

MAXIMIZE CHROMEBOOK™ LEARNING

Give your students superior functionality and more app choices

EXECUTIVE SUMMARY

Chromebook™ devices are a favorite among educators because they are practical for everyday student use and are available at a price point that schools can afford. But not all Chromebooks offer the same quality or performance. Some are slower than others or might have functionality breakdowns—for example, apps or features that could enrich teachers' lesson plans are not supported. These limitations can lead to more time waiting and to disengaged students. However, some Chromebooks do offer better performance, so students spend less time waiting and stay more focused on their learning. In addition, some Chromebooks are better suited to withstand punishing classroom use.

To find out which Chromebooks perform best in the classroom, our team at Prowess Consulting put two Chromebooks to the test: the Dell™ Chromebook™ 11 (regulatory model P22T), powered by an Intel® Celeron® processor N2840, and the ASUS® Chromebook™ C201, powered by a Rockchip® processor RK3288C.

We ran the Chromebooks through two typical classroom scenarios and discovered that the Dell Chromebook 11 consistently outperforms the ASUS Chromebook C201 in the classroom because it offers:



Better app functionality

so educators have more app choices



Less wait time

so students can stay focused on learning



More powerful performance

to handle students' multitasking habits

How to Decide Between Chromebooks

Chromebooks are continuing to prove their worth in the K-12 education market. They offer students an easy-to-use operating system, a long battery life, easy collaborative tools, and a variety of free educational apps—all at an attractive price. But with so many Chromebook models available, how do you know which one is best for your students?¹

All Chromebooks run on the same Google™ Chrome OS™ operating system, but that doesn't mean that they perform equally. The processor that powers the device makes a big difference in how each Chromebook performs and the functionality that it supports. Lesser-performing processors can lead to functionality issues and more wait time for students, while more powerful processors can keep students more engaged because their devices are much less prone to lag times and functionality shortfalls. For example, some apps can't even be installed on certain Chromebooks, as we discovered while testing the Senet Online app in a classroom scenario.

To find out how much of a difference the processor makes, our team at Prowess Consulting tested and compared the following Chromebooks, each with a different processor:

- Dell Chromebook 11, powered by an Intel Celeron processor N2840
- ASUS Chromebook C201, powered by a Rockchip processor RK3288C

We ran these devices through a series of real-world classroom learning scenarios to see which device performed the best. The scenarios included a middle-school social-studies lesson on ancient civilizations and a high-school creative-writing lesson. After extensive testing, the results show that the Dell Chromebook, powered by an Intel® processor, outperformed the ASUS Chromebook C201, powered by a Rockchip processor, because the Dell Chromebook offers:

- **Better app functionality** so educators have more app choices
- **Less wait time** so students can stay focused on learning
- **More powerful performance** to handle students' multitasking habits

Don't Limit App Choices

One of the biggest perks of Chromebooks is the growing selection of free educational apps available along with other classroom tools. Teachers from any discipline can find a variety of apps and educational websites to help enhance their lessons. However, some Chromebooks don't have the processing power to handle certain apps.

Two of the primary apps tested in our scenarios simply didn't work on the ASUS Chromebook C201. Senet Online, which lets students play an ancient Egyptian game, showed a “not compatible” error on the ASUS Chromebook and could not be installed. The Blue Toad Murder Files® app, a mystery solving puzzle game, showed a native client app load-failure error and could not be used on the ASUS model we tested.² In contrast, both of these apps worked flawlessly on the Dell Chromebook.

Based on our testing, teachers and students can feel confident in the ability of the Dell Chromebook to handle a wide selection of education apps. The device's more powerful Intel processor can handle the interactive, graphical nature of today's apps, which means that the Dell Chromebook is better equipped for the more demanding apps of the future as well. That's important if you're counting on your Chromebooks having a lifespan of three or four years.

When you look at the costs, you can see that the performance benefits of the Dell Chromebook come with a minimal price difference. Based on educational pricing, the price is only slightly higher for the Dell Chromebook 11 compared to the ASUS Chromebook C201.³ This means that for only pennies more per day, you can get a better performing device with the Dell Chromebook 11.⁴

Table 1. You can get the better-performing Dell™ Chromebook™ 11 (regulatory model P22T) for only \$0.13 more per school day over a three-year life cycle (as compared to the ASUS® Chromebook™ C201)

Get more performance for your money with the Dell™ Chromebook™ device powered by an Intel® processor	Additional price per device per school day over a three-year life cycle, as compared to the ASUS® Chromebook™ C201 ^{3,4}
Dell Chromebook 11 (regulatory model P22T)	+ \$0.13

