Teaching with Digital Tools and Apps

Torrey Trust

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EdTech Books

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Torrey Trust, Ph.D. is a Professor of Learning Technology in the Department of Teacher Education and Curriculum Studies in the College of Education at the University of Massachusetts Amherst. Her work centers on the critical examination of the relationship between teaching, learning, and technology; and how technology can enhance teacher and student learning. Specifically, Dr. Trust studies how educators engage with digitally enhanced professional learning networks (PLNs), how emerging pedagogical tools (e.g., HyperDocs), practices (e.g., Making) and technologies (e.g., 3D printers, augmented reality, ChatGPT, generative AI tools) influence learning, how to design and use open educational resources (OERs), and how to find, critically evaluate, and teach with digital tools and apps. Dr. Trust served as a professional learning network leader for the International Society for Technology in Education (ISTE) for five years, including a two-year term as the President of the Teacher Education Network from 2016 to 2018.

Dr. Trust's research, teaching, and service in the field of educational technology has received noticeable recognition, including the 2016 ISTE Online Learning Network Award, 2017 *Journal of Digital Learning in Teacher Education* Outstanding Research Paper Award, 2017 American Educational Research Association (AERA) Instructional Technology SIG Best Paper Award, 2017 ISTE Emerging Leader Award, 2019 AERA Technology as an Agent of Change for Teaching & Learning SIG Early Career Scholar Award, 2020 University of Massachusetts Amherst College of Education Outstanding Teaching Award, 2020 AECT Annual Achievement Award, 2023 MERLOT Classics Award, and the 2023 University of Massachusetts Amherst Distinguished Teaching Award. In 2018, Dr. Trust was selected as one of the recipients for the ISTE Making IT Happen Award, which "honors outstanding educators and leaders who demonstrate extraordinary commitment, leadership, courage and persistence in improving digital learning opportunities for students." www.torreytrust.com

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Accessibility Statement

Dr. Torrey Trust believes that open educational materials need to be digitally accessible in order to ensure that education is available to everyone. As such, this eBook was designed with accessibility in mind from the very first page to the very last page. We used the [Web Content Accessibility Guidelines (WCAG 2.0, 2.1)](#) of "perceivable, operable, understandable, and robust" and Coolidge et al.'s (2018) [Checklist for Accessibility](#) to create and select digitally accessible content and materials for this eBook.

If you have any questions about the accessibility of the eBook or suggestions for improvement, please contact [Dr. Torrey Trust](#).

Introduction

With the abundance in education technology (edtech) tools and apps currently available, and new ones popping up in app stores daily, how do you find the right ones for your practice? How do you ensure the digital tools and apps that you select for use in your classroom will enrich and extend your teaching, provide an accessible learning experience, and protect students' privacy? What should you look for when evaluating the user experience of apps and tools?

This free, open access eBook highlights the key steps and considerations for finding, evaluating, and teaching with digital tools and apps!

The book was designed as part of a class project for the Teaching & Learning with Technology course at the University of Massachusetts Amherst. The following undergraduate and graduate students contributed to the book: Michelle Barrett, Matthew Checrallah, Jacob Desgres, Alyssa Federico, Kiel Maurath, Madeleine Olson, Shaunak Shah, Khizar Shaikh, Alexander Shum, Caroline Sonnett, Isabelle Manrong Wang, Chenyang Xu, Chrystal Zajchowski, and Fred Zinn.

Kiel, Michelle, and Fred (authors) at the College of Education Tech Tools Showcase
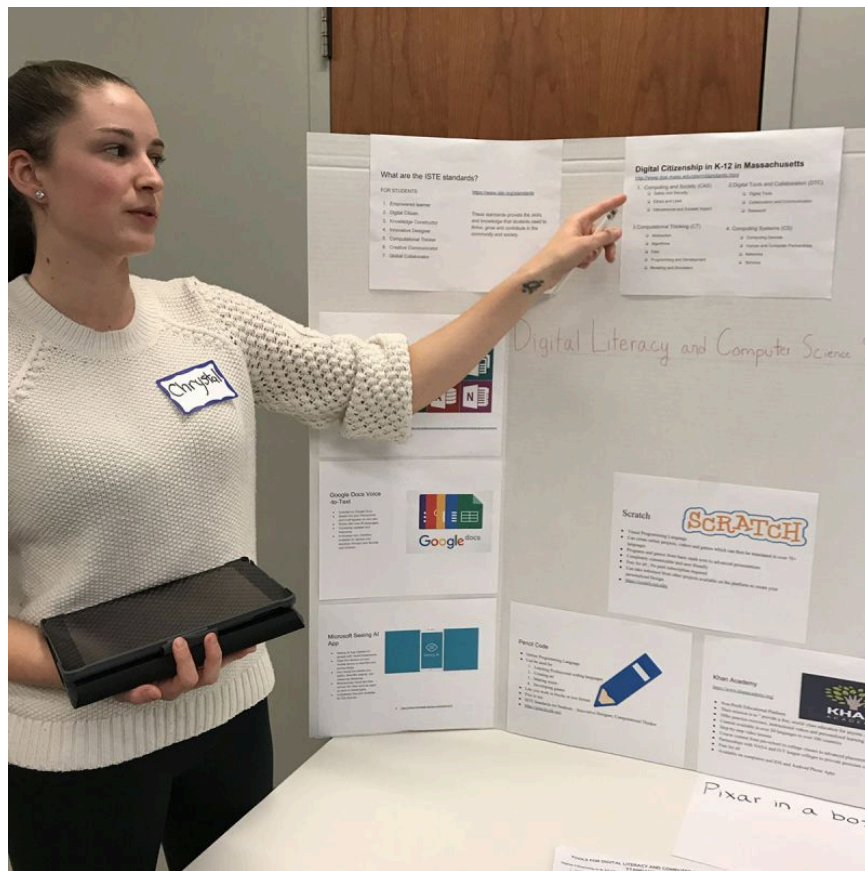
Chrystal, one of the book authors, discussing Digital Literacy and Computer Science at the College of Education Tech Tools Showcase
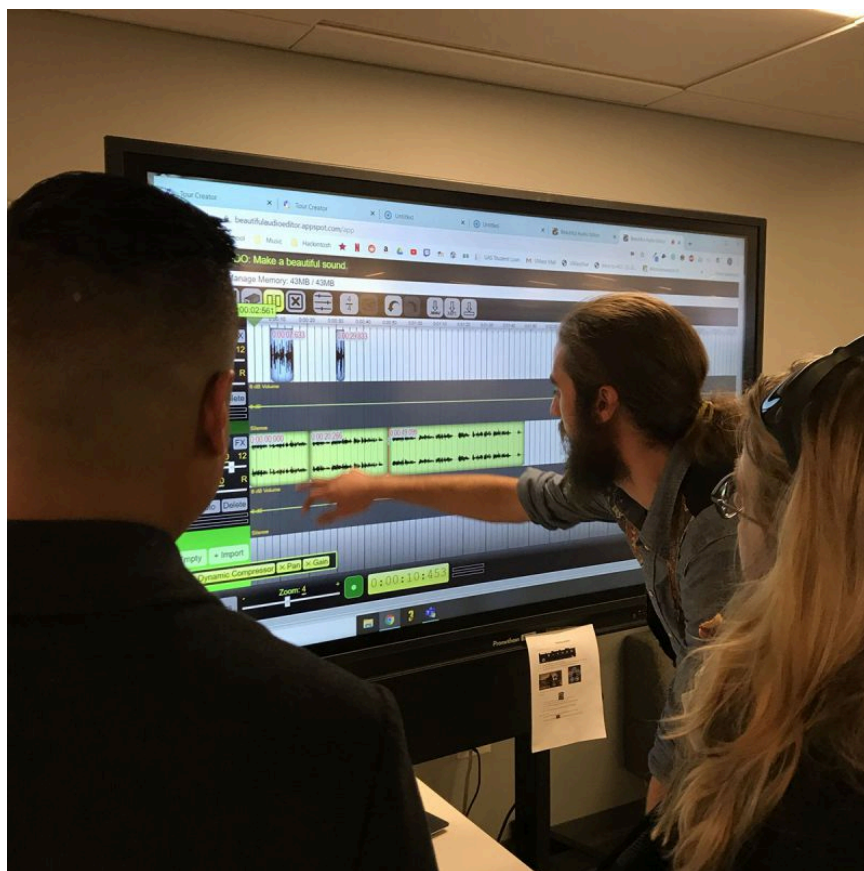
Jacob, one of the book authors, showcasing Beautiful Audio Editor at the College of Education Tech Tools Showcase

Using This Book

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Finding Digital Tools and Apps

Alex Shum, H. M., & Fred Zinn

> ## Hypothes.is Social Annotation
>
> This chapter is annotated every year as part of an undergraduate/graduate class on Teaching and Learning with Technology. To turn off the highlighted text, click on the "eye" icon in the top right corner of the browser screen.

Introduction

There are thousands of digital tools and apps out there in the world waiting to be discovered by educators like you. So, how do you find out about the latest trends, tools, and apps for teaching and learning? And, how do you discover which tools other educators are using with great success?

In this chapter, we will first discuss how to use a simple **Internet search** to find tools and apps. We will provide tips for **evaluating websites and blogs** that provide advice about tools and apps. Then, we will showcase educational technology (edtech) databases, curated lists, and tool review sites that can serve as helpful resources for finding digital tools and apps. Finally, we'll wrap up the chapter with a discussion about how to cultivate a **digitally enhanced professional learning network** to connect and learn with others about current and emerging technology tools.

Finding Digital Tools: Internet Searches

If you have a learning objective or classroom challenge (e.g., my students are struggling with math fractions) in mind, you can use an Internet search engine, such as Google, Yahoo!, Bing, or DuckDuckGo, to see if you can find a tool or app to meet your teaching needs.

However, combing through all of the results from a single search can be overwhelming. There is also the risk of finding yourself deep down the rabbit hole of interesting results and forgetting what you initially set out to find. To reduce this risk and narrow your Internet searches, here are some tips:

- Include **specific details** in your initial search, then **add or remove terms to adjust the results** (e.g., if "augmented reality" gives too many results, use "augmented reality map of national parks").

- Use **quotation marks** to group words that should be searched together (e.g., "augmented reality math app").

- If you have a specific question, write it out in the search bar. **Framing a search as a question** will often result in finding pages that specifically answer that question (e.g., "How can I teach with augmented reality?").

- If you do not see results that match your needs, **try using similar terms** that could also be used to describe this tool or topic until you find what most authors use to describe it (e.g., different ways to describe a school: "elementary school" or "primary school" or "K-12" or "early grade").

