Get a more responsive Chromebook to help accelerate learning outcomes using Intel® Skills for Innovation applications

An Intel® Core™ i3-1215U processor-powered Chromebook completed many tasks faster than one powered by an Intel® Celeron® N5100 processor

The Intel® Skills for Innovation (SFI) framework includes activities, lessons, and projects that rely on engaging, fun applications. More responsive devices that can complete tasks quickly in those applications can pay off in significant ways—the time savings could help instructors finish lessons within allotted time or help students stay focused on assignments to finish them sooner.

Using applications in the Intel SFI framework and others, we tested the responsiveness of two Chromebooks configured with different Intel® processors:

- An Intel® Core™ i3-1215U processor-powered Chromebook
- An Intel® Celeron® N5100 processor-powered Chromebook

In our tests, the Intel® Core™ i3 processor-powered system saved time on tasks in applications such as Blender, Tinkercad®, Google Sheets™, and others. Faster, more responsive systems also make student experiences more immersive and collaborative.

60% less time

Loading a module
in CoSpaces Edu*

61% less time

Baking a mesh in
a simulation in Blender*

67% less time

Opening and editing files*

*Intel® Core™ i3-1215U processor-powered HP Elite Dragonfly Chromebook vs. Intel® Celeron® N5100 processor-powered HP Chromebook x360 11 G4 Education Edition with both systems running a Zoom video call in the background
See the **science behind this report for detailed system configurations and benchmark results.

Supplement your curriculum with engaging applications

The applications in the Intel SFI framework allow teachers to create technology-based lessons, activities, and projects that can promote cognitive skill development in students. According to Intel®, "the Intel® SFI Initiative guides [learners] to build their skills to maximize learning outcomes and prepare students for a changing, technology-dominated world."[1]

For educators using Intel® SFI in their curriculum, devices powered by faster, more responsive Intel® Core™ i3-1215U processors have the potential to provide a more immersive and collaborative learning experience, which could also help maximize learning outcomes. In addition, faster processors could help instructors using the Intel® SFI framework and other applications do more with class time and help manage the classroom by reducing distractions due to longer load times. More responsive systems allow students to complete tasks, such as rendering a biology animation or a weather simulation, quickly, which could mean a better experience and better outcomes. Saving seconds of time may not seem like much on the surface but can really add up over a day of learning.

Intel® Skills for Innovation

Intel® Skills for Innovation (SFI) is a framework that helps teachers incorporate technology into an existing curriculum. According to Intel®, the "Intel® SFI Initiative helps educators integrate technology into their teaching as they foster the development of social, emotional, cognitive, and technological skills, which prepare students for a technology-driven workplace."[2] Many of the applications we tested are part of SFI. For more information, visit https://skillsforinnovation.intel.com/landing/index.html.

Key findings

CoSpaces Edu
- Loading Pirate Roller Coaster animation: 60% less time—save 24 seconds
- Loading End of Dinosaurs animation: 35% less time—save 12 seconds
- Loading At the Airport interactive environment: 48% less time—save 18 seconds

Blender
- Baking data for fluid simulation: 49% less time—save 25 seconds
- Baking mesh for a fluid simulation: 61% less time—save 54 seconds
- Rendering a 2D animation: 42% less time—save 14 minutes

Tinkercad
- Using the Copy & Tinker function on a futuristic city design: 49% less time—save 26 seconds
- Rendering blocks for a futuristic city design: 50% less time—save 32 seconds

Labster**
- Loading the Impact on Climate Change lab: 58% less time—save 18 seconds
- Loading the Cell Division lab: 57% less time—save 12 seconds

Scenario of common productivity tasks: 67% less time—save 86 seconds
- Launching the Zoom application and a meeting
- Opening a PDF preview from Google Drive and viewing a print preview of a PDF
- Opening a shared Excel file from Google Sheets and inserting a bar graph
- Opening a shared Google Slides Presentation and copying and pasting a graph from Google Sheets

*See the **science behind this report** for detailed system configurations and benchmark results.
**At the time of this report, Labster is not in the SFI framework.