Make Sure Your Chromebook™ Is Built to Last

Our hands-on experience with the Chromebooks discussed in this report demonstrates that the Dell™ Chromebook™ 11 is more rugged than the ASUS® Chromebook™ C201. Here are a few features that help Dell Chromebooks withstand heavy classroom use and provide a better return on investment:



Dell™ Chromebook™ 11

Powered by an Intel® Celeron® processor N2840

Get More Learning Time with Faster Performance

It doesn't take long for students to lose focus. Even a few seconds of lag time can cause them to get distracted. In our testing, we carefully timed every task so that we could determine wait times for each device. For example, we measured the time it takes to open an image in a photo editing app, edit the photo, and save it to an online storage service. We totaled up the time used to run every test and compared results between devices. After tallying the results, the Dell Chromebook 11 was the clear winner, with the least wait time in classroom scenarios. Figure 1 shows the averages of the combined timed tests for both classroom scenarios.

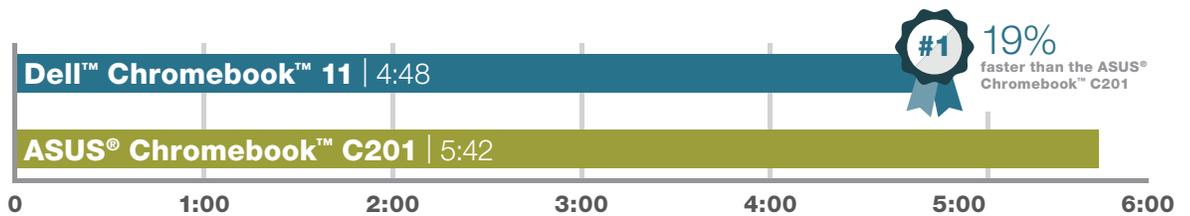


Figure 1. The Dell™ Chromebook™ 11 averaged 19 percent faster for both classroom scenarios

Now, let's convert those numbers into actual time savings in the classroom. A few seconds here and there might not seem like much, but those seconds can quickly become minutes and hours of lost learning time. Even if you use Chromebooks in just two classes per day, you can get significant time savings from using the Intel processor-powered Dell Chromebook instead of the ASUS Chromebook.

Table 2. Even if you use a Chromebook™ device in just two classes a day, you can get significant time savings from using the Intel® processor-powered Dell™ Chromebook™ device instead of the ASUS® Chromebook™ C201⁴

Estimates based on two Chromebook™ activities per school day over one school year*	Dell™ Chromebook™ 11 (regulatory model P22T), powered by an Intel® Celeron® processor N2840, compared to the ASUS® Chromebook™ C201
Time savings per school year	5 hours
Time savings over a 3-year life cycle	15 hours = 2.25 school days

*Estimates based on National Center for Education Statistics, which shows that the average class time per day in U.S. schools is 6.64 hours and the average number of school days per year as 180. "Schools and Staffing Survey." https://nces.ed.gov/surveys/sass/tables/sass0708_035_s1s.asp.

Provide Students with the Power to Multitask

Next time you see a K-12 student with a device, count how many browser tabs he or she has open. It is habitual these days for students to keep multiple tabs open at a time, often to save the time it takes to pull up the same site again, or to switch easily between sites. The modern classroom environment is often very demanding, requiring that students engage with multiple apps and sites to complete a single assignment. Therefore, we decided to test how the Chromebooks would perform with more than one tab open at a time in the Google™ Chrome™ browser.

Our test involved opening one tab at a time using only the apps selected in the two classroom scenarios. The two devices performed the same until opening the sixth tab: a YouTube™ video

about ancient Egypt. The YouTube video took an average of nearly 32 seconds to load on the ASUS Chromebook C201. In addition, during that wait time, two of the other tabs showed errors and stopped working.

In contrast, the YouTube video opened immediately on the Dell Chromebook, and all of the other tabs ran seamlessly without slowing down or showing errors of any kind. If your students are in the habit of having multiple tabs open at a time, the Intel processor–powered Dell Chromebook is better equipped to handle their multitasking needs.

Device Report Card

The Dell Chromebook 11 gets straight As across the board with great app functionality, fast load times, and slick multitasking capabilities. By comparison, the ASUS Chromebook C201 lags behind, with a D for poor app functionality because so many apps failed to work, a C for slower load times, and an F for browser performance with multiple tabs open, because half of the tabs either had errors or problems loading.