- If you want to focus your search on **specific sites**, or kinds of sites, add "**site:**" and a portion of a URL (e.g., "site:.gov" searches only government sites, "site:.edu" only searches education sites, and "site:umass.edu" only searches sites hosted by the University of Massachusetts Amherst).

- If you want to see newer pages, **activate the "Tools" feature** in the Google search and limit your **search by time frame** (e.g., setting this tool to "Past Month" for a search on "Yellowstone National Park" will limit results to the most recent posts about the park.) (see Figure 1).
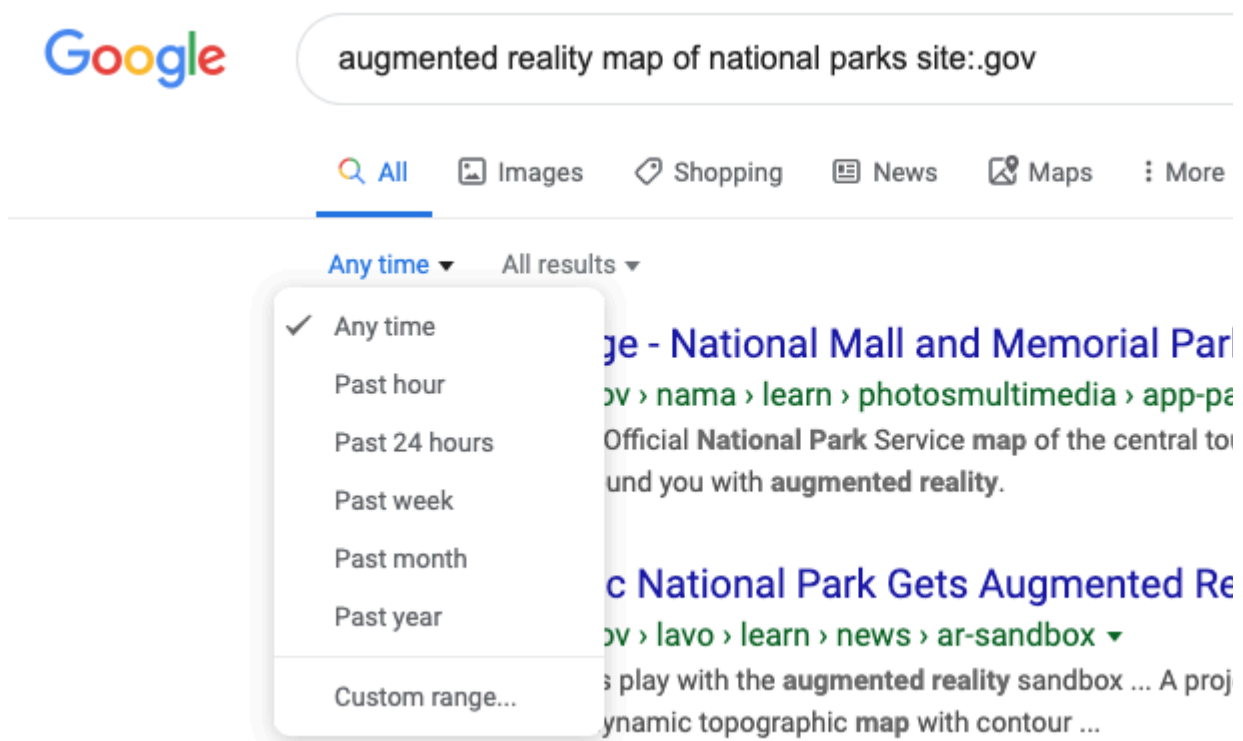
Figure 1. Using the Google search "tools" feature to restrict results to a certain time frame.

- If you want to find **specific types of files**, add "**file:**" to your search. This will show results that are only a specific kind of file (e.g., "national parks lesson plan file:pdf" will only show PDF files of lesson plans related to national parks).

- If you typically "know it when you see it," use the **Google image search**. This lets you review results more quickly by skimming images of software screenshots or students in action (e.g., searching for images of "augmented reality" will show pictures of what different augmented reality tools look like when in use).

Applying the SIFT Model to Identify Reliable Sources

When using an Internet search engine to find a tool or app, you will be presented with various sites, including blogs, articles, and websites, as well as videos that relate to your search query. **How do you know which ones to trust?**

First, take a moment to check that the information is accurate, reliable, and valuable. Some pages that promote educational technologies are posted by the same company that sells them or benefits from their use.

You can use the **SIFT model of evaluating online information** to quickly assess the veracity of a website or video (see the Check Please! Online course for more details about SIFT).

SIFT stands for **Stop, Investigate, Find,** and **Trace**:

> **Stop.** When you first enter a site, take a moment to notice information about the site itself, such as revision dates, author names, author profiles, and other background information about the author or organization. Reputable sites will include details about themselves, including contact information.
>
> **Investigate the Source.** Look for signs the site has been recently and regularly updated - When was the page last updated? Are there broken links? Who maintains this site or posted this review? Does the individual or company have a page that describes who they are and their motivation for posting this information?
>
> **Find Trusted Coverage.** Is this the best source available? Do other experts reference this site? Can you find references to this organization or individual outside their own site? Highly respected sources will be referenced on other sites and in tweets about this topic.
>
> **Trace Claims, Quotes, and Media to Their Original Content.** What criteria do they use to review tools? Do they reference known frameworks and principles? Do they provide links to other sources? Do they post evidence of how this tool makes a difference for students (other than a few endorsements)?

Use SIFT Before You Click

Keeping the SIFT model in mind when you conduct Internet searches will help you identify blogs, articles, websites, and videos that you can trust to provide accurate and reliable information that can guide your tool selection process.

Finding Digital Tools: Social Media Searches

Did you know that you can search for digital tools, apps, strategies, subject-specific content, and people within social media platforms, such as Facebook at Twitter?

Take a look at Tessa Davis' Twitter thread about how to use advanced search terms on Twitter to fine-tune what you are looking for.

Tessa Davis ✔
@TessaRDavis

The most powerful feature that Twitter has:

Advanced search

Until recently I hadn't even heard of it, but now I use it all the time.

Here are 6 twitter advanced search features that will revolutionise the way you search for what to read: 🧵 👇

8:09 AM · Apr 8, 2022 · Twitter Web App

13.1K Retweets   1,408 Quote Tweets   47.6K Likes

Finding Digital Tools: Databases, Curated Lists, and Tool Review Sites

If you are interested in discovering the newest or most popular digital tools and apps for educators, it's often easier to explore databases, curated lists, and tool review sites than to conduct a broad Internet search. These digital resources are usually created by educators who have experience using the tools or non-profit organizations who seek to help educators with their tool selection process.

Edtech tool and app databases, curated lists, and review sites can be a **good place to browse** if you are simply looking for ideas and inspiration. **You may even find a tool serendipitously** (one that you did not know you needed) that would be a perfect fit for your instructional goal(s).

The following websites and blogs are a great place to find reviews and curated lists of tools:

- Online Tools for Teaching & Learning
- Common Sense Media
- Practical Ed Tech Handbook
- Digital Connections Toolkit
- ISTE Edtech Advisor (requires ISTE membership)
- Free Tech 4 Teachers
- Practical Ed Tech
- Cult of Pedagogy
- OER Commons
- Edutopia
- TeachThought
- eLearningIndustry

Ideally you will find a database, curated list, or tool review site you **can continue to use as a resource** whenever you need to find a new tool. When you find authors who regularly post curated lists of tools and apps, **subscribe to their blogs or follow them on social media** so you can keep up to date with the latest information they share, which leads us to one of the best ways to find tools: cultivating a digitally enhanced professional learning network.

Finding Digital Tools: Cultivating a Digitally Enhanced a Professional Learning Network

Sometimes you cannot find an appropriate tool on your own, or you are just not sure if a tool you have found is as effective as it appears to be. Or, you may want to keep up to date with the latest digital tools and apps but have no time to do so. This is when personal recommendations from educators in your professional learning network (PLN) can be useful.

A professional learning network (PLN) is your own curated system of **people, spaces, and tools** that support your ongoing learning and professional growth ([Trust, Krutka, & Carpenter, 2016](#)).

When searching for digital tools, you can turn to your PLN for recommendations of new tools to try, examples of how a specific app can be used in a classroom setting, advice for how to use digital tools to address classroom challenges or meet instructional goals, and assistance for figuring out how to find and evaluate digital tools and apps for teaching and learning.

In the following video, [Professional Learning Networks (PLNs) for Educators](#), Dr. Daniel Krutka discusses how the people, spaces, and tools in his PLN support his professional growth as an educator.

[Watch on YouTube](#)

Adding People to Your Professional Learning Network

In addition to peers, family members, and people in your immediate school or community, you can use social media to reach out to a wider network of people committed to supporting each other and sharing information about teaching. As Rachelle Dene Poth ([2019](#)) stated, "It's through these relationships and finding the right tools that we will grow personally and professionally, and bring our best selves into our classrooms each day" (para. 1).

Consider who is currently part of your PLN. Who do you go to for advice about teaching, learning, and/or technology? A classmate? A colleague? A Pinterest board curator? A YouTuber?

How often do you learn about digital tools and apps for teaching and learning from the people in your PLN? If your answer is "not very often," then consider adding people to your network, such as the [six edtech bloggers who focus on classroom implementation](#) or [FableVision's Nine EdTech Thought Leaders to Watch in 2019](#).

When you are deciding who to add to your PLN, it can be helpful to reflect upon the people currently in your network and assess how you interact with them in order to identify ways to grow your PLN. Start by considering the following questions:

- How do the people in my PLN add to my professional growth?
- How often do I engage with them?
- What perspectives do they offer me? My PLN?
- Am I missing any perspectives that might help my professional growth?
- In what ways do I interact with the people in my network? (e.g., am I just following others and reading social media posts or am I engaging in thoughtful conversations with my PLN?)

Clarifying the social aspect of your network is a great first step toward expanding your PLN.

Choosing the Best Spaces to Grow Your Professional Learning Network

There are many spaces where you can connect, communicate, and learn with others as part of your PLN. These spaces might be **physical places** you go to in person, such as your school or classroom, teachers' lounge, graduate course classroom, workshop, conference, Edcamp unconference, or district training. There are also **virtual spaces**, where you can discover new ideas and engage in conversations with others both near and far, such as video conferencing tools, text and voice messaging apps, social media sites, discussion forums, blogs, and YouTube/TeacherTube.

Take a moment to think about which spaces you currently go to learn about teaching, learning, and technology:

- Which spaces are most valuable in helping you grow your craft as an educator?
- Which spaces help you learn about new digital tools and apps?
- Do spaces you visit present voices from diverse perspectives?
- Do spaces you visit push and challenge your thinking as an educator?