How we tested

The devices under test

We compared two Chromebooks: one with a six-core Intel® Core™ i3-1215U processor and one with a four-core Intel® Celeron® N5100 processor.

In addition to the processors, the systems differed in many ways, primarily in size and component upgrades to support the more powerful Intel® Core™ i3-1215U processor. The Intel® Core™ i3 processor-powered system weighed less but had a larger (13.5-inch) screen. In terms of resources, the Intel® Core™ i3 processor-powered Chromebook had 8 GB of memory, 128 GB of SSD storage, and a 50WHr battery.

The Intel® Celeron® N5100 processor-powered system weighed more and had a smaller 11.6-inch screen, 4 GB of slower memory, 32 GB of embedded MultiMediaCard storage, and a 47WHr battery.

Our testing

We ran Zoom in the background during most testing. To minimize the effect of network performance on testing results, we performed testing on the same day and connected each Chromebook to the same Wi-Fi network.

Phase 1: Compute-intensive app scenarios

In the first phase, we hand-timed compute-intensive tasks that teachers might have students perform to supplement assignments and projects in four educational apps:

- CoSpaces Edu
- Blender
- Labster
- Tinkercad

The following sections describe the apps and how students and teachers might use them for educational activities. We ran each test three times and report the median time.

Phase 2: Common productivity apps scenario

For the second phase, we created a multi-tasking scenario featuring common productivity apps that students might encounter in the course of their work. To account for anytime/anywhere learning, each device ran Zoom in the background, while we completed tasks in Google Drive™, Google Sheets™, and Google Slides™.

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

The dark teal box below represents a fictional scenario based on the results of PT testing. Though the people aren't real, the scenario represents a lifelike picture of the benefits users may see in the real world.

Ms. Arnold loves using CoSpaces Edu activities from the Intel® SFI framework with her ninth graders. This year, the school got new Intel® Core™ i3-1215U processor-powered devices, which can help students stay on task in CoSpaces Edu instead of chatting with classmates. Fitting more activities into a class period and not having to keep her students focused is a win-win for Ms. Arnold.

Compute-intensive tasks

Save time in CoSpaces Edu

CoSpaces Edu is a browser-based, 3D animation app that allows users to create, code, and explore their own digital projects. The Intel® Core™ i3-1215U processor-powered system loaded two animations and one interactive environment faster than the Intel® Celeron® N5100 processor-powered system. Figure 1 shows the time that each system needed to load the 3D animations.

Save 24 seconds loading Pirate Roller Coaster animation with CoSpaces Edu

15.7 sec
40.2 sec

60% less time[*]

Save 12 seconds loading End of Dinosaurs animation with CoSpaces Edu

22.6 sec
34.8 sec

35% less time[*]

Save 18 seconds loading At the Airport interactive environment with CoSpaces Edu

19.5 sec
38.2 sec

48% less time[*]

■ Chromebook with an Intel® Core™ i3-1215U processor
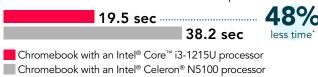■ Chromebook with an Intel® Celeron® N5100 processor

Figure 1: Time (in seconds) to complete tasks in CoSpaces Edu while running a Zoom call in the background. Less is better. Source: Principled Technologies.

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

Save time in Blender

Blender allows students to work extensively on computer graphics projects, including performing tasks for modeling, animation, rendering, motion tracking, video editing, and more. The tasks we timed provide a glimpse of how well the Chromebooks can handle some of the compute-intensive tasks involved with this work.* For example, baking, a task we timed in different simulations, requires significant compute resources because the system is storing or caching the results of a complex calculation.

Having faster, more responsive Chromebooks enables educators to include more compute-intensive skill-building activities into their Intel® SFI-inspired lesson plans.

In all four of our Blender tests, the Intel® Core™ i3-1215U processor-powered system completed the tasks faster than the Intel® Celeron® N5100 processor-powered system. The largest percentage difference between the two systems was when they baked a mesh for a fluid simulation (61.9 percent less time).