Table 3. Report card with a breakdown of the grades for each device based on Prowess testing

	FUNCTIONALITY Features performing as expected	LOAD TIMES Time waiting for apps and tasks to run	PERFORMANCE Ability to run apps with multiple tabs open	DURABILITY Durability features help devices last longer
 Dell™ Chromebook™ 11 Intel® Celeron® processor 3205U	A	A	A	A
 ASUS® Chromebook™ C201 Rockchip® processor RK3288C	D	C	F	F

***Grade Criterion:** A: full or greater than 90 percent functionality for tested task; B: 80–90 percent functionality; C: 70–80 percent; D: 60–70 percent functionality; F: missing or less than 60 percent functionality

Classroom Test Scenarios and Results

The following sections compare the classroom experience for students using the featured Chromebooks in two typical K-12 scenarios: a middle-school social-studies lesson and a high-school creative-writing activity. Each scenario explains the student tasks involved in the activity, and then gives the highlights of our test results, in addition to the functionality differences and the timed results for performance. For full step-by-step test procedures and all timed-test results, see Appendix B.

Classroom Scenario 1: Middle-School Social-Studies Lesson on Ancient Civilizations

Leo is an eighth-grade social-studies student.⁵ His class is studying ancient civilizations, and his teacher has assigned them an in-class activity using Chromebooks to learn more about ancient Egypt. First, Leo learns about Egyptian traditions by deciphering the game of the pharaohs, Senet. He then takes a virtual field trip using the Google Maps™ app to visit ancient pyramids and other sites around the world. He records and annotates a virtual aerial tour of one of his favorite pyramids using the Screencastify app, and then he uploads his recording to YouTube.

Next, Leo visits the Google Cultural Institute website to check out a 3-D artifact of a sphinx statue. He can zoom in, rotate the sphinx, and study it in great detail. He takes screenshots of the statue from various angles, edits them in the PicMonkey® app, and saves them to Google Drive™.

Next, Leo plays an online educational game about ancient Egyptian artifacts, and he then watches part of a YouTube video on ancient Egypt. When he is finished, he uses the WeVideo® app to compile a video report that summarizes what he's learned. The students get together in groups and share their videos with each other.

STUDENTS HAVE LIMITED APP FUNCTIONALITY ON THE ASUS CHROMEBOOK C201

When we follow Leo more closely through this activity, we discover that he runs into problems right away on the ASUS Chromebook C201. The Senet Online app, the modern version of the game of the pharaohs, won't work at all on the ASUS Chromebook C201. The Chrome store shows a “not compatible” error for his device, so he can't even install the game (see Figure 2). Leo spends a few minutes trying to troubleshoot the problem, but that only leads to frustration. The same frustration would likely be felt by the other 20+ students in the class, leaving the teacher with a very disrupted lesson and a hole in her series of student tasks.

In contrast, the Dell Chromebook 11 fully supports the Senet Online app (see Figure 3). Leo has no problem opening the app and playing a fun game that the pharaohs used to play, and he learns about ancient Egyptian culture. He has no delays or frustrations, and his learning is not disrupted.

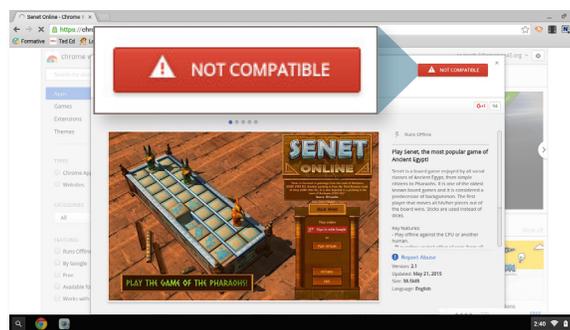


Figure 2. The Senet Online app is not compatible with the ASUS® Chromebook™ C201; students cannot do this activity at all



Figure 3. The Senet Online app in action on the Dell™ Chromebook™ 11 (regulatory model P22T), where it is fully supported

STUDENTS RUN INTO MULTITASKING PROBLEMS ON THE ASUS CHROMEBOOK C201

Leo opens several browser tabs for the various activities in this lesson, which allows him to refer to each of them as he prepares his summary video. However, this becomes problematic on the ASUS Chromebook C201. When he opens his sixth browser tab with a YouTube video about ancient Egypt, two of the other tabs stop working completely, and the video takes up to 31 seconds to even start playing.

The Google Maps app disappears completely showing the following error: “Aw, Snap! Either Chrome ran out of memory or the process for the webpage was terminated for some other reason.” (See Figure 4). The Google Cultural Institute app with the 3-D sphinx head shows a Web Graphics Library (WebGL) error (see Figure 5); WebGL is a JavaScript® interface that allows users to create real-time-rendered, interactive 3-D graphics in a browser without the need to download any plug-ins. In addition, the YouTube video shows the following error: “If playback doesn’t begin shortly, try restarting your device.” (See Figure 6). To move forward, Leo has to reload both of the other tabs to get them to work, and then each time he goes back to the video, he has to wait for it to load again. This is frustrating, time consuming, and disruptive.