If you are looking for more spaces to add to your PLN, consider exploring some digital spaces that will allow you to interact with people across the country and around the world whom you might add to your network, such as Twitter chats, Facebook groups, Reddit forums, or Edmodo communities. Take a look at the [Online PLN Spaces for Educators database](#) to see if you can identify new spaces to add to your network. Look for spaces that are active (frequent posts) and relevant to your instructional goals.

Selecting Tools to Support Your Professional Learning Network

A PLN is made up of people, spaces, AND tools that support your ongoing learning and professional growth. Professional learning network tools range from those that allow you to **acquire new information** (e.g., email listservs, Internet or database searches, phone calls, curriculum materials, books) and **curate information** (e.g., spreadsheets, email folders, note taking apps, social bookmarking tools).

Which tools have been the most beneficial for you in finding new digital tools and apps for teaching and learning?

When you find amazing new tools, apps, ideas, and resources, how do you keep track of them all?

It might help to use an organizational tool to create curated lists or folders of things you learn from your PLN that you can reference when needed. Popular tools include Google Keep, Diigo, Google Spreadsheets or Docs, Microsoft Word or Excel, or Symbaloo.

Diigo is a social bookmarking tool that allows you to keep track of websites and also add comments/highlights directly on any webpage, article, or PDF. The following video provides a brief overview of Diigo:
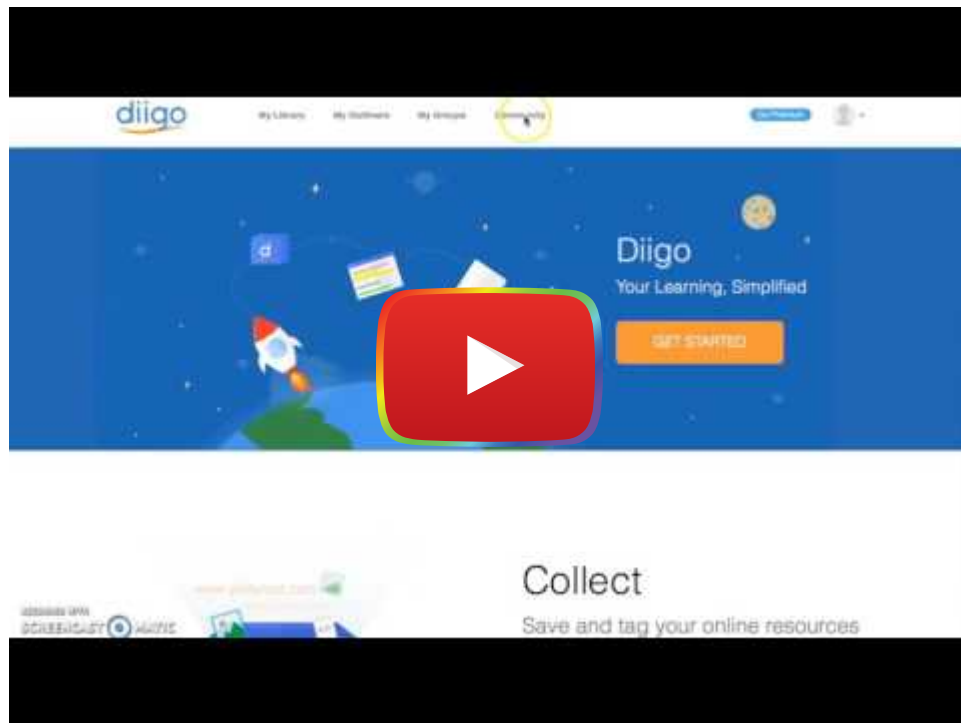
[Watch on YouTube](#)

Designing a Professional Learning Network That Promotes Personal Growth

A PLN should promote learning, growth, and change. Does your PLN interest you and excite your passions? Does your PLN offer you support and encouragement? Does your PLN challenge you to think differently? Keep changing it until it does!

The best way to do this is to make sure your PLN features a broad range of ideas and perspectives, allows for a varied learning interactions, and evolves with your interests, needs, and goals (see the PLNs for Educators open online course). Three attributes to look for in a PLN are **Diversity, Depth, and Dynamism:**

- **Diversity -** Having a diverse PLN means surrounding yourself with people and spaces that provide you with a variety of different perspectives, including gender, age, religion, nationality, pedagogical approach, discipline, years of teaching experience, school community (e.g., rural, suburban, urban), subject(s), and grade level(s), for example.
- **Depth -** Your PLN should provide deep, quality interactions with others that are engaging, discovering, experimenting, reflecting, and sharing.
- **Dynamism -** Your PLN should shift, grow, and evolve over time based on your professional goals, interests, and needs.

Participating Fully in Your Professional Learning Network

When you attend a workshop or conference or visit a social media space, which of the following actions do you typically do?

1. Read posts or listen to others
2. Retweet or share ideas provided by others
3. Ask for advice, resources, or ideas
4. Engage in thoughtful conversations about your practice
5. Collaborate with others
6. Write or present your own ideas

Each of these actions can support your learning and growth. Reading posts and listening to others can help you discover new ideas and tools and even spark creative thinking about how to use technology in your classroom. Retweeting and sharing ideas provided by others can help you build your digital reputation and network for further learning. Asking for advice, resources, and ideas is a direct way to find digital tools and apps you can use immediately in your practice. Engaging in thoughtful conversations might lead to changes in the way you teach with technology or think about teaching. Collaborating with others can result in the development of new digitally enhanced lesson plans and learning activities. While, writing or presenting your own ideas can lead to advice, feedback, or insights from others that will support your professional growth.

While each of these actions can support your learning and growth, the key is to **vary your actions within and across the spaces** in your network in order to maximize the value of your PLN learning experiences.

If you think that you don't have anything to contribute to your network and would prefer to just "lurk and learn," think again! Whether it is success stories, epic fails, or creative ideas, you have something you can share that will benefit others. Participating and connecting with others allows you to heighten your opportunity for learning and crowdsourcing.

Expanding Your Digital Professional Learning Network With Feedly and Twitter

In the following two sections, we will take a closer look at two popular tools for expanding your PLN: **Feedly** and **Twitter**.

Feedly

Feedly, a news aggregator, can be used to gather posts from multiple sources into a single "feed." Instead of having to go to multiple sites to check for updates, Feedly curates the latest posts and information from blogs, news sites, or social media channels you follow into a single site.

Getting started is free and easy. Feedly is offered on Android devices, at the App Store, and in your favorite web browser.

Once you log in to Feedly, you can create a "feed," which is a folder where you can curate multiple blogs, news sites, or other RSS feeds. For example, you might create one feed for "edtech" and another one for "teaching."
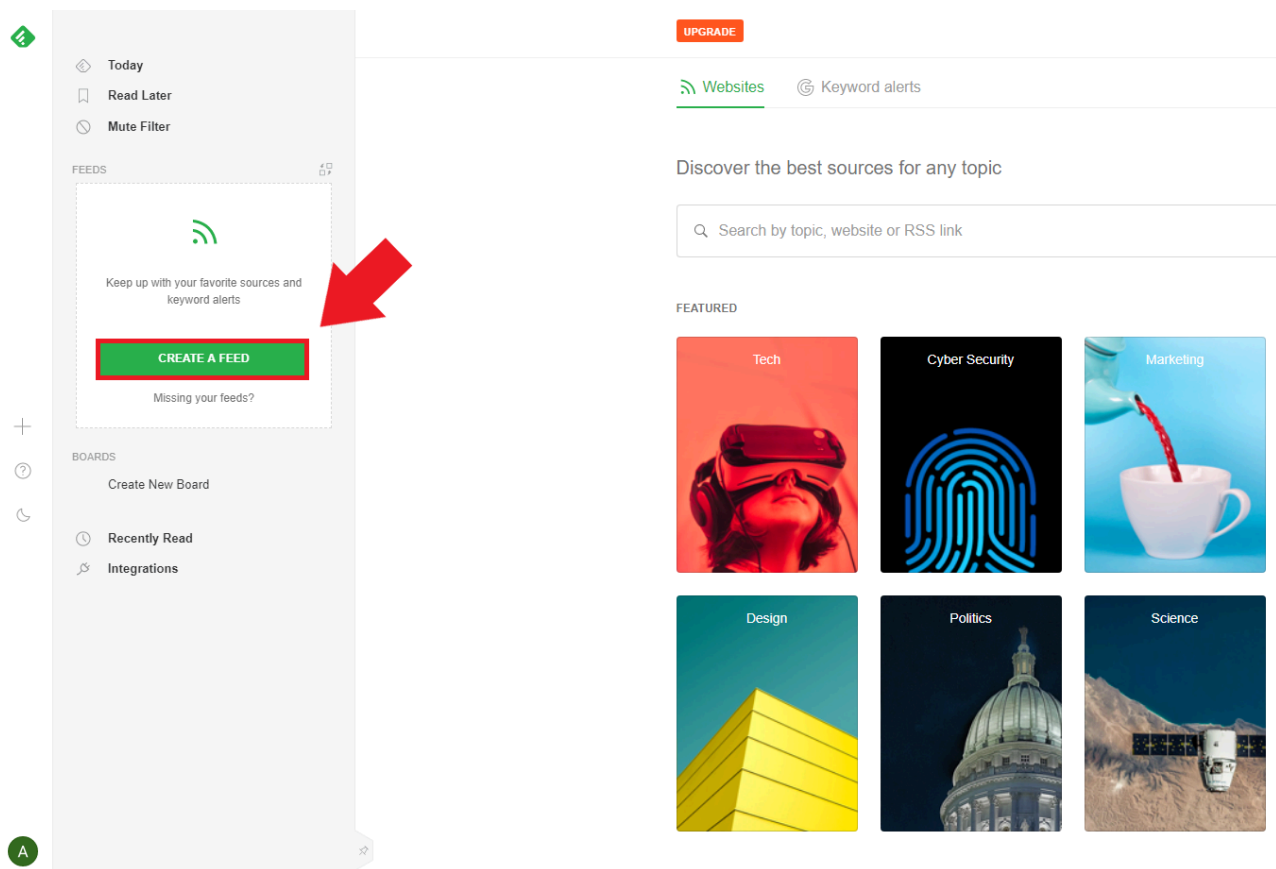
Figure 2. Creating a new feed.

