



The science behind the report:

# Get a more responsive Chromebook to help accelerate learning outcomes using Intel Skills for Innovation apps

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report [Get a more responsive Chromebook to help accelerate learning outcomes using Intel Skills for Innovation apps](#).

We concluded our hands-on testing on November 23, 2022. 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 October 7, 2022 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

## Our results

To learn more about how we have calculated the wins in this report, go to <http://facts.pt/calculating-and-highlighting-wins>. Unless we state otherwise, we have followed the rules and principles we outline in that document.

Table 1: Results of our testing in seconds. Less time is better.

	Intel® Core™ i3-1215U processor-powered Chromebook	Intel® Celeron™ N5100 processor-powered Chromebook	Percentage win
<b>Compute-intensive tasks</b>			
<b>CoSpaces Edu</b>			
Loading Pirate Roller Coaster animation	15.7	40.2	60%
Loading End of Dinosaurs animation	22.6	34.8	35%
Loading At the Airport interactive environment	19.5	38.2	48%
<b>Blender</b>			
Baking data for a fire simulation	11.1	20.0	44%
Baking data for a fluid simulation	26.3	52.2	49%
Baking mesh for a fluid simulation	33.4	87.7	61%
Rendering a 2D animation	1,115.1	2,011.2	42%

	Intel® Core™ i3-1215U processor- powered Chromebook	Intel® Celeron™ N5100 processor- powered Chromebook	Percentage win
<b>Tinkercad®</b>			
Using the Copy & Tinker function on a futuristic motorcycle design	8.4	11.2	25%
Rendering blocks for a futuristic motorcycle design	6.1	10.5	41%
Using the Copy & Tinker function on a futuristic city design	27.6	54.2	49%
Rendering blocks for a futuristic city design	31.6	64.0	50%
<b>Labster</b>			
Loading the Impact on Climate Change lab	12.8	31.1	58%
Loading the Cell Division lab	9.6	22.5	57%
<b>Common productivity tasks</b>			
<b>Zoom</b>			
Launching application	0.84	1.16	27%
Launching a meeting	3.58	5.27	32%
<b>Google Drive™</b>			
Opening a PDF preview from Google Drive™	3.95	6.69	40%
Viewing a print preview of a PDF	4.90	11.33	56%
<b>Google Sheets™</b>			
Opening a shared Excel file with Google Drive™	4.74	5.30	10%
Opening an Excel file with Google Sheets™	8.08	25.52	68%
Inserting a bar graph in Google Sheets™	3.10	11.06	71%
<b>Google Slides™</b>			
Opening a shared Google Slides™ presentation	10.90	59.22	81%
Copying and pasting a graph from Google Sheets™ into a Google Slides™ presentation	1.14	1.81	37%

## System configuration information

Table 2: Detailed information on the systems we tested.

System configuration information	HP Elite Dragonfly Chromebook	HP Chromebook x360 11 G4 Education Edition
Processor		
Vendor	Intel®	Intel®
Name	Core™ i3-1215U	Celeron™ N5100
Core frequency (GHz)	4.40	2.80
Number of cores	6	4
Memory		
Amount (GB)	8	4
Storage		
Amount (GB) and type	128, NVMe	32, eMMC
Connectivity/expansion		
Bluetooth®	5.2	5
USB	1x USB 3.0 Type-A, 2x Thunderbolt 4 with USB4 Type-C	2x USB 3.2 Type-C, 2x USB 3.2 Type-A
Battery		
Type	Lithium-ion	Lithium-ion
Capacity (WHr)	50	47
Display		
Size (in.)	13.5	11.6
Resolution	2256 x 1504	1366 x 768
Weight (lbs.)	2.8	3.33

# How we tested

## Compute-intensive tests

For our compute-intensive tasks, we opened the Zoom application and joined a two-participant video meeting. We ran all tests with the Zoom meeting running, and we minimized the application. We did not run Zoom in the background during the Rendering a 2D animation test in Blender.

### Completing the CoSpaces Edu tasks

#### Loading the Pirate Roller Coaster animation

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open the Play Store, and install the CoSpaces Edu application.
4. Open the CoSpaces Edu application, and log in.
5. Navigate to the Gallery.
6. Navigate to the Pirate Roller Coaster animation.
7. Simultaneously start the timer and click the Pirate Roller Coaster animation.
8. Once the animation fully loads and the play button appears, stop the timer.
9. Uninstall the CoSpaces Edu application.

#### Loading the End of Dinosaurs animation

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open the Play Store, and install the CoSpaces Edu application.
4. Open the CoSpaces Edu application, and log in.
5. Navigate to the Gallery.
6. Navigate to the End of Dinosaurs animation.
7. Simultaneously start the timer and click the End of Dinosaurs animation.
8. When the animation fully loads and the play button appears, stop the timer.
9. Uninstall the CoSpaces Edu application.

#### Load the At the Airport interactive environment

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open the Play Store, and install the CoSpaces Edu application.
4. Open the CoSpaces Edu application, and log in.
5. Navigate to the Gallery.
6. Navigate to the At the Airport interactive environment.
7. Simultaneously start the timer and click the At the Airport interactive environment.
8. When the interactive environment fully loads and the play button appears, stop the timer.
9. Uninstall the CoSpaces Edu application.