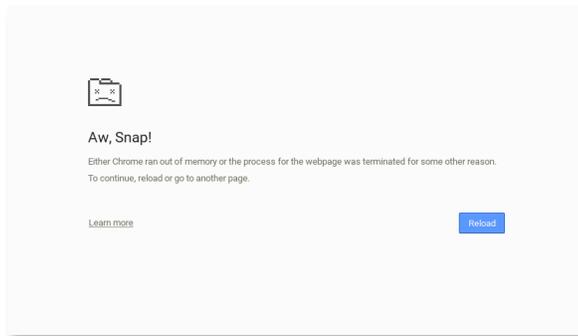


Figure 4. The Google Maps™ site freezes and shows this error on the ASUS® Chromebook™ C201 when multiple browser tabs are open; students must reload the tab to get it to work again



Figure 5. The 3-D web app stops working and shows a WebGL error on the ASUS® Chromebook™ C201 when multiple browser tabs are open; students must reload the tab to get it to work again

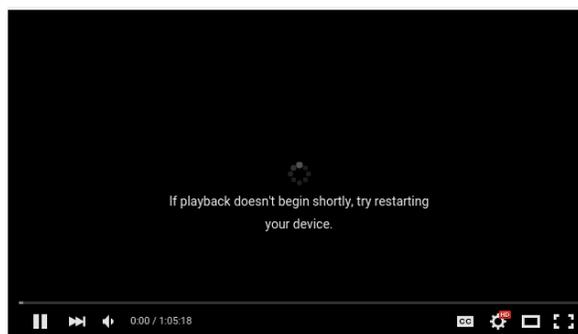


Figure 6. The YouTube™ video takes up to 45 seconds to load and shows this playback error on the ASUS® Chromebook™ C201 when multiple browser tabs are open

On the Dell Chromebook, Leo can easily open the same six browser tabs with no disruptions in any of the sites on the tabs. His YouTube video loads and plays instantly, so he doesn't have to wait at all. He can seamlessly switch between tabs with no wait times or reloading, which makes it easier to create his report-summary video.

STUDENTS SPEND LESS TIME WAITING WHEN USING THE INTEL PROCESSOR-POWERED DELL CHROMEBOOK

Overall, Leo has a difficult time completing his social-studies activities on the ASUS Chromebook C201. The Senet Online app doesn't work at all, and when he tries to multitask, the browser tabs start crashing. In addition, he ends up waiting more on the ASUS Chromebook C201. The Dell Chromebook 11 is an average of 13 percent faster than the ASUS Chromebook C201 for completing the tasks. Fewer and shorter wait times mean that Leo can stay more focused and engaged in his learning.

Table 4. Results of the combined timed tasks for the social-studies lesson scenario; full task list and times are in Appendix B

Social-Studies Assignment Tasks	Dell™ Chromebook™ 11 (regulatory model P22T) compared to ASUS® Chromebook™ C201
Open Google Maps™, record video in Screencastify, and upload to YouTube™	12% faster
Go to the Google Cultural Institute, open the Sphinx Head website, take screenshots, and then edit and save files in PicMonkey®	39% faster
Total time for all tasks combined	17% faster

Classroom Scenario 2: Creative-Writing Lesson in a High-School English Class

Serena is a high-school sophomore.⁵ Her English class is studying creative writing, and the students have been assigned a Chromebook activity designed to help them think more critically and to understand logic's role in writing. First, she gets to play a fun, interactive mystery game called Blue Toad Murder Files as part of her homework assignment.² The humorous game guides students through solving a mystery while playing different types of puzzles. The next day in class, Serena and the other students make guesses about who is guilty and have a discussion about it.

During class the next day, the students hone their critical thinking skills by playing logic puzzles online and learning about brain teasers on the Khan Academy® site. They also watch a TED-Ed® video called "Can you solve this logic puzzle?" and visit the Formative® website to take a logic quiz. Next, students work in teams to craft their own unique mystery games using Google™ Slides and Google™ Drawings. They post their work to a RealtimeBoard location to share their presentations with their peers.