Though your edtech feed will start completely empty, it is simple to start adding sources you would like to follow. Click the "Add Content" button (or plus "+" sign on the left side of the screen) to get started. We recommend adding the following blogs, which have been around for quite some time, are largely trusted by educators, and provide an excellent jumping-off point for your explorations into digital tools and apps:

- Free Tech 4 Teachers
- User Generated Education
- Cult of Pedagogy
- TeachThought
- Getting Smart
- EdSurge
- History Tech
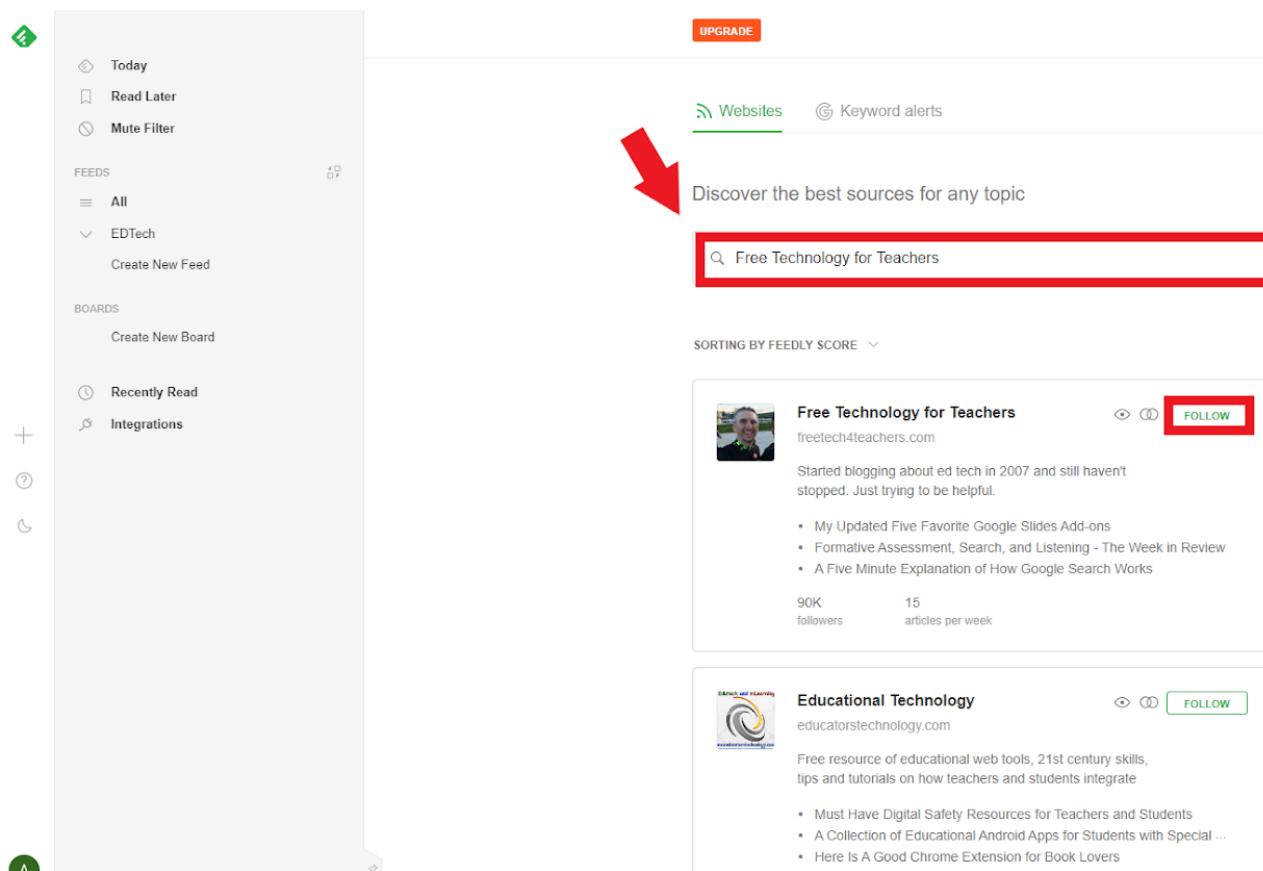
Figure 3. Adding blogs to your feed. NOTE: Type in the name of the blog in the search bar and hit the follow button!

Feedly will automatically recommend related sources depending on sources you have already added. Explore these options and see if any pique your interest.

Once you are done adding sources to your edtech feed, click on the edtech feed button on the left side of the screen. This will allow you to see the latest posts from all of the sources in that feed.
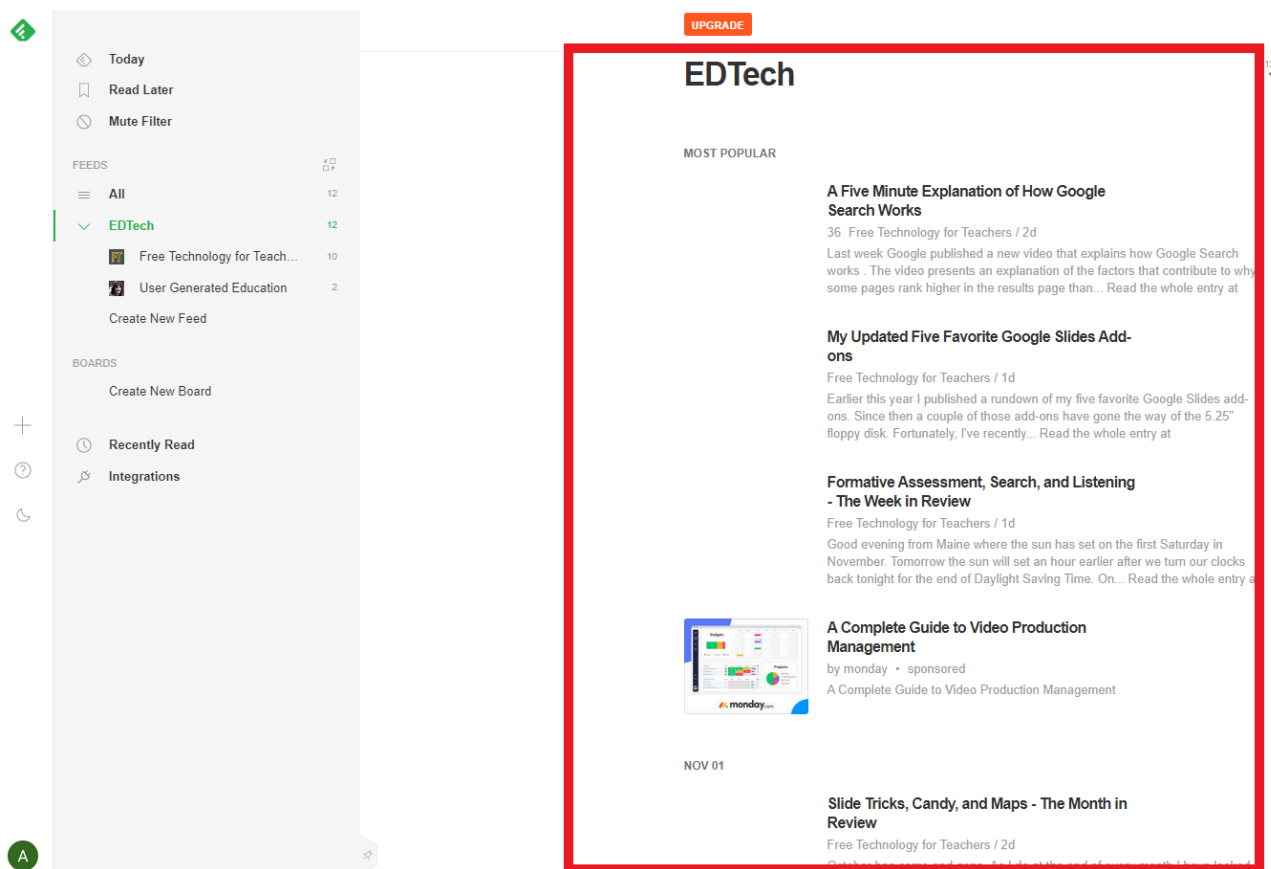
Figure 4. Viewing all the blogs from the EDTech feed in one area.

Feedly is a great way to meet other educators from different education communities. For example, Richard Byrne, whose blog Free Tech 4 Teachers was mentioned earlier, has a section on his website with contact information, so you could follow him on Twitter.

Feedly also allows you to share your personally curated feeds with anyone—friends, classmates, colleagues, your PLN—through the Feedly Teams feature. This is a great way to keep everyone up to date on the latest edtech news.

To get started, go to the feed you wish to share and click on the icon that looks like an arrow pointing at two people (in the top right corner of the screen). Follow the on-screen instructions, and you and your teammates will automatically receive updates from your feed!
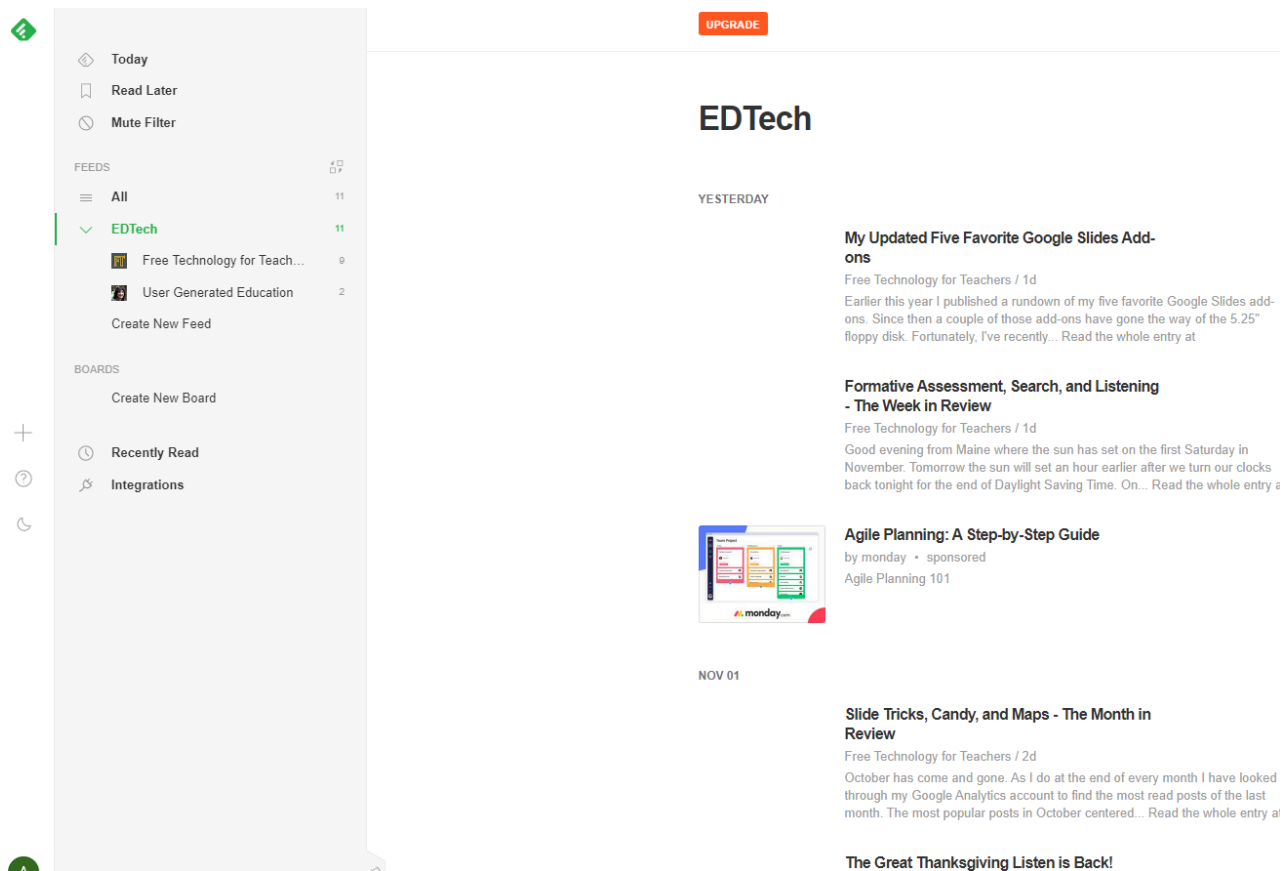
Figure 5. Button for sharing your feed with others.