## Completing the Blender tasks

To use Blender on Chromebook devices, we set up Linux and installed Blender through the Linux command line.

### Baking data for a fire simulation

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open the Blender test file `fire_simulation.blend`.
4. On the right-hand panel, click Physics Properties.
5. Verify that the Frame Start time in the Cache drop down menu is set to 1 and that the End time is set to 300.
6. In the Settings menu, simultaneously start the timer and click Bake Data.
7. Once the bake data process completes, stop the timer.

### Baking data for a fluid simulation

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open the Blender test file `saucy_viscosity.blend`.
4. On the right-hand panel, click Physics Properties.
5. Verify that the Frame Start time in the Cache drop down menu is set to 1 and that the End time is set to 300.
6. In the Settings menu, simultaneously start the timer and click Bake Data.
7. Once the bake data process completes, stop the timer.

### Baking a mesh for a fluid simulation

1. With the saucy viscosity Blender test file open after running the bake data process, expand the Mesh drop down menu in Physics Properties.
2. Simultaneously start the timer and click Bake Mesh.
3. Once the bake mesh process completes, stop the timer.

### Rendering a 2D animation

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open a browser, and navigate to <https://www.blender.org/download/demo-files/>.
4. Download the test file `For You`.
5. Open the test file `(Anim) ForYou 2014.blend`.
6. To open the render menu, Click Render.
7. Simultaneously start the timer and click Render Animation.
8. Once the render process completes, stop the timer.

## Completing the Tinkercad tasks

### Using the Copy and Tinker function on the Futuristic Motorcycle project

1. Navigate to <https://tinkercad.com>, and sign in with a test account.
2. Click Gallery.
3. Click to open the Futuristic Motorcycle Tinkercad project.
4. Simultaneously start the timer and click Copy and Tinker.
5. When the 3D model has fully loaded, stop the timer.

### Rendering blocks from the Futuristic Motorcycle model

1. With the Futuristic Motorcycle project open, simultaneously start the timer and click the pickaxe.
2. When the block view has fully rendered, stop the timer.

## Using the Copy and Tinker function on the Futuristic City project

1. Navigate to <https://tinkercad.com>, and sign in with a test account.
2. Click Gallery.
3. Click to open the Futuristic City Tinkercad project.
4. Simultaneously start the timer and click Copy and Tinker.
5. When the 3D model has fully loaded, stop the timer.

## Rendering blocks from the Futuristic City model

1. With the Futuristic City project open, simultaneously start the timer and click the pickaxe.
2. When the block view has fully rendered, stop the timer.

## Completing the Labster tasks

### Loading the Impact on Climate Change lab

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open the Play Store, and install the Labster application.
4. Open the Labster application, and log in.
5. Click Catalog.
6. Click Simulations.
7. Navigate to the Human Impact on Climate Change: Balance human emissions and a growing population module.
8. Simultaneously start the timer and click play.
9. Once the module fully loads, stop the timer.

### Loading the Cell Division lab

1. Power on the device, and log in.
2. To clear any background startup activity, allow the device to idle for 10 minutes.
3. Open the Labster application, and log in.
4. Click Catalog.
5. Click Simulations.
6. Navigate to the Cell Division (Principleds): Mitosis and Meiosis module.
7. Simultaneously start the timer and click play.
8. Once the module fully loads, stop the timer.

## Common productivity test

For our common productivity application scenario, we opened Zoom and joined a four-participant video meeting. We tested each task sequentially.

## Zoom

### Launching Zoom

1. Simultaneously start the timer and launch the Zoom application from the shelf.
2. When the application fully loads and the webcam preview appears, stop the timer.

### Launching a new Zoom meeting

1. From the Zoom main screen, simultaneously start the timer and click New meeting.
2. When the meeting invite code appears and the webcam preview refreshes, stop the timer.
3. For the remainder of our timings, we joined a four-way meeting and minimized the application.

## Google Drive™

### Opening a PDF preview from Google Drive™

1. From the Google Meet chat window, simultaneously start the timer and click the link to the test PDF.
2. When the PDF preview fully loads in the web browser, stop the timer.

## Google Sheets™

### Opening a shared Microsoft Excel file with Google Drive™

1. From the Google Meet chat window, simultaneously start the timer and click the link to the test .csv file shared via Google Drive™.
2. When the Google Sheets™ document fully loads, stop the timer.

### Creating a chart in Google Sheets™

1. From Google Sheets™, select the range of data, and click Insert.
2. Simultaneously start the timer and click Chart.
3. When the chart fully loads into the document, stop the timer.

## Google Slides™

### Opening a shared Google Slides™ presentation

1. From the Google Meet chat window, simultaneously start the timer and click the link to the Google Slides™ test document shared via Google Drive™.
2. When the Slides presentation fully loads, stop the timer.

### Copying and pasting a graph from Google Sheets™ into a Google Slides™ presentation

1. Navigate to the Google Sheets™ test document tab.
2. Select and copy the bar graph.
3. Navigate to the first slide of the Google Slides™ presentation.
4. Simultaneously start the timer and paste the bar graph into the first slide.
5. When the bar graph fully loads, stop the timer.

Read the report at <https://facts.pt/XLi8BZz>



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