STUDENTS RUN INTO ANOTHER APP FAILURE ON THE ASUS CHROMEBOOK C201

When we follow Serena more closely through this activity, we see that she is unable to complete the entire assignment on the ASUS Chromebook C201 because the Blue Toad Murder Files app doesn't work. The following error appears along the top of the screen: "NaCl [native client app] module load failed: manifest: no version of program given for current arch and no portable version found." (See Figure 7). Serena has to skip that part of the assignment on the ASUS Chromebook C201. Her teacher is also frustrated because she didn't know that the app wouldn't work on the ASUS Chromebook C201 until her students started complaining.

Conversely, if Serena uses the Dell Chromebook 11, she has no problem running the app (see Figure 8). She has a lot of fun playing the game and is excited to talk about it in class the next day. Her teacher is also relieved that the app works flawlessly on the Dell Chromebook 11 so she doesn't have to worry about frustrated students.



Figure 7. The Blue Toad Murder Files® app won't run on the ASUS® Chromebook™ C201; the error on the top of the screen reads: "NaCl module load failed: manifest: no version of program given for current arch and no portable version found."



Figure 8. The Blue Toad Murder Files® mystery game working on the Dell™ Chromebook™ 11 (regulatory model P22T)

STUDENTS CAN OPEN MORE BROWSER TABS FOR EASIER MULTITASKING ON THE DELL CHROMEBOOK 11

To complete the various tasks for this assignment, Serena needs to have more than one browser tab open at a time. But when she opens the fifth tab on the ASUS Chromebook C201 to watch the TED-Ed talk, the video screen goes black and the entire device freezes for a few seconds (see Figure 9). At the same time, another tab with a brain-teaser activity also freezes

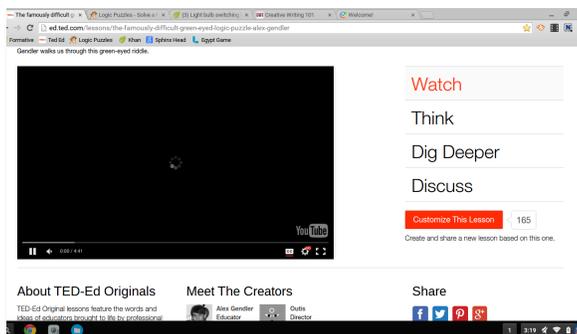


Figure 9. The TED-Ed® video freezes with five tabs open on the ASUS® Chromebook™ C201

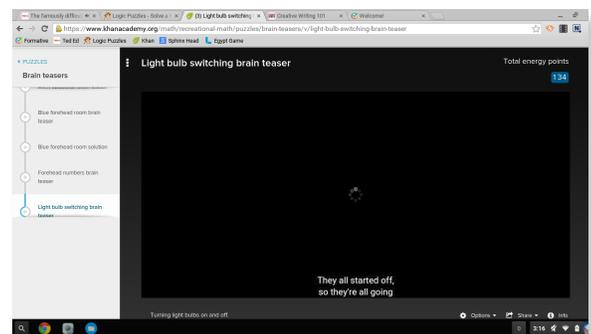


Figure 10. The Khan Academy® brain-teaser screen freezes and has to be reloaded when five browser tabs are opened on the ASUS® Chromebook™ C201

up and has to be reloaded (see Figure 10). Serena tries opening the tabs in a different order, but the result is always the same: the ASUS Chromebook does not support these five tabs working at once.

In contrast, on the Dell Chromebook, Serena can open five or more tabs with no functionality problems at all. All of the sites, including those with videos and games, continue to run flawlessly. The videos play instantly with no delays. Serena can multitask and easily complete her assignment while jumping between the browser tabs.

STUDENTS HAVE LONGER WAIT TIMES ON THE ASUS CHROMEBOOK C201

In addition to the Blue Toad Murder Files app not working and the multitasking problems, Serena also ends up waiting longer in general to complete all of the tasks involved in her creative-writing activity on the ASUS Chromebook C201. Creating her assignment using Google Drawings, Google Slides, and RealtimeBoard takes longer on the ASUS device. By using the Dell Chromebook 11, she can complete her tasks about 26 percent faster compared to the ASUS Chromebook C201. That means less time to get bored, distracted, or frustrated, and more time to spend learning.

Table 5. Results of the combined timed tasks for the creative-writing lesson scenario; full task list and times are in Appendix B

Creative-Writing Assignment Tasks	Dell™ Chromebook™ 11 (regulatory model P22T) compared to ASUS® Chromebook™ C201
Load logic-puzzle video, quiz, and games	18% faster
Create Formative® quiz assignment	16% faster
Create new Google Docs™ assignments including using Google™ Drawings and Google™ Slides	30% faster
Create a new RealtimeBoard location and insert a presentation	17% faster
Total time for all tasks combined	26% faster

The Dell™ Chromebook™ 11, Powered by an Intel® Processor, Helps Clear Obstacles to Student Engagement

The Dell Chromebook 11, powered by an Intel processor, is better equipped to handle students' daily classroom needs compared to the ASUS Chromebook C201, powered by a Rockchip processor. The Dell Chromebook 11 provides full app functionality, so teachers are not limited in their app choices. The Dell device also performed consistently faster in all the tasks that we tested associated with the scenarios' classroom activities, so students have less wait time and can better focus on the task at hand with fewer disruptions. In addition, the Dell Chromebook 11 has more processing power to better accommodate multitasking habits, so students can have multiple tabs open at once with no interruptions.