Feedly provides an extraordinary amount of information that can sometimes become overwhelming without proper organization. To keep track of the most valuable information and tools you find in your feed, we recommend **using either a note taking software or organizational tool**. [Google Keep](#) is a great way to take notes and keep them organized. Alternatively, you can use [Diigo](#), a social bookmarking website and browser extension that allows you to annotate, bookmark, and share web pages. Even a Google spreadsheet or Microsoft Excel file can help keep your tools organized and make your PLN experience as smooth as possible.

Twitter

While Feedly is a great way to follow, read posts, and learn from others, it is not a social media tool. That is, you can't interact with others, collaborate, and exchange ideas and insights through Feedly. In order to do this, you'll need to join social media spaces for educators.

Twitter is a popular social media space among educators. You can connect and engage in conversations with others located across spatial and temporal boundaries (e.g., around the world!).

Twitter can provide more timely access to experts, some of whom will even answer questions you post to your network. As your social media network grows, and you become more comfortable contributing your own ideas to the network, you will find the social connections can become strong enough to develop into in-person connections, such as meeting at conferences (Krutka, 2017).

To get started with Twitter:

- **Create a Twitter account** if you do not already use it professionally. If you already use Twitter for personal posts, you may want to create a separate account for your teaching.

- **Find people to follow** on Twitter who will help you learn more about digital tools and apps (explore this list of suggestions: [Top 25 EdTech Influencers to Follow on Twitter in 2018](#)) and who will expand your thinking and perspectives (e.g., [Inspirational Black Educators to Follow on Twitter](#)). Note: Do not follow too many people when you first sign up or else your account may get blocked, as Twitter might think you are a bot.

- Then, **explore hashtags** on Twitter for topics that interest you. Take a look at the other hashtags that are used in the tweets of interest to you (e.g., a single tweet might have multiple hashtags like #edtech #edtechchat #gbl #GAFE) and explore those as well.

- **Continue adding more people to your network**. When you find a person who shares ideas you like, "follow" them. This will put their posts directly in your feed. When you read books and articles that inspire you, check to see if the author is active on Twitter. When you go to conferences, presenters will often list their Twitter handles on slides and handouts. As you follow more people, Twitter will begin to suggest similar accounts. You can keep adding people as long as you feel you can keep up. Do not worry about missing anything! No one assumes you are reading everything on Twitter. Check in whenever you have time or are looking for ideas!

Getting more out of Twitter. Initial interactions on Twitter are as simple as "liking" posts you want to support. Commenting on posts can begin conversations full of useful ideas and expand your network of followers. Retweeting posts shows your support for a tweet, shares the tweet with your network, and adds the tweet to your own feed where you can find it later. Posting your own questions and ideas to Twitter puts them out into the public sphere where others can see them and respond or share them. Adding hashtags to your posts (e.g., #K12) helps group them with similar posts on a topic and allows you to reach a broader audience (e.g., anyone exploring that hashtag rather than just your followers).

[Watch on YouTube](#)

After you get used to following people on Twitter and posting your own ideas, look for **Twitter chats** to join. Twitter chats occur at a set time and cover a specific topic. Everyone in the chat uses a specific hashtag (e.g., #games4ed) to

associate their posts with the chat, and a moderator typically keeps things moving with questions (that begin with Q1, Q2, Q3...) to prompt discussion. Participants in the chat respond to questions by using A1, A2, A3, etc... to match with the corresponding question number (see How to slay your first Twitter chat & Understanding Twitter Chats – A Guide to Start & Join the Conversation).

To find a chat related to education, explore the ISTE list of 40 Education Twitter Chats Worth Your Time and the Education Chats calendar. If you miss a Twitter chat, you can still see what everyone tweeted by exploring the hashtag later that same day or the following day.

Figure 6. Screenshot of the Education Chats calendar on Google

The first time you participate in a live Twitter chat, plan to just watch it go by. Use a tool like tchat.io to pause the chat, as needed, or reduce the retweets to make it more manageable to follow. Once you are comfortable with the pace and the topic, begin interacting by liking and commenting on posts. Once you begin to post your own answers to questions, you will find yourself connecting to others with similar ideas who will also like and comment on your posts. Next thing you know, you are helping others as much as they are helping you—a sign of a valuable PLN.

Chapter Summary

Digital tools and apps can inspire creativity, support critical thinking and problem solving, transport students to virtual worlds, and offer students new learning experiences never before possible. This chapter showcased how you can get started with finding digital tools and apps, and, ultimately, improve teaching and learning. Whether you conduct an Internet search, explore tool review sites and curated lists, or tap into the power of your PLN, you can find digital tools and apps with ease.

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Checklist of Next Steps

- Conduct an Internet search to identify specific tools and apps for teaching and learning.
- Find blogs, databases, and review sites that provide you with good recommendations.
- Cultivate a digitally enhanced PLN that is diverse, deep, and dynamic to engage in ongoing learning and professional growth.
- Set up a Feedly account to follow useful blogs so you can easily keep up to date with the latest edtech trends.
- Set up a Twitter account and start following professionals who offer useful advice.
- Join a Twitter chat on a topic that interests you.
- Become a resource for others by posting your own ideas on Twitter or another social media site

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Evaluating the User Experience

Chenyang Xu & Shaunak Shah

> ## Hypothes.is Social Annotation
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> This chapter is annotated every year as part of an undergraduate/graduate class on Teaching and Learning with Technology. To turn off the highlighted text, click on the "eye" icon in the top right corner of the browser screen.

Introduction

Consider this: You recently attended a national conference and discovered a fascinating digital tool from a session. You thought it would be a perfect match for your class, so you integrated this tool into a lesson for your first day back from the conference.

However, it did not go as planned...The students had no idea how to use the tool. The tool had too many features that overwhelmed students rather than supporting their learning. Some of the students could not open the tool on their device or browser. Many students complained about how long it took to load the tool due to the slow school wifi. The students were frustrated and stressed and too much class time was wasted on figuring out the tool rather than using the tool for learning.
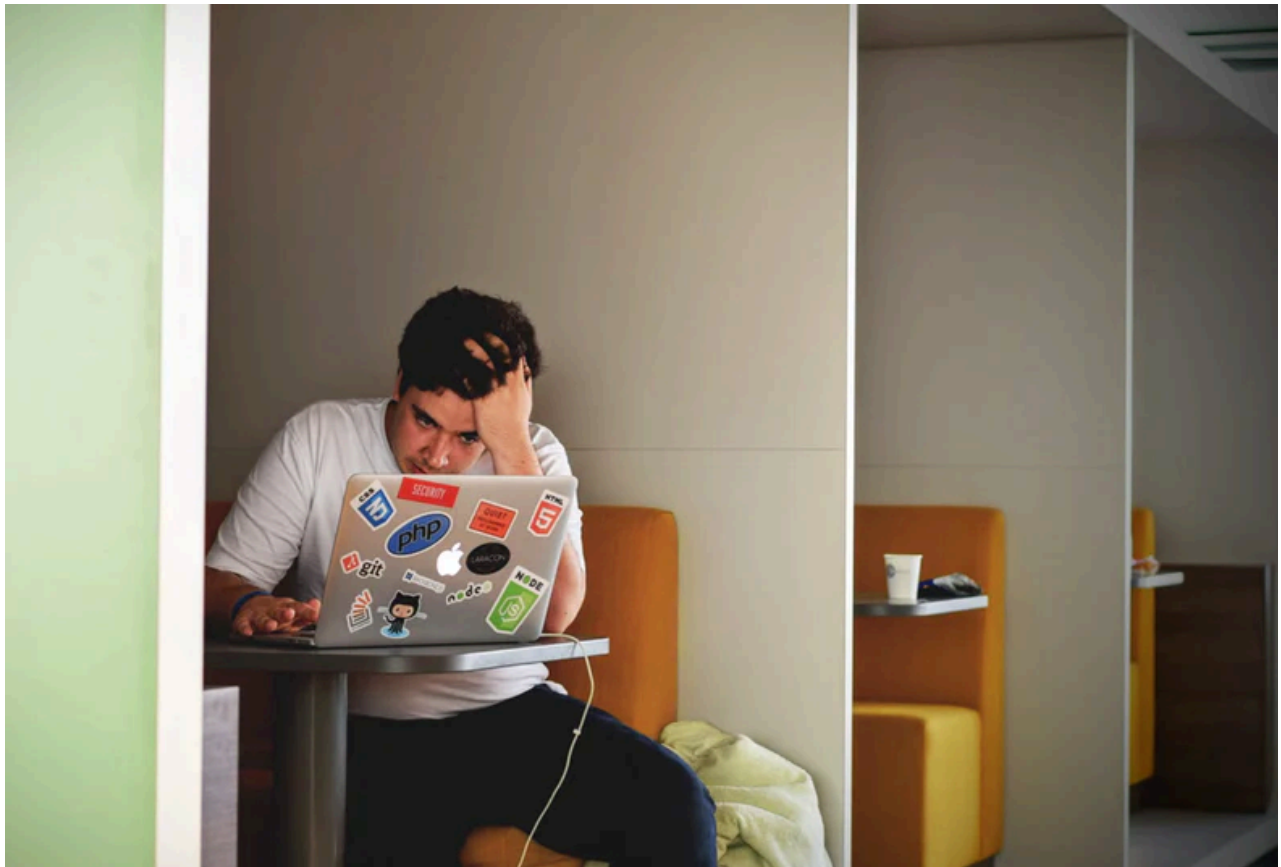
We have all been there—wrapping up a class feeling frustrated, just like the students, because the technology did not work out as planned. In this case, the problem was the tool did not provide students with a good user experience.

