PROJECT SPECTRUM

Does Your Little Learner Use a Secure Distance-learning Tool?

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Executive Summary

The COVID-19 pandemic has caused a massive shift in the U.S. education system from traditional in-person classrooms (*kindergarten through university*) to online distance-learning. This shift was an easy adjustment for some students because many school districts had already incorporated aspects of distance-learning curricula before the pandemic began. However, some school districts were still relying on traditional in-class participation, with students attending only an occasional computer class. Through careful research of the top ten platforms (i.e., Blackboard, Canvas, Coursera, Edmodo, EdPuzzle, Google Classroom, Khan Academy, Loom, Pear Deck, and Socrative), Google Classroom rose to the top. Despite the security vulnerabilities each tool may have, from privacy to malvertising, educators prefer Google Classroom.

Introduction

The sudden shift from traditional in-class teaching to global homeschooling has produced some frustrating moments for parents, teachers, administrators, and students. As school districts searched for the best platforms, administrators looked at distance-learning and online tools that were already in use by colleges and universities. At the collegiate level, students are more experienced with computers and are accustomed to studying independently; however, from kindergarten through high school (K-12), many parents are often actively involved in their children's education, including helping with homework.

Over the past several years, that involvement has included using computers to help their children learn lessons and do homework. Unfortunately, distance-learning via computers was a significant shift, and most families simply lacked the skills to understand or participate with their children in online instruction. Even computer-savvy families complained that there was insufficient instruction on how to interact with online curricula.

There are more difficulties: tens of thousands of children in the U.S. do not have the mobile devices they need to connect with their schools; many more cannot afford internet service. In desperation, teachers and school administrators advised students to go to parking lots or other public places where they could connect to the internet and listen to their lessons. This behavior is a potential threat because open public networks are not secure, so hackers can eavesdrop on public network traffic and steal information. The result has steepened the connectivity learning curve for educators from offline to online teaching. Teachers have been forced to think creatively to optimize the learning experience for K-12 and higher education students, as distance-learning technology moves forward during the pandemic. Distance-learning tools, which are essentially learning management systems (LMS), pose additional challenges because of the abruptness of the change in physical to e-learning classrooms. Other challenges include selecting the best distance-learning tool and awareness of potential cybersecurity threats to these tools.

The paper compares the most popular platforms, along with their tools and functions, and then discusses any potential cybersecurity threats.

P R O J E C T S P E C T R U M

The Platforms
The table below shows the top 10 distance-learning tools. All of them have received consistently high marks from educators across all grade levels and subject matter.

TOP 10 DISTANCE-LEARNING TOOLS									
Blackboard	Canvas	Coursera	Edmodo	EdPuzzle	Google Classroom	Khan Academy	Loom	Pear Deck	Socrative

Distance-learning Tools:

1. **Google Classroom** may be the easiest, most accessible, and most affordable way to launch an online learning experience. To begin with, it is free. It also works well with the popular classroom model of the HP Chromebook. Teachers assign students to specific classrooms via password from which they can attach and submit assignments for grading, feedback, and assessment.[1] Since the onset of COVID-19, many schools have continued their curricula with the help of G Suite for Education. The suite offers free productivity tools, designed for learning and teaching, including Hangouts (for video and audio conferencing), Gmail, Docs, Slides, Sheets, Forms, and Google Classroom.[2]

   Top benefits of Google Classroom:
   - **Accessibility** - can be accessed from any computer via Google Chrome or from any mobile device regardless of platform
   - Performs well with Chromebook and is **Free**
   - **Paperless -** eliminates the excessive use of paper
   - Built-in tools make **Communicating** with students and parents easier
   - It offers several ways for students to **Collaborate**
   - **Data Analysis** collected from assessments with feedback from teachers, ensures that students understand and identify learning objectives

   In contrast to Google's regular services, Google Classroom does not allow advertising on its interface. Also, issuer data cannot be scanned or used for advertising purposes.[3]

   Cybersecurity:
   Google maintains a robust cybersecurity culture for data, network, cloud, and physical security. *Google Chromebooks* are the most popular devices, capturing 53% of the K-12

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[1] https://edu.google.com/products/classroom/?modal_active=none
[2] https://journal.com.ph/technology/other-technologies/tools-and-resources-distance-learning
[3] https://www.thetechedvocate.org/10-benefits-of-google-classroom-integration/

market.[4] Google values community assistance in identifying vulnerabilities in Cloud Platforms and other Google products.