Only pennies more per day

\$0.13

Additional price per device per school day over a three-year life cycle, as compared to the ASUS® Chromebook™ C201

When looking at the big picture, you can see that for just \$0.13 more per device per school day over a three-year lifecycle, you can get the Dell Chromebook 11, which offers better performance over the ASUS Chromebook C201. The bottom line is that, with the Dell Chromebook 11, you will help your students maximize learning in the classroom.



Dell™ Chromebook™ 11

Powered by an Intel® Celeron® processor N2840

Don't limit your students' choices and functionality by choosing a lesser-performing Chromebook™ device.

Appendices

Appendix A: Test Environment

Hardware		
Device	ASUS® Chromebook™ C201	Dell™ Chromebook™ 11
Reg. Model	C201P	P22T
OS	Google™ Chrome OS™	Chrome OS
Processor	Quad-core Rockchip® processor RK3288C (1.8 GHz)	Intel® Celeron® processor N2840 (2.16 GHz)
Storage	16 GB solid-state drive (SSD) (embedded MultiMediaCard [eMMC])	16 GB SSD (Serial ATA [SATA])
Memory	2 GB LPDDR3	2 GB DDR3L SDRAM
Battery	Up to 13 hours of use	Up to 9 hours of use
Display	11.6" (1,366 x 768)	11.6" (1,366 x 768)
Graphics	Integrated Rockchip® Mali™ T764	Intel® HD Graphics
Card Reader	Micro-SD, micro-SDXC, micro-SDHC	SD card
Camera	HD web camera	HD web camera
Interface	1 x 3.5 mm audio jack 2 x USB 2.0 port(s) 1 x micro HDMI 1 x AC adapter plug	HDMI 1 x USB 3.0 port
Audio	2 built-in speakers and digital microphone	4 W internal stereo speaker (min 2 W x 2)
Networking	Integrated 802.11a/b/g/n/ac Bluetooth® 4.1 support (on WLAN+ Bluetooth 4.1 combo card)	10/100 Mbps Intel® Dual-Band Wireless-AC 7260 802.11/a/b/g/n Bluetooth 4.0
Weight	2.16 lbs	2.74 lbs
Price at Time of Purchase ³	\$177.99	\$249.99
Software and Websites		
Name	Version	
Google™ Chrome OS™	47.0.2526.80	
Blue Toad Murder Files®	2.026	
Google Docs™	0.9	
Google™ Slides	0.9	
Google™ Drawing	1.1	
RealtimeBoard	1.38.1.6	
Senet Online	2.1	
Google Maps™	5.4.1	
PicMonkey®	1.6	
Screencastify	1.12.5	
WeVideo®	4.3.0	
Network Speed		
Unless otherwise indicated, our tests were performed while devices were connected to an 802.11n wireless network. Network throughput fluctuates continually. We recorded network speeds at several points during the testing, and averaged the results. Averages are shown here.		
Upload Speed	23.59 Mbps	
Download Speed	66.07 Mbps	

Appendix B: Test Procedures and Results

Scenario 1: Ancient Civilization

Senet Online

1. From the bottom-left of the screen, click the **Search** icon.
2. Click **All Apps**.
3. Find **Senet Online**, and then click to open

Google Maps

1. From the bottom-left of the screen, click the **Search** icon.
2. Click **All Apps**.
3. Find **Google Maps**, and then click to open.
4. From the bottom-left of the screen, click the **Earth** view.
5. In the search field, type **Egyptian Pyramid**, and then press Enter.
6. From the top-right of the screen, click **Screencastify**.
7. Click **Start Recording** to record the video.
8. Record a 1-minute video.
9. Click **Stop Recording** to stop recording the video.
10. Click **Share**, and then click **YouTube > Channel > Privacy**.
11. Click **Upload**.