In this chapter, we will discuss how to evaluate the user experience of digital tools and apps so you can prevent this type of experience in the future. We will focus on **five key features** to help you identify the best tools for **maximizing learning and minimizing technology frustration**.

Before you get started with exploring the chapter, watch the [Evaluating the User Experience Powtoon animated video](#) featured below for a brief overview of the chapter content.

[Watch on YouTube](#)

What is User Experience?

Generally speaking, user experience is the **interaction between the user and the tool**, including the user's thoughts, feelings, and perceptions of the product or outcomes (Tullis & Albert, 2008)

When students feel a tool is easy to learn to use and navigate, they are more likely to engage with it, enjoy the learning experience, and focus their learning on developing knowledge and skills.

[NOTE: Professional user interface designers, such as Donald Norman, can provide more [detailed insight into the best practices that software designers take into account when designing new tools](#).]

Top 5 Features for Evaluating User Experience

Through conversations with educators and researchers, we identified five key features that will help you quickly evaluate a new digital tool or app and make a decision about whether to use it in your classroom:

- [User Instruction](#)
- [User Interface](#)
- [Access Across Devices and Platforms](#)
- [Diversity and Language Support](#)
- [Cost and Required Devices](#)

User Instruction

User instruction is the guide provided to new users that accompanies a tool. It contributes to the user's first impression of a digital tool when it teaches the user **how to find, use, and manage its functions**.

When a tool provides good instruction, students are more willing to use the tool and more confident when they use it. This means students will spend their time on learning content knowledge and skills rather than learning the tool itself.

Tinkercad, a digital 3D modeling tool, offers a well-designed user instruction feature that makes it easy to learn how to create 3D models.
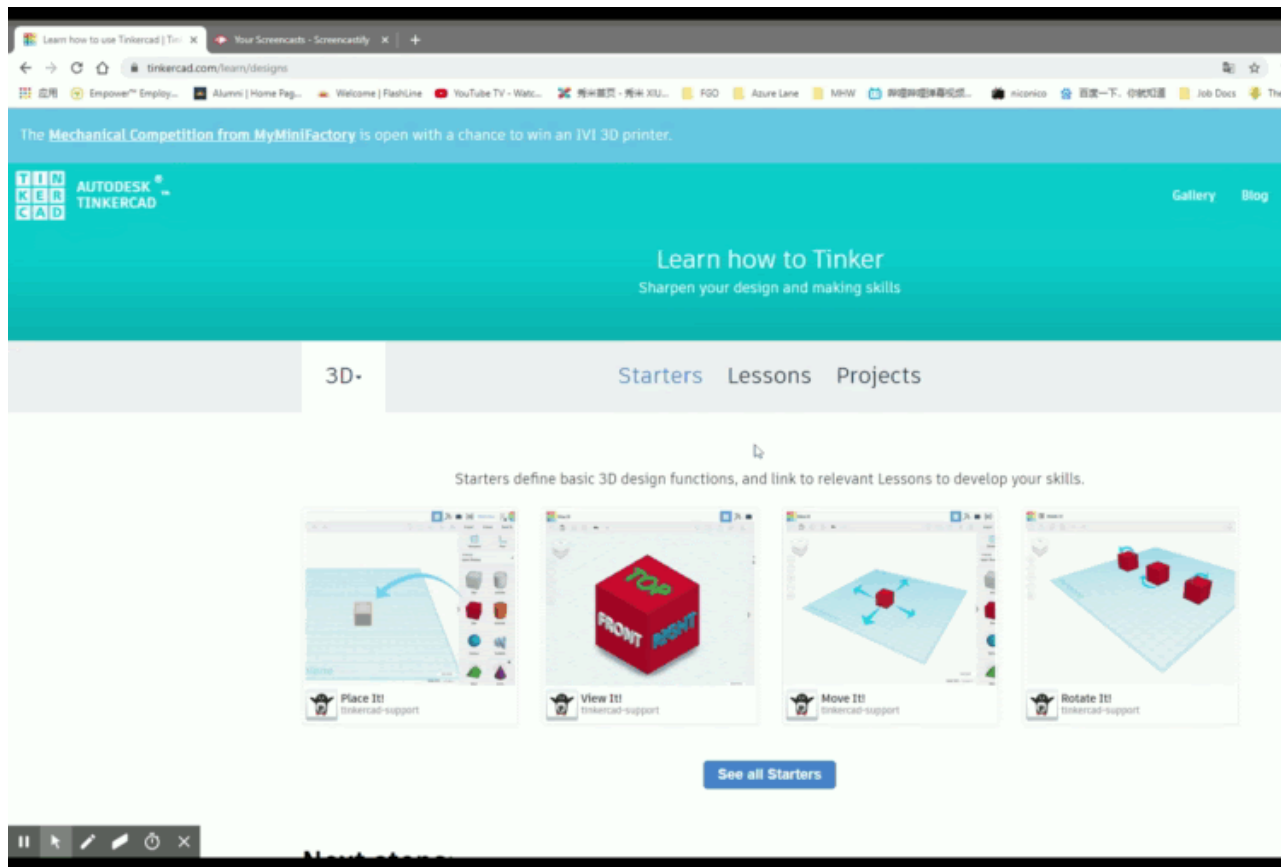
On Tinkercad, instructions are divided into three categories: (1) starters, which cover basic operations like moving an object; (2) lessons, which teach specific functions, like combining multiple objects or hollowing shapes; and (3) projects, which contain advanced model building skills.
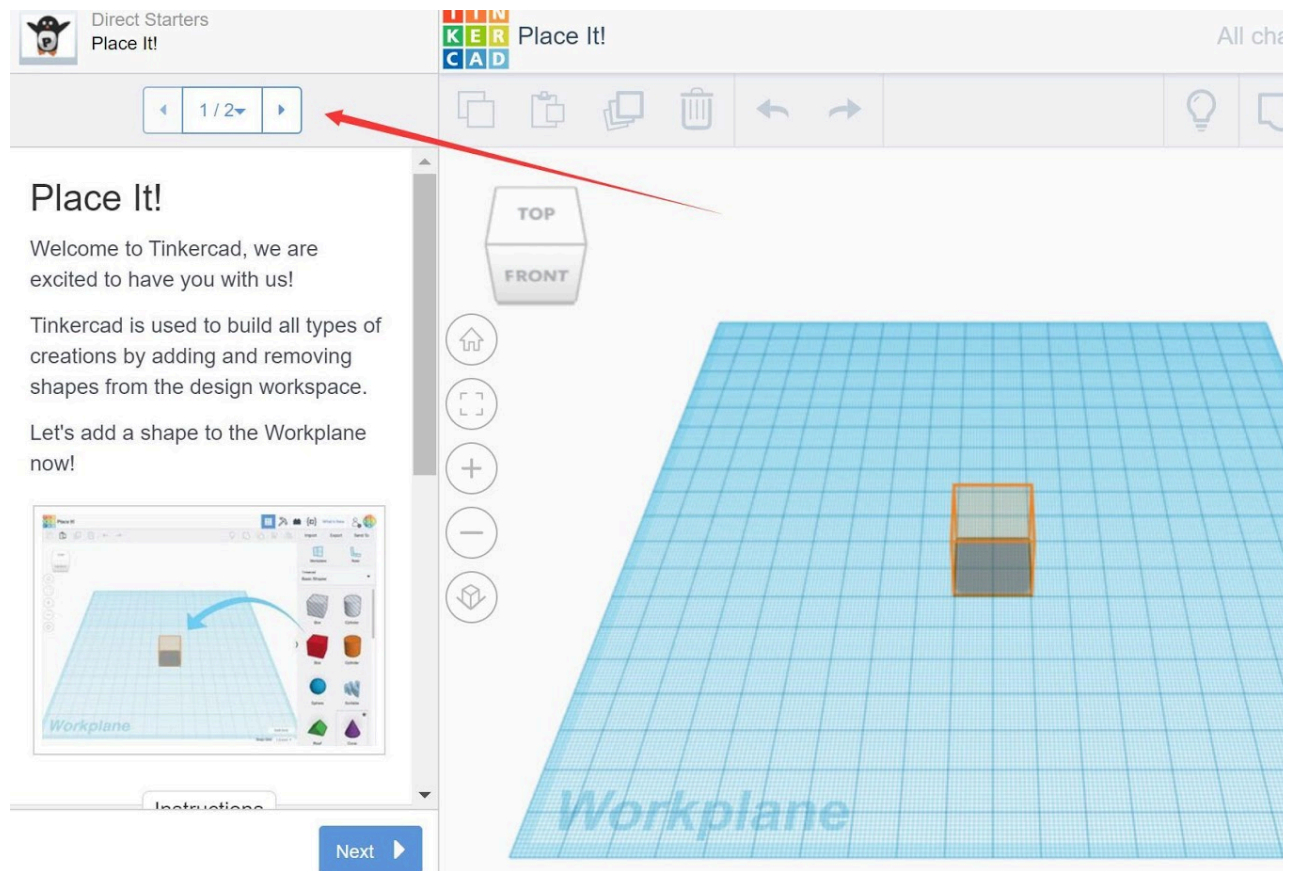
In each of these three types of instructional tutorials, users can follow step-by-step instructions while trying out the directions directly in the Workplane on the right side. Here are the two advantages of this instruction:

1. **Step-by-step tutoring:** Step-by-step tutoring is easy to follow and students can practice the operations simultaneously, which allows for a hands-on, trial-and-error learning experience in a safe space (e.g., students can make mistakes and learn from their mistakes in a virtual sandbox rather than on their own projects).

2. **Multimodal instruction:** The instructions feature text, images, and videos, which are multimodal ways to learn how to use the tool. Using multiple media removes barriers to learning, increases student engagement, and stimulates students' motivation (Bass, 2020).

Perhaps students will try the tool without exploring the user instruction tutorials. If a student gets stuck and can't figure out how to use a certain feature, you can walk them through (or point them to) the user instruction tutorials to demonstrate the operation of the tool. This can reduce the need for you to provide substantial technical support and troubleshooting.