Save nearly 9 seconds baking data for a fire simulation with Blender

11.1 sec ··· **44%** less time**
20.0 sec

Save 25 seconds baking data for a fluid simulation with Blender

26.3 sec ·· **49%** less time**
52.2 sec

Save 54 seconds baking a mesh for a fluid simulation with Blender

33.4 sec ··· **61%** less time**
87.7 sec

■ Chromebook with an Intel® Core™ i3-1215U processor
■ Chromebook with an Intel® Celeron® N5100 processor

Figure 2: Time (in seconds) to complete tasks in Blender while running a Zoom call in the background. Less is better. Source: Principled Technologies.

Compared to the Intel® Celeron® N5100 processor-powered system, the Intel® Core™ i3-1215U processor-powered system saved the most time on a Blender task when rendering a 2D animation—14 minutes (see Figure 3).

Save over 14 minutes rendering a 2D animation
with Blender

Chromebook with an Intel® Core™ i3-1215U processor

19 min 15 sec ···························· **42%** less time*

Chromebook with an Intel® Celeron® N5100 processor

33 min 31 sec

Figure 3: Time (in minutes and seconds) to render a 2D animation in Blender. Less is better. Source: Principled Technologies.

Make education more accessible

Zoom is a teleconferencing and video chat application that enables users to connect, share ideas, and participate in remote events, seminars, and more. Individuals and companies around the world use Zoom as an integral part of their day-to-day operations.[3]

*To use Blender on the Chromebook devices, we set up a Linux environment and installed Blender through the Linux command line.
See the **science behind this report for detailed system configurations and benchmark results.

Save time in Tinkercad

Tinkercad is a browser-based computer-aided design (CAD) for 3D design, electronics, and coding. The app offers an introduction to many of the tasks that Autodesk®, a suite of popular professional CAD programs, supports.

In addition to completing all four Tinkercad 3D design tasks in less time than the Intel® Celeron® N5100 processor-powered system, the device containing the Intel® Core™ i3-1215U processor handled the added pressure of the more complex futuristic city design load better. The Intel Core processor-based device needed roughly half the time to complete those two tasks that the Intel Celeron processor-based system needed.
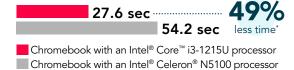
Save 2 seconds using the Copy & Tinker function on a futuristic motorcycle design with Tinkercad

8.4 sec .... **25%** less time*
11.2 sec

Save 4 seconds rendering blocks for a futuristic motorcycle design with Tinkercad

6.1 sec .... **41%** less time*
10.5 sec

Save 26 seconds using the Copy & Tinker function on a futuristic city design with Tinkercad

27.6 sec .... **49%** less time*
54.2 sec

Save 32 seconds rendering blocks for a futuristic city design with Tinkercad

31.6 sec .... **50%** less time*
64.0 sec

■ Chromebook with an Intel® Core™ i3-1215U processor
■ Chromebook with an Intel® Celeron® N5100 processor

Figure 4: Time (in seconds) to complete tasks in Tinkercad while running a Zoom call in the background. Less is better. Source: Principled Technologies.
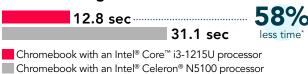
Save time in Labster

Labster provides over 300 virtual science lab simulations that enable students to learn and apply their understanding of STEM topics.[4] Labster virtual labs can serve as standalone assignments or as supplemental activities to reinforce important concepts or lab techniques.

In our Labster testing, the Intel® Core™ i3-1215U processor-powered system loaded two labs faster than the Intel® Celeron® N5100 processor-powered system. This speedier interaction can provide a more immersive and interactive learning environment for students practicing lab skills and visualizing theory.

Save 18 seconds loading the Impact on Climate Change lab with Labster

12.8 sec .... **58%** less time*
31.1 sec

Save 12 seconds loading the Cell Division lab with Labster

9.6 sec .... **57%** less time*
22.5 sec

■ Chromebook with an Intel® Core™ i3-1215U processor
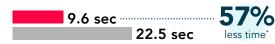■ Chromebook with an Intel® Celeron® N5100 processor

Figure 5: Time (in seconds) to complete tasks in Labster while running a Zoom call in the background. Less is better. Source: Principled Technologies.