Google Cultural Institute

1. Find and click **Chrome** to open a browser window.
2. Click the **Sphinx Head** bookmark to open the website.
3. Hold Ctrl plus the Window switcher key to take a screenshot of the head. Do this three times for three different screenshots.
4. From the bottom-left of the screen, click the **Search** icon.
5. Click **All Apps**.
6. Find **PicMonkey**[®], and then click to open.
7. Click **Collage**.
8. Select all three screen captures of the head, and then click **Open**.
9. Click each image and drag it into the collage.
10. Click **Edit**, and then click **Open in Editor**.
11. Select **Didact Gothic**, and then click **Add text**.
12. Type **Sphinx**, and then move the text to the top of the collage.
13. Click **Effects**.
14. Click **Dusk**.
15. Click **Save**.
16. In the **File name** field, type **SphinxHeadCollage**.
17. Select **Roger** for quality.
18. Click **Save to my computer**.

Scenario 1: Ancient Civilization (Continued)

Ancient Egyptian Artifacts Game

1. Find and click **Chrome** to open a browser window.
2. Click the **Egypt Game** bookmark to go to the website.

WeVideo®

1. From the bottom-left of the screen, click the **Search** icon.
2. Click **All Apps**.
3. Find **WeVideo**, and then click to open.
4. Click **Upload Media**.
5. Click **Browse to select**.
6. Select all three sphinx-head screen shots using Ctrl+click, and then click **Open**.
7. Click **Upload**.
8. Click **Create a video**.
9. Click **Theme, Memories**, and then click **Use this theme**.
10. Click **Music, Free music, Exploring, Time Pressure**, and then click **Use this track**.
11. Click **Voice**, and then record a 15-second intro.
12. Type **Sphinx Head** as the title for video.
13. Click each image, and then click **+** to add a voice to be voiceover.
14. At the top of the page, click **Name of Video**, and then type **Sphinx** to rename the video.
15. Click **Finish**, select **720p HD**, and then click **Finish Video** to render the video.

History Documentary

1. Find and click **Chrome** to open a browser window.
2. Open a movie in a tab with five other tabs open.

Scenario 1 total time (for tests that both devices were capable of running)

ASUS® Chromebook™ C201	Dell™ Chromebook™ 11 (regulatory model P22T)
5 minutes 42 seconds	4 minutes 48 seconds

Scenario 1 Results

Test	ASUS® Chromebook™ C201 (Rockchip® processor RK3288C)	Dell™ Chromebook™ 11 (regulatory model P22T) (Intel® Celeron® processor N2840)
Senet Online		
Open Senet Online	Not applicable (NA)	6.46 seconds
Total	NA	6.46 seconds
Google Maps™		
Open Google Maps	3.41 seconds	3.22 seconds
ScreenCastify: Capture video of flyover	2.61 seconds	1.74 seconds
Upload video to YouTube™	4.82 seconds	4.75 seconds
Total	10.84 seconds	9.71 seconds
Google Culture Institute		
Open Sphinx Head website	5.12 seconds	4.36 seconds
Open PicMonkey®	1.89 seconds	1.83 seconds
Select file to edit	7.34 seconds	4.61 seconds
Add text (Sphinx)	1.82 seconds	0.81 seconds
Add effect (Dusk)	1.99 seconds	1.04 seconds
Save as Roger quality	2.31 seconds	2.08 seconds
Total	20.47 seconds	14.73 seconds

Scenario 1 Results (Continued)

Test	ASUS® Chromebook™ C201 (Rockchip® processor RK3288C)	Dell™ Chromebook™ 11 (regulatory model P22T) (Intel® Celeron® processor N2840)
Ancient Egyptian Artifacts		
Open Egyptian game website	2.54 seconds	2.37 seconds
Total	2.54 seconds	2.37 seconds
WeVideo®		
Open WeVideo	6.45 seconds	4.91 seconds
Create video	14.11 seconds	13.40 seconds
Finish video	180.49 seconds	183.03 seconds
Total	201.05 seconds	201.34 seconds
History Documentary		
Start a YouTube video with five tabs open	31.50 seconds	0.00 seconds
Total	31.50 seconds	0.00 seconds

Scenario 2: Mystery Puzzles

Playing Blue Toad Murder Files®

1. From the bottom-left of the screen, click the **Search** icon.
2. Click **All Apps**.
3. Find **Murder Files**, and then click to open.
4. From the bottom-right of the screen, click **Press to continue**.
5. Click **Episode 1** to choose the episode to play.
6. Click **Play Story**.
7. Select a character, and then click the character's picture.

Logic Quizzes

1. Click **Chrome** to open a browser window.
2. Click the **TED-Ed®** bookmark to open the website.
3. Click **Play** on the "Can you solve this logic puzzle?" video to load the video.
4. Click the **Logic Puzzles** bookmark to open the website.
5. Click the **Khan Academy®** bookmark to open the website.