The next time you come across a new digital tool or app for your classroom, ask yourself the following questions:

- How will students learn to use the tool?
- Does the tool provide multimodal instructions (e.g., images, text, and video)?
- Does the tool provide interactive instructional tutorials?
- How much class time would be spent on students learning to use the tool?
- Do you need to provide additional instruction to students?

User Interface

The user interface (or "UI") is "**the means in which a person controls a software application or hardware device**. A good user interface provides a 'user-friendly' experience, allowing the user to interact with the software or hardware in a

natural and intuitive way" ([Christensson, 2009, para. 1](#)).

Well-designed digital tools are easy to navigate, have a clear and simple layout, and have readily accessible controls and features. Here are some principles to evaluate the user interface of a new tool:

1: Less is More

A good user interface will only include controls directly connected to the user's current needs. For example, [Canva](#), a graphic design tool, features only the design functions toolbar (which can be hidden) and the project workspace. This simple, but effective, user interface makes it easy for the user to focus their attention on the design project.
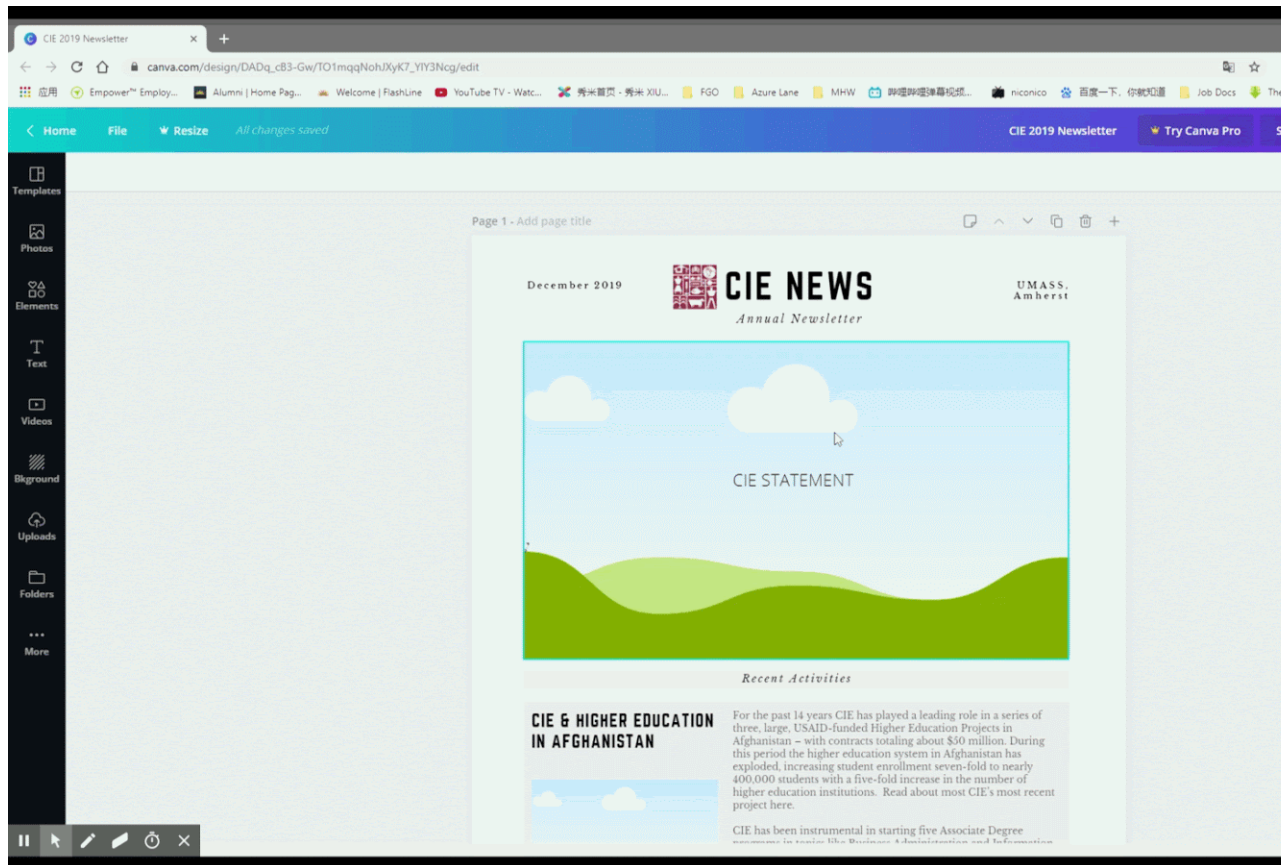
A poorly designed user interface, with too many features or an unintelligible layout, may confuse and exhaust users as they are working on their tasks. In addition, user interfaces with too many advertisements may distract the user from tasks, and sometimes the ads can be inappropriate for young users, like in the screenshot below.
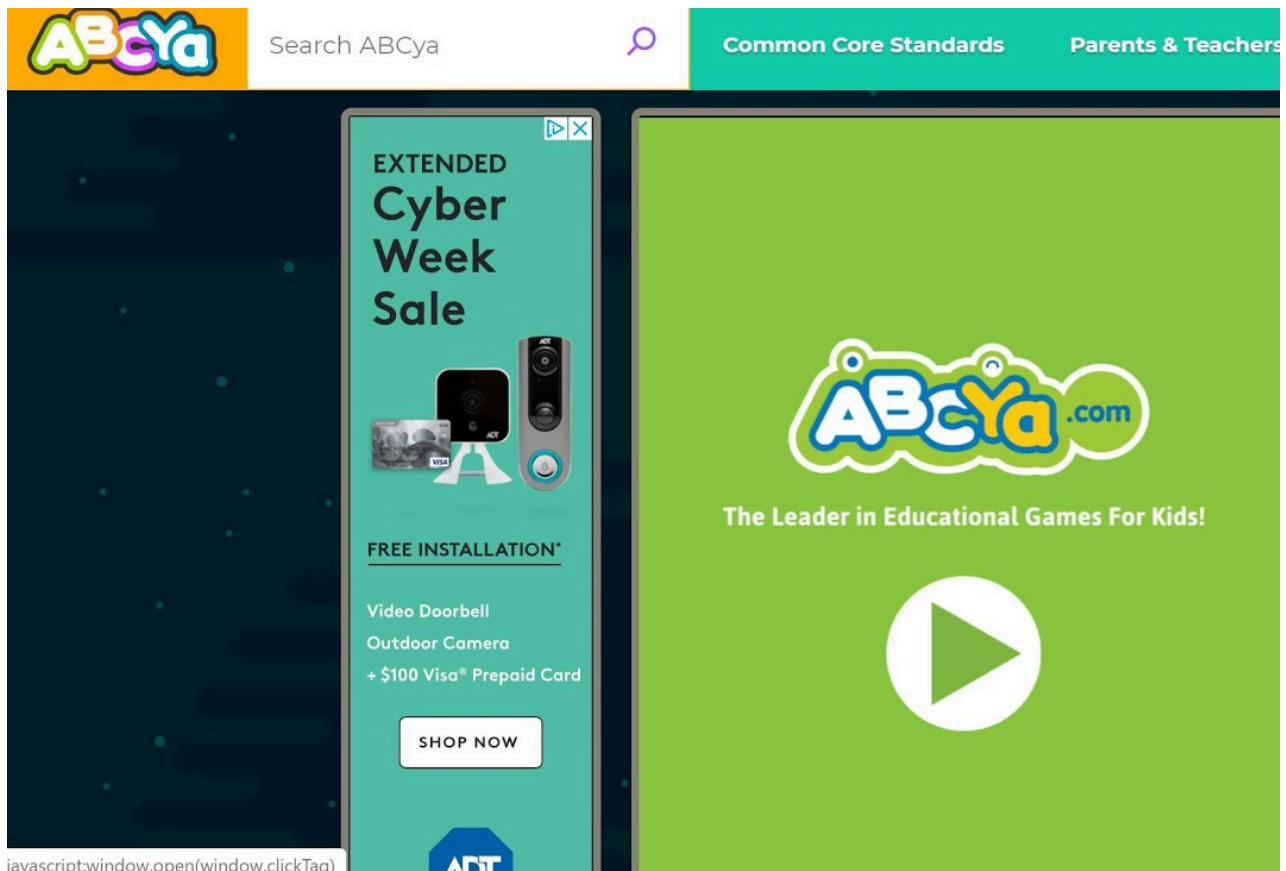
2: What you see is what you get (WYSIWYG)

The interface should allow users to see and edit a project in a view that shows them what the final product will be. In that case, the students do not need to memorize the complicated codes and can focus on their work.