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

Let's imagine how teachers and students might benefit from faster devices in the real world. Ms. Almas allotted 15 minutes for her statistics students to confirm that their upcoming group presentations were ready. Zahara and Frannie were shocked to discover missing data points in their presentation. They used Zahara's Intel® Core™ i3-1215U processor-powered device to Zoom with their teammate, Rose, who was visiting relatives in another state. The trio quickly loaded the problematic PDF, opened and edited the incomplete spreadsheets, and updated their presentation file before time ran out. This helped Ms. Almas keep the presentation schedule intact.

Common productivity tasks

Spend less time on tasks in Google Workspace apps

Figure 6 shows the results of our multitasking, scenario-based tests, which included the use of several Google Workspace™ apps with Zoom running in the background. As an example of one of those tasks, when opening a shared Google Slides presentation, the Intel® Core™ i3-1215U processor-powered Chromebook performed the task in 81.1 percent less time than the Intel® Celeron® N5100 processor-powered Chromebook. For all the individual task results in this scenario, see the science behind this report.

Save up to 86.1 seconds working with documents, charts, and presentations during a Zoom meeting

with Google Drive, Google Sheets, Google Slides, and Zoom

67% less time* with the Intel® Core™ i3-1215U processor-powered Chromebook

- Copying/pasting a graph from Google Sheets into presentation
- Opening a shared presentation

with Google Slides™

- Inserting a bar graph
- Opening a Microsoft Excel file
- Opening a shared Microsoft Excel file

with Google Sheets™

- Viewing a print preview
- Opening PDF preview

with Google Drive™

- Launching meeting
- Launching Zoom application

with Zoom application

Chromebook with an Intel® Core™ i3-1215U processor
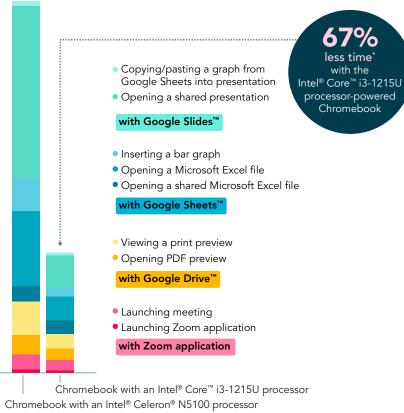Chromebook with an Intel® Celeron® N5100 processor

Figure 6: Time (in seconds) to complete tasks in Google Workspace apps while connected to a Zoom call. Less time is better. Source: Principled Technologies.

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

Conclusion

Educators can use applications from the Intel® Skills for Innovation framework to engage students in higher-order cognitive activities and build skill sets and mindsets that can promote success for a future technology-driven workforce. Providing students with faster, more responsive systems to run those applications could unlock better learning experiences while potentially maximizing instructional time. We found that in some applications within the Intel® SFI framework, such as CoSpaces Edu, students can complete tasks faster on an Intel® Core™ i3-1215U processor-powered Chromebook compared to an Intel® Celeron® N5100 processor-powered one.

1. Intel®, "Intel® Skills for Innovation is Reinventing Technology's Role in Education to Empower Students to Become the Next Generation of Innovators," accessed January 9, 2023, https://skillsforinnovation.intel.com/landing/index.html.
2. Intel®, "Introducing Intel® Skills for Innovation," accessed December 6, 2022, https://skillsforinnovation.intel.com/landing/index.html#what_is_intel.
3. Zoom, "Video Conferencing, Cloud Phone, Webinars, Chat, Virtual Events | Zoom," accessed December 7, 2022, https://zoom.us.
4. Labster, "Explore our Growing Catalog of Virtual Labs," accessed December 15, 2022, https://www.labster.com/simulations.

Read the science behind this report at https://facts.pt/kV5ku6k ▶

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