Formative® Quiz

1. Click **Chrome** to open a browser window.
2. Click the **Formative** bookmark to open the website.
3. Click **Dashboard** to load the dashboard.
4. Click **New Assignment!** to create a new quiz.

Google Docs™

1. From the bottom-left of the screen, click the **Search** icon.
2. Click **All Apps**.
3. Find **Google Docs**, and then click to open.
4. Click **+** to create a new blank document.
5. From the bottom-left of the screen, click the **Search** icon.
6. Click **All Apps**.
7. Find **Google™ Drawings**, and then click to open.
8. From the bottom-left of the screen, click the **Search** icon.
9. Click **All Apps**.
10. Find **Google™ Slides**, and then click to open.
11. Click **+** to create blank presentation.

Scenario 2: Mystery Puzzles (Continued)

Recording a Presentation

1. From the bottom-left of the screen, click the **Search** icon.
2. Click **All Apps**.
3. Find **RealtimeBoard**, and then click to open.
4. Click **Create** to create a board.
5. Click **Continue without a template** to create a board without a template.
6. Click **Insert** to load a file on the board.
7. Click **Google Drive** to select a file.
8. Select **Logic presentation**, and then click **Open** to open the file.

Scenario 2 total time (for tests that both devices were capable of running)

ASUS® Chromebook™ C201	Dell™ Chromebook™ 11 (regulatory model P22T)
1 minute 16 seconds	1 minute

Scenario 2 Results

Test	ASUS® Chromebook™ C201 (Rockchip® processor RK3288C)	Dell™ Chromebook™ 11 (regulatory model P22T) (Intel® Celeron® processor N2840)
Blue Toad Murder Files®		
Open Blue Toad Murder Files	NA	22.84 seconds
Start new game	NA	18.59 seconds
Total	NA	41.43 seconds
Logic Quizzes		
Open TED-Ed® website	5.19 seconds	3.03 seconds
Load "Can you solve this logic puzzle?" video	1.69 seconds	1.58 seconds
Open Logic Puzzles website	1.86 seconds	1.39 seconds
Open Khan Academy® website	2.43 seconds	1.78 seconds
Total	11.17 seconds	7.78 seconds
Formative® Quiz		
Open Formative® website	2.32 seconds	2.03 seconds
Load dashboard	2.89 seconds	2.09 seconds
Create new assignment	5.17 seconds	4.82 seconds
Total	10.38 seconds	8.94 seconds

Scenario 2 Results (Continued)

Test	ASUS® Chromebook™ C201 (Rockchip® processor RK3288C)	Dell™ Chromebook™ 11 (regulatory model P22T) (Intel® Celeron® processor N2840)
Google Docs™		
Open Google Docs	4.64 seconds	4.42 seconds
Create new document	5.91 seconds	5.06 seconds
Open Google™ Drawings	7.18 seconds	3.16 seconds
Open Google™ Slides	5.72 seconds	4.91 seconds
Start new presentation	10.61 seconds	8.75 seconds
Total	34.06 seconds	26.30 seconds
Recording a Presentation		
Open RealtimeBoard	8.86 seconds	7.85 seconds
Create board	7.27 seconds	6.07 seconds
Insert presentation	3.88 seconds	3.22 seconds
Total	20.01 seconds	17.14 seconds

¹ Based on Chromebook™ models listed by Google as of January 2016. <https://www.google.com/chromebook/find/>.

² Blue Toad Murder Files® is rated "Guidance Suggested" on the Amazon® Kindle® Store, as opposed to more stringent levels, "Mature" and "Adult." The "Guidance Suggested" rating indicates "the app may include account creation, location detection, user generated content, advertisements, infrequent or mild references to violence, profanity, or crude themes, or other content not suitable for all ages." However, this game is actually a mild game with no profanity, graphic violence, or other mature content. For more information, see <http://www.amazon.com/gp/help/customer/display.html?nodeId=201357550>.

³ Educational prices pulled January 12, 2016, from www.cdw-g.com. ASUS® Chromebook™ C201: \$177.55; Dell™ Chromebook™ 11 3120 (regulatory model P22T): \$249.37.

⁴ The National Center for Education Statistics (NCES) shows that the average class time per day in U.S. schools is 6.64 hours and the average number of school days per year as 180. "Schools and Staffing Survey." https://nces.ed.gov/surveys/sass/tables/sass0708_035_s1s.asp.

⁵ Leo and Serena are fictional characters used as an example to explain the test results from a student's perspective.



The analysis in this document was done by Prowess Consulting and commissioned by Intel.

Results have been simulated and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

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