The principal risk to Google products is the threat to privacy and fundamental rights. Google tends to collect information from users with or without their knowledge. According to Commonsense.org, "Google may also collect personal information directly from users of G Suite for Education accounts, such as telephone number, profile photo, or other information they add to a G Suite for Education account."[5]

2. **Blackboard** is a leader in providing assignments and grading for colleges and universities, according to its website. Blackboard is an open community for students who enroll for courses on Blackboard's CourseSites, Learn, Collaborate, SafeAssign, and Ally, and are available for a trial. According to Blackboard's website, its streamlined delivery brands the platform supportive through its learning tools and engages the entire Blackboard user's community.[6]
Cost of Blackboard: free 30-day trial
Ongoing account: Contact Blackboard for a quote.

   Cybersecurity: Despite claims on the vendor's website, Blackboard has many known security vulnerabilities,[7] such as cross-site scripting (XSS)[8] and authorization vulnerabilities.[9] There is also an article about a teen who hacked Blackboard.[10]

3. **Canvas** is a learning management platform used by more than 30% of the higher education community. It is also becoming a top provider for K-12 learning. Canvas is an open-source option, with several built-in tools that handle the needs of remote students, teachers, and parents. The app allows parents to see their children's assignments. It also provides data metrics for administrators to assess performance. The Canvas website states that it is a course-training, learning-management system. The app, however, is not a time-saver for teachers because they must design and develop content and resources for lesson support and place it in the app.[11]
Cost of Canvas: Free to students and teachers for the basic account.
Full account: Schools and districts should contact Canvas for a quote.

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[4] https://gbhackers.com/google-dedicate-cyber-security/
[5] https://privacy.commonsense.org/evaluation/Google-Classroom
[6] https://www.blackboard.com/educator-resources/k12-resources
[7] https://www.cvedetails.com/vulnerability-list/vendor_id-504/Blackboard.html
[8] https://nvd.nist.gov/vuln/detail/CVE-2020-9008
[9] https://www3.cs.stonybrook.edu/~ttran/blackboard_report.pdf
[10] https://www.wired.com/story/teen-hacker-school-software-blackboard-follett/
[11] https://www.instructure.com/canvas/

Cybersecurity:

Case study – Schools nationwide closed abruptly because of the pandemic. Students in Broward County Public Schools began online learning on a Monday morning on the "Canvas Learn" platform; however, Canvas crashed because of the sudden surge leaving students and teachers unable to log on and webpages unresponsive.[12]

Canvas has many security vulnerabilities[13] such as XSS and SSL attack vulnerabilities, but it also has many advantages:[14]

Key security features that Canvas supports

- Full encryption for data at rest

- Multi-factor authentication

- SOC 1/SSAE 16/ISAE 3402 certification

- HTTPS for all pages

4. **Khan Academy** is a free learning management system popular with parents and educators, according to the company's advertising. The offerings include K-12 courses with instructional videos, and college preparatory standardized content. Khan Academy students can test their retention with practice questions and quizzes. Once they have selected courses, instructors set up classrooms and invite students. Grading is automatic. Khan Academy's website says it is a "highly sophisticated, next-generation LMS that caters to any business or organizational type."[15]

Cost of Khan Academy: Free non-profit
Donations accepted

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[12] https://www.nbcmiami.com/news/local/broward-schools-starting-virtual-learning-amid-growing-coronavirus-pandemic/2212795/
[13] https://community.canvaslms.com/community/answers/security
[14] https://it.umn.edu/sites/itumn.umn.edu/files/security_analysis_-_moodle_and_canvas_.pdf
[15] https://www.khanacademy.org/

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Cybersecurity:

Like many online tools, Khan Academy has security vulnerabilities, such as "spoofing," i.e., emails are sent that appear to be from khanacademy.org. The company is eager to maintain and secure its website and encourages users to report any vulnerabilities.[16]

Educational institutions and distance-learning tools will continue to face cyber threats because of the valuable information stored on their networks. BC19 (*before COVID-19*) university networks were difficult for administrators to effectively secure, because of the size of the networks, the number of users, and the need for internal and external users to access and share information.[17] COVID-19 has exacerbated these issues. Many educational institutions operate on tight budgets, which often means working with antiquated IT systems. Even many state-funded schools with heathy budgets have put technology investments on hold because of funding cuts at the local, state, or federal level. One result is that many schools do not have the dedicated IT budgets and resources that corporate enterprises enjoy. Nevertheless, they encounter many of the same challenges and threats.

External threats – In addition to the challenges noted above, schools remain prime targets for a variety of advanced and evolving cyberthreats. Malvertising compromises a student's interaction on a website, by including malicious advertisements. Malvertising embeds attacks to well-known websites for attempted delivery of ransomware. Commercial advertising on Khan Academy's website could potentially be dangerous for teachers and students because some advertising may not be what it appears to be.

According to a Malwarebytes article, there are some concerning threats: "Any of these threats can be easily spread or propagated from students to teachers to staff and back again, because of the open sharing policies that make the connected distance-learning classroom concept work." Distance-learning tools require advanced threat protection to address the challenges their IT/help desk departments face.