For example, while the final outcome of using a WYSIWYG web design tool like Wix is the same as using complicated HTML coding, Wix is much more intuitive and easier to learn. Therefore, students using Wix will spend more time learning about the content they are posting on their websites and less time learning the coding skills needed to create a website.
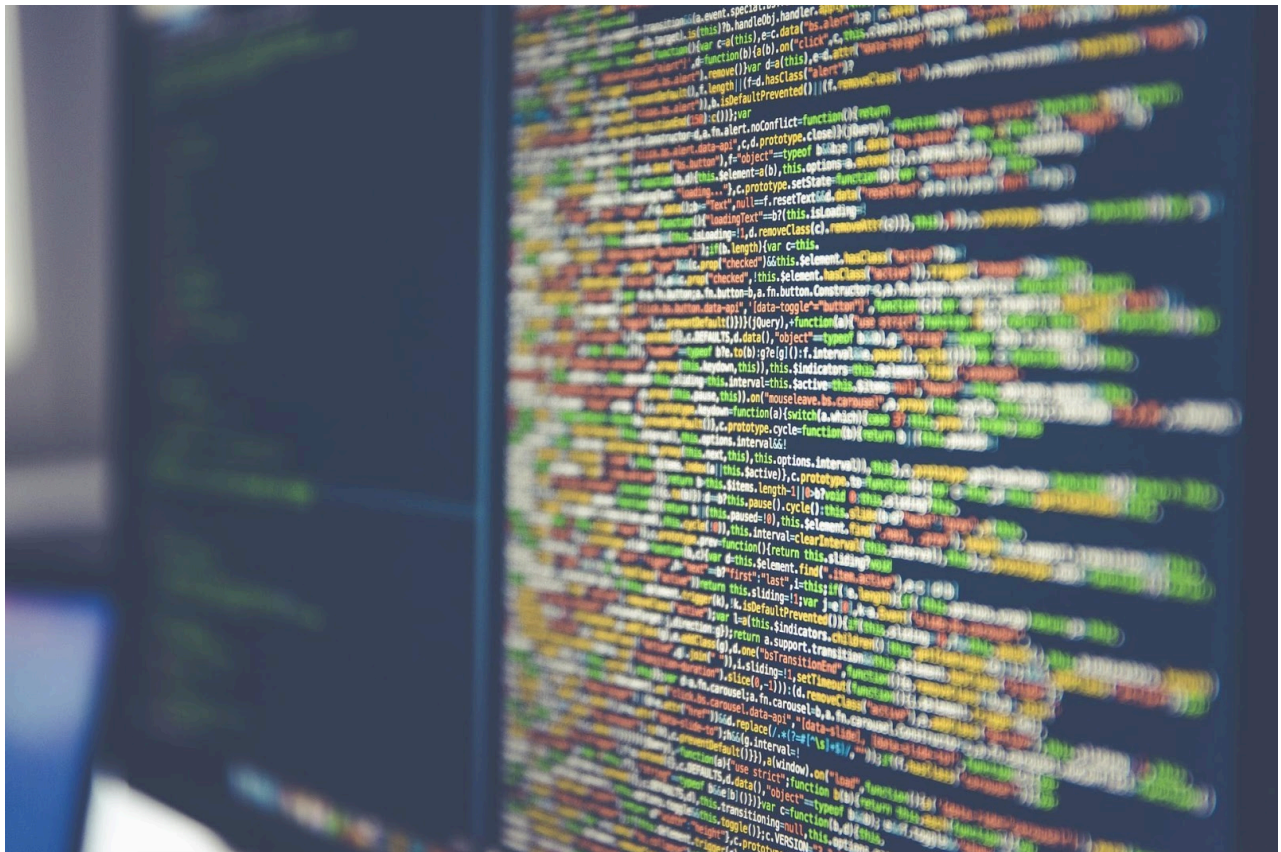
Unless you are teaching coding, look for tools that do not require coding capabilities to use the features of the tool or produce artifacts
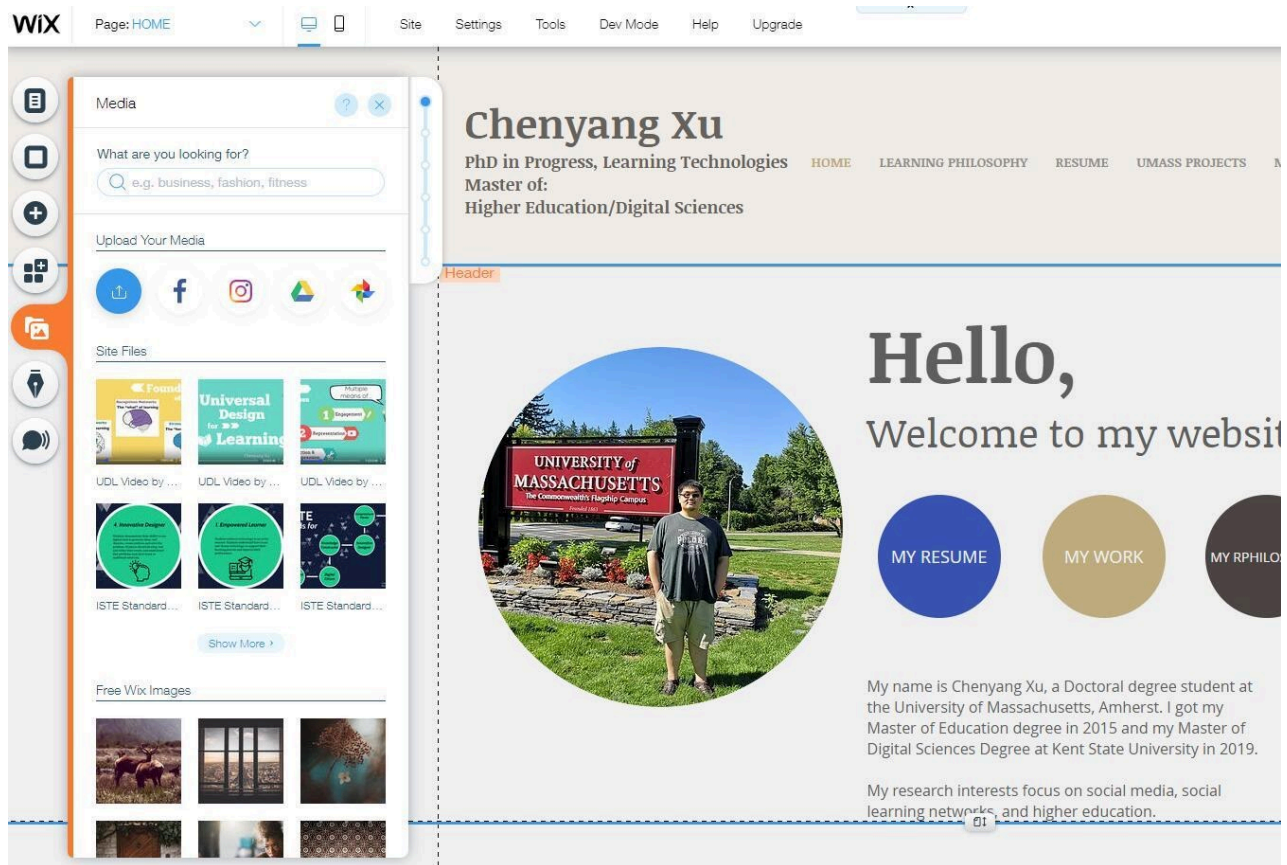
Wix, for example, allows students to design without HTML knowledge and see their design unfold as they build it (WYSIWYG)

3: Sharing Work With Others is Easy

When using digital tools and apps for learning, students will need a way to share their work with you so you can assess their learning and provide feedback. If a tool allows users to **export files in multiple, generally compatible formats** (e.g., .pdf, .jpg, .doc), **students will have the flexibility to post and present their work** on different platforms, such as a class website, ebook, interactive document, or social media platform.

When students get to share their work with an authentic audience (e.g., family and community members, authors, scientists), they will be more engaged and invested in their learning experience. So, when you evaluate the user interface of a digital tool or app, check to see how student work can be shared. Bonus tip: If the tool does not allow students to share their work, teach students how to capture screenshots to show their learning with the tool.
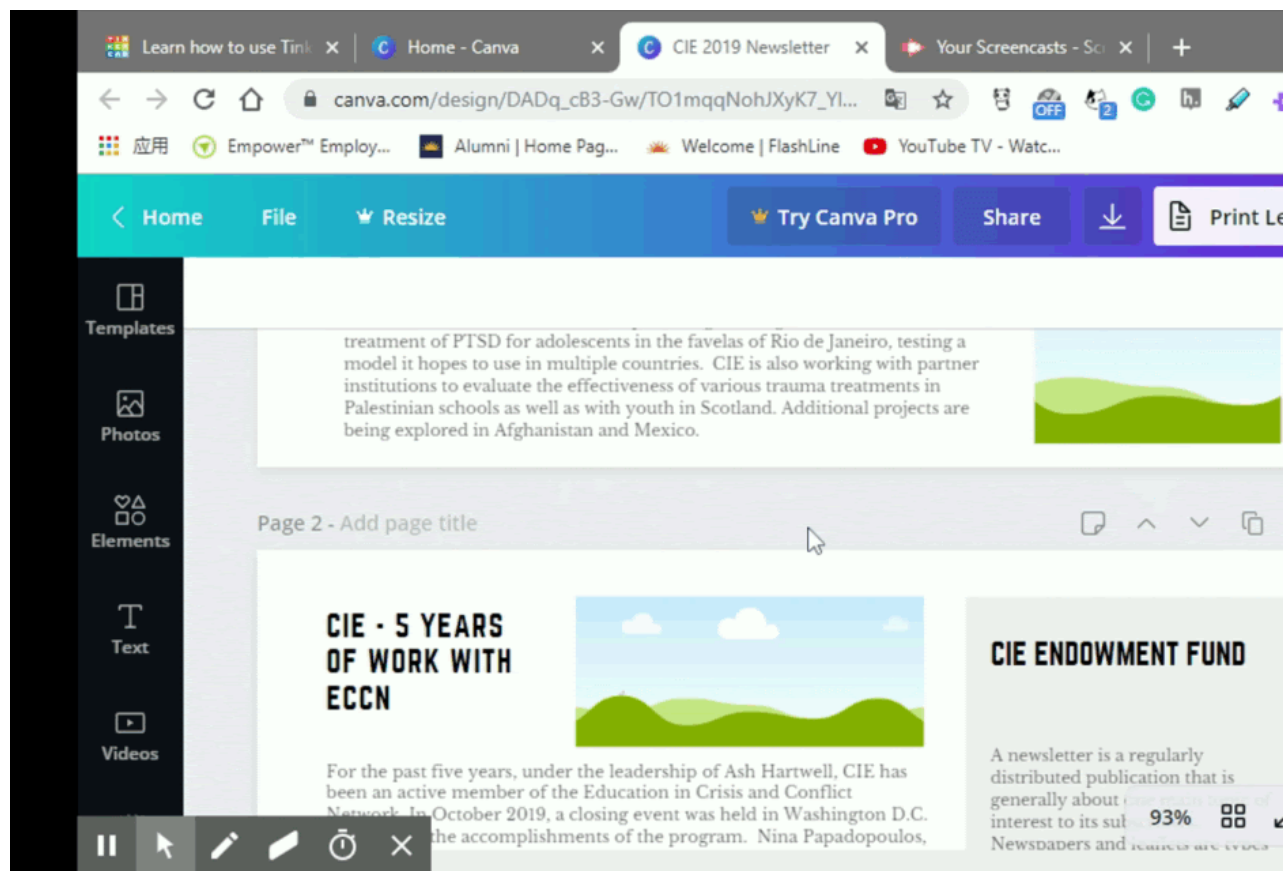
4: Collaboration

For many years, the Google Apps for Education Suite (e.g., Google Docs, Slides, Sheets) has offered an innovative learning experience where users can collaborate and work together in real time even if they are not in the same location. Some tools are starting to follow suit, such as Padlet, while others allow for multiple users to work on the same project asynchronously (e.g., Powtoon allows users to "collaborate" but only one person can be using the tool at a time).

Since social learning experiences enrich and advance knowledge and skill development (see the Evaluating the Learning Experience Chapter) it can be beneficial to examine whether a tool supports collaboration, either simultaneously or one user at a time.

Some additional user interface considerations include:

- Does the interface align with Mayer's Multimedia Design principles (e.g., signaling, coherence, spatial contiguity)? Take this interactive self-assessment quiz (designed by Elise Fredericks, Emma Ferrari, Madiha Noor, Sam Torres, and Sara Shea) to learn how to evaluate tools based on the design principles.
- Does the interface clearly represent ("afford") what the features do?
- Is the interface clearly labelled and does it provide a mix of text and symbols (e.g., recognizable icons, such