**  
Save 31% on lesson planning tasks



**Sharper visuals**  
with 73% greater screen resolution

\*See the appendices for complete test data and device configurations.



We looked at a range of education apps to determine how each Chromebook might fare during real-world K-12 classroom use—teachers included. We divided the apps into four categories: coding, 3D modeling, lesson planning, and media creation. Here’s how each device fared:

### Coding tasks

From serving as a foundation for problem-solving skills to opening pathways to future STEM careers, computer science education can benefit students for years to come. That’s why it’s important for them to learn in as stress-free an environment as possible. In apps such as Code.org, CodeHS, Trinket.io repl.it, and VidCode, the Intel Core m3 processor-powered HP Chromebook x2 was faster than the Intel Celeron processor-powered Acer Chromebook R 11, which means less time waiting and more time coding.

### Lesson planning tasks

A teacher’s job doesn’t begin with the first class of the day. Planning lessons to meet students at their level and raise them up—that takes time and dedication. We found that tasks in Explain Everything were faster with the HP Chromebook x2 than the Acer Chromebook R 11, which could enable teachers to get through their planning sessions faster than before.

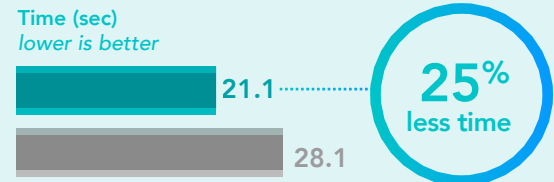
### Computer-aided design tasks

CAD teaches students how the world fits together, potentially sparking interest in engineering careers. In our tests, the HP Chromebook x2 was faster at tasks in Tinkercad than the Acer Chromebook R 11.

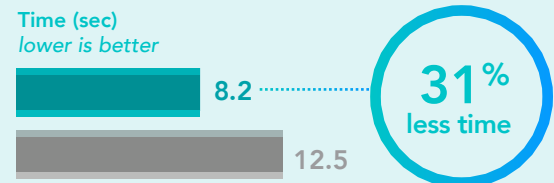
### Creating media

When it’s time for students to prepare multimedia projects, they’ll appreciate having a device that can accomplish tasks fast. The Intel Core processor-powered device saved time on apps including Soundtrap and WeVideo Video Editor.

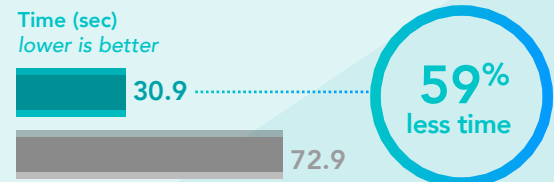
### Save time on coding tasks\*



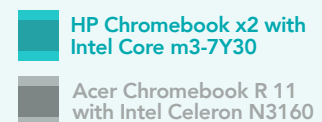
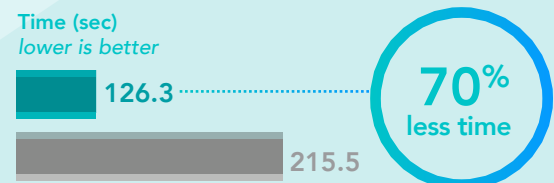
### Save time on lesson planning tasks



### Save time on 3D tasks



### Save time on media tasks



\*See the appendices for complete test data and device configurations.

## 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 classroom to new possibilities and functionality you can't get with older or unsupported models.<sup>1,2</sup>

Sharper visuals with greater screen resolution\*

73%  
increase



## Take notes the natural way with a pressure-sensitive active stylus

Students who take handwritten notes retain information better than their peers who type lecture notes on a computer.<sup>3</sup> But why risk losing valuable notes to a lost or damaged composition book? Get the best of both worlds by taking advantage of the active pen that comes with the HP Chromebook x2. Use the pressure-sensitive pen to write and draw the natural way, while keeping your notes safe in a virtual space. Just remember to back up your notes to the cloud!



\*According to HP: <https://press.ext.hp.com/us/en/press-releases/2018/chromebook-x2.html>

\*\*See the appendices for complete test data and device configurations.



### More collaboration features with the HP Chromebook x2

Working together with other students has always been a key part of the education experience. But with the user-facing camera on the HP Chromebook x2, remote collaboration becomes easier. The HP Chromebook x2 also features a greatly expanded screen resolution, allowing students to see their classmates and their work more clearly than before.

*“We like to envision a future of teaching and learning where students and teachers use more media—drawings, images, videos, documents, webpages, audio and more—to tell their stories. From explaining a concept to demonstrating understanding, we expect all individuals to expand their use of media while pushing the boundaries of what their devices will support. When investing in computing hardware, you have to consider not only what you might want to accomplish (and accomplish well) today within your school, but also where your teachers and students will want to end up when you approach the end of cycle of the devices.”*

*– Reshan Richards, CEO of Explain Everything.*

Explain Everything is a popular whiteboard app that allows students and teachers to share and collaborate on notes and presentations in real time, allowing teachers to better address the needs of a diverse cohort of students. Learn more at <http://explaineverything.com>.





### A device with staying power

For new Chrome devices, Google guarantees updates for at least 6.5 years from the launch of the hardware platform.<sup>4</sup> This means that your next Chromebook will continue receiving all the latest updates for years to come.

## Conclusion

When it's time to invest in new classroom hardware, it pays to think of future as well as current needs. In our tests, the Intel Core m3 processor-powered HP Chromebook x2 helped us perform tasks in educational apps much faster than the Intel Celeron processor-powered Acer Chromebook R 11. This cuts down on classroom wait times, and suggests that the newer Chromebook would prove more capable in the face of more processor-demanding education apps. The Intel Core processor-powered device also had an improved set of features, which could give students a better overall experience.

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- 1 "HP Introduces the World's First Chromebook Detachable," accessed August 27, 2018: <https://press.ext.hp.com/us/en/press-releases/2018/chromebook-x2.html>
  - 2 "Chrome OS Systems Supporting Android Apps," accessed August 27, 2018: <https://sites.google.com/a/chromium.org/dev/chromium-os/chrome-os-systems-supporting-android-apps>
  - 3 Pam Mueller & Daniel Oppenheimer, "The Pen is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking," accessed July 16, 2018: <https://doi.org/10.1177/0956797614524581>
  - 4 "Auto Update policy – Google Chrome Enterprise help," accessed July 16, 2018: <https://support.google.com/chrome/a/answer/6220366>

On June 29, 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 July 5, 2018.

## Appendix A: System configuration information

System configuration information	HP Chromebook x2	Acer Chromebook R 11
Processor	Intel Core m3-7Y30	Intel Celeron N3160
Processor freq (GHz)	1.00 – 2.60	1.60 - 2.24
Processor cores	2	4
Memory (GB)	4	4
Storage (GB)	32	32
Bluetooth	4.2	4.0
USB	2x USB 3.1 Type C	1x USB 3.0, 1x USB 2.0
Battery type	Lithium-Ion	Lithium-Ion
Battery capacity (Wh)	48	32
Display	12.3" 2400x1600	11.6" 1366x768
OS (version)	67.0.3396.99	67.0.3396.99
Build/firmware	Soraka.10431.48.0	Cyan.7287.57.165
System Weight (lbs.)	3.07	2.70

# 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.
  - reddit.com/r/pics
  - instagram.com/intel
  - simple.wikipedia.org
  - 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.

## Code.org

### Creating a new project

1. From the Chrome browser, navigate to code.org.
2. Sign in with your Google account.
3. Scroll to the Start a new project section.
4. Simultaneously start the timer and click Artist.
5. When the project editor fully loads, stop the timer.

### Opening the Floral Inception project

1. From the Chrome browser, navigate to code.org.
2. Sign in with your Google account.
3. From the top toolbar, click Projects.
4. Click Public Projects.
5. Simultaneously start the timer and click the Floral Inception project.
6. When the page fully loads, stop the timer.

## CodeHS

### Creating a new Python program

1. From the Chrome browser, navigate to codehs.com.
2. Sign in with your Google account.
3. Click Sandbox.
4. Under Create New Program, type a name and click Create Program.
5. Select Python.
6. Simultaneously start the timer and click Create Program.
7. When the project editor fully loads, stop the timer.

## Trinket

### Opening the “From Block to Code” lesson

1. From the Chrome browser, navigate to [trinket.io](http://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 [trinket.io](http://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 [repl.it](http://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.

### Opening the C# editor

1. From the Chrome browser, navigate to [repl.it](http://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 C#.
5. When the project editor fully loads, stop the timer.

## VidCode

### Starting an activity

1. From the Chrome browser, navigate to [app.vidcode.io](http://app.vidcode.io).
2. Sign in with your Google account.
3. Click free activities.
4. Simultaneously start the timer and click Start Deal With It.
5. When the page fully loads, stop the timer.

### Viewing a project from the gallery

1. From the Chrome browser, navigate to [app.vidcode.io](http://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.



## Explain Everything

### Exporting a presentation as a PDF

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. Click the project you created earlier.
4. Click Share, and click Export.
5. On the Export project screen, select PDF.
6. For the source, select Local storage.
7. Simultaneously start the timer and click Export.
8. When the Export successful message appears, stop the timer.

### Exporting a presentation as a project

1. From the shelf, launch the Explain Everything app.
2. Click the project you created earlier.
3. Click Share, then click Export.
4. On the Export project screen, select Project.
5. For the source, click Local storage.
6. Simultaneously start the timer and click Export.
7. When the Export successful message appears, stop the timer.

## Tinkercad

### Creating a new design

1. Install Tinkercad from the Google Chrome Store, and pin the app to the shelf.
2. Launch the app from the shelf.
3. Start the timer, and click Create new design.
4. Stop the timer when the design editor fully loads.

### 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.

### Exporting a model to an OBJ file

1. From the Chrome browser, navigate to tinkercad.com.
2. Click Copy of City, then click Tinker this.
3. Click Export.
4. Simultaneously start the timer and click .OBJ.
5. When the model finishes downloading, stop the timer.

## Soundtrap

### Entering the studio

1. From the Google Play store, install SoundTrap. Pin the app to the shelf.
2. Launch the SoundTrap app from the shelf.
3. Simultaneously start the timer and click Create New Project.
4. When the studio fully loads, stop the timer.

### Merging 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, start the timer, and click Merge.
8. Stop the timer when merging completes.

## WeVideo Video Editor

### Rendering a 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 blue + icon.
4. Click Gallery.
5. Click Allow to enable access to device media storage.
6. From the folder browser, select the test footage, and click the green checkmark icon.
7. Click the paper airplane icon.
8. Start the timer, and click Save with watermark.
9. Stop the timer when the saving completes.

## Appendix C: Our results

The table below contains detailed results from our testing. All times are in seconds. Each result represents the median time of three separate runs.

Task	HP Chromebook x2 Intel Core m3-7Y30 processor	Acer Chromebook R 11 Intel Celeron N3160 processor	Percentage difference
Tinkercad			
Create a new design	3.6	9.8	63%
Load the design gallery	1.7	3.9	56%
Open a city model	19.9	52.4	62%
Export model to an OBJ file	5.7	6.8	16%
Total for all tasks	30.9	72.9	59%
repl.it			
Open Java editor	3.6	5.5	34%
Open C# editor	3.6	5.1	31%
Total for all tasks	7.2	10.6	32%
Trinket			
Open from Block to Code lesson	2.9	4.8	39%
Open Switch Case Challenge	1.9	4.2	54%
Total for all tasks	4.8	9.0	46%
WeVideo			
Render 720p video	91.2	157.0	41%
Total for all tasks	91.2	157.0	41%
Soundtrap			
Enter studio	5.3	11.0	51%
Merge tracks	29.8	47.5	37%
Total for all tasks	35.1	58.5	40%
Explain Everything			
Export presentation as PDF	3.6	5.7	36%
Export presentation as project	4.6	6.8	32%
Total for all tasks	8.2	12.5	31%
CodeHS			
Create new Python program	2.4	3.7	35%
Total for all tasks	2.4	3.7	35%

Task	HP Chromebook x2 Intel Core m3-7Y30 processor	Acer Chromebook R 11 Intel Celeron N3160 processor	Percentage difference
Code.org			
Create new project	2.1	4.4	52%
Open Floral Inception project	1.5	3.1	51%
Total for all tasks	3.6	7.5	52%
VidCode			
Start Deal With It activity	1.4	2.6	46%
View project from gallery	1.7	3.7	54%
Total for all tasks	3.1	6.3	50%

This project was commissioned by Intel Corp.



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