Threats to education systems exacerbated by COVID-19 include:

- Email phishing
  - Staff and students redirected to malicious websites
- Botnet attacks
  - Student and campus computing resources infected and hijacked
- Malvertising
  - Malware and scams delivered via infected ads on popular sites (e.g., msn.com, nytimes.com, bbc.com)
- Ransomware

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[16] https://hackerone.com/khanacademy

[17] https://www.fireeye.com/content/dam/fireeye-www/current-threats/pdfs/ib-education.pdf

- - Campus storage arrays and student devices attacked; encrypted data held for ransom
- PUPs and PUMs
  - Potentially unwanted programs and modifiers downloaded, slowing down computer performance
- Threat proliferation
  - Malware spreading across endpoints (e.g., infected homework emailed to professors, compromised files uploaded to class webpages or portals)[18]

The Activity of Cybercriminals' Global Evolution during March and April

The daily global evolution of COVID-19-themed threats demonstrates the consistent effort of cybercriminals and their persistent interest in exploiting fear and misinformation about the global pandemic to lure victims into clicking on malicious links, open malicious attachments, and even download and install malware.
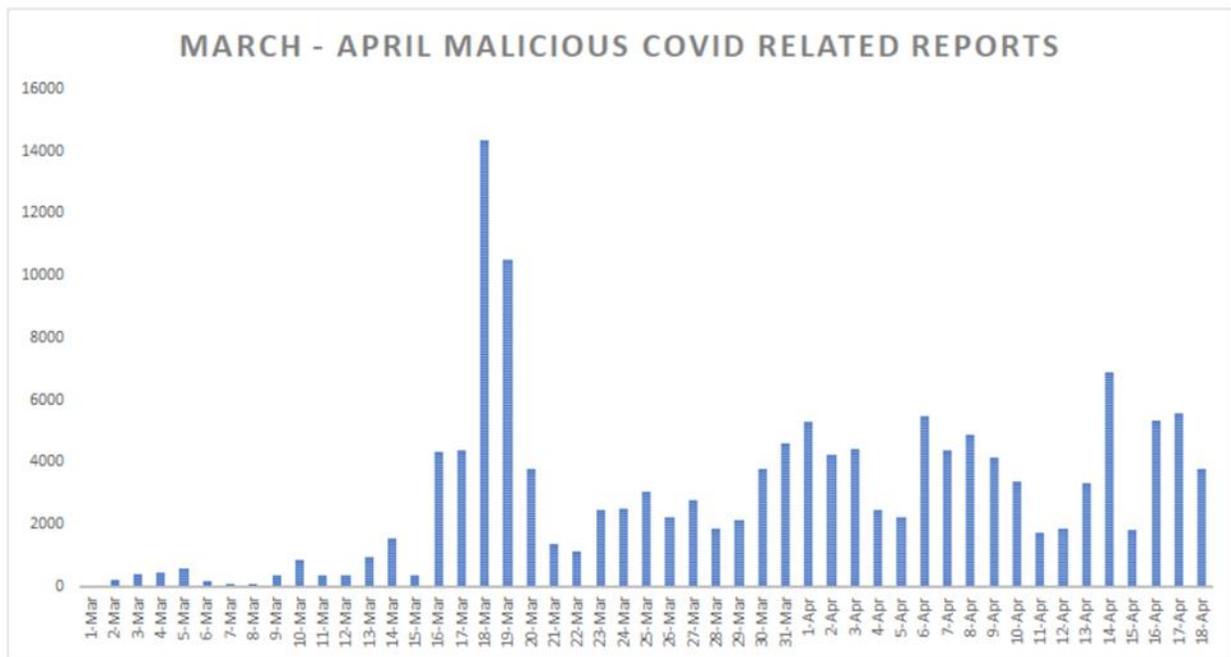

Figure 1: March – April Malicious COVID-19 Related Reports

According to a Bitdefender article, March 18 and March 19 saw spikes in Coronavirus themed threat reports, peak at 14,350, and 10,516, respectively.[19] These numbers call attention to the pattern of how reports fluctuate throughout the week.

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[18] https://www.malwarebytes.com/pdf/datasheets/EducationIndustryBrief.pdf
[19] https://labs.bitdefender.com/2020/04/coronavirus-themed-threat-reports-havent-flattened-the-curve/

Example: There are more threat reports during the workweek than during the weekend, especially on Saturdays when such reports subside. The difference may indicate that people (*students, teleworkers*) spend more time online during weekdays. Also, work computers are often shut down or at least unattended on weekends, meaning even if emails do reach inboxes during the weekend, they are less likely to be opened. Chances are they will be read on Mondays. It is important to be alert of malvertising during the week.

The New York Times calls Google Classroom the *Googlification* of the distance-learning classrooms:

> Today, more than half the nation's primary- and secondary school students — more than 30 million children — use Google education apps like Gmail and Docs… And Chromebooks, Google-powered laptops that initially struggled to find a purpose, are now a powerhouse in America's schools. Today they account for more than half the mobile devices shipped to schools.

Teachers helped drive the adoption of Chromebooks and Google Classroom by testing the application, with feedback, and word of mouth. The result is that Google Classroom is the number one web app distance-learning tool.[20] Google is winning the competition by merely offering free apps and services, ease of use, and the familiarity of G-suites.

According to the International Society for Technology in Education, Inc., educators conducted "a hands-on interactive demonstration of how administrators, counselors, and teachers can use Google Classroom beyond the traditional classroom setting." [21] During this evaluation, there were staff meetings, daily bulletins, postings of questions, and comments from students and faculty on Google Classroom. The positive feedback from students and faculty made Google Classroom tool of choice.

Dr. L. Nicely, Assistant Professor of Information Technology at colleges and universities in the U.S. and Ghana, provides another perspective. He believes that school districts are locked into G Suites because that is what their school districts have chosen. However, he adds that Google Docs is a collaborative app in real-time, and its features are easy to use. He suggests that when school officials are in the market for distance-learning tools that they should consider the opinions of teachers and students. Nicely has been told by his colleagues of how frustrated they are and that they fear distance learning will be the long-term norm. Their concern is not knowing what tool is suitable for curricula with the student or themselves. They do not want to be a help desk; they just want to teach.

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[20] https://www.nytimes.com/2017/05/13/technology/google-education-chromebooks-schools.html
[21] https://conference.iste.org/2018/program/search/detail_session.php?id=110885159

The chart below highlights some of the concerns of Professor Nicely, his colleagues, and students.

Students Needs and Concerns	Educators Needs and Concerns
Material needed for distance learning. (e.g., laptop, mobile device).	Distance learning tools suitable for curricula.
Lack of funds to continue the internet or hot spot data plans.	Alternative materials for teaching online classes.
Instructions on how to use the tool.	Instructions on how to use the tool.
Students are unable to ask questions as they could in a face-to-face classroom. Response time lags with distance learning.	Concern that students are learning from their peers and not from educators
Loss of interest	Class management e.g., attendance
Parent(s) can't support the student with their studies.	Will learning outcomes decrease or increase with online teaching?
Students do not grasp the lesson.	Will the tool support the activity of the curricula?
Need special ed lessons, not mainstream lessons.	Will the tool support special ed students?
Loss of interaction with peers.	Loss of personalization, connection with students
	Adapt curricula to what students need most.

Nicely mentioned the Individuals with Disabilities Education Act (IDEA). He and his colleagues wonder how a distance learning tool will accommodate these students and their instructors. He believes that if distance learning is the new norm, educators must be sure that it incorporates the aspirations of "No child left behind."

An email response from the author, Everett Bishop of the Record-Journal, replied to the question, "Why are most schools using Google Classroom for distance learning?:

> The question concerning Google Classroom I feel can be answered by two primary reasons (at least these are the two most common responses I have received from school administrations):

> 1. Equitability - When distance learning became the necessary alternative to education because of COVID-19, one of the biggest challenges was making sure students were able to have access to the internet so they could continue participating in school. This change meant internet connections, as well as tools (i.e., laptops, tablets, what have you), needed to get into the hands of students.

If you must address something of that scale, then it makes sense to use a platform such as Google because it is such a ubiquitous website and program to use. Many office jobs these days are requiring knowledge of Google and/or Microsoft Office programs.

Now some schools have resorted to other applications where they can post assignments and send out quick blurbs or directions to parents and teachers. But I think keeping the focus on Google, as well as the simplicity of access, was a big reason why.

2. Convenience - Google Classroom offers a variety of tools and options to its users that makes distance learning feel as much like a classroom as possible. There are "chat" and "meet" options that allow students and teachers to talk over the camera or instant messaging to keep in touch through lessons. Assignments can be sent out to individual students or groups so that everyone can participate in real-time. Essentially all correspondence and work can be completed in one program, which makes life much easier.[22]

Educational institutions and their distance-learning tools will continue to face cyber threats because of the valuable information stored on their networks. The pandemic will eventually fade, but distance-learning is poised to become a permanent feature of education. This fact will require developers, vendors, and educators to remain vigilant and resilient to cybersecurity threats.

Based on Project Spectrum's research, most school districts seem to prefer Google Classroom as the platform of choice.

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[22] https://www.myrecordjournal.com/News/Town-Times/Durham-Middlefield-News/Schools-receive-positive-feedback-on-transition-to-distance-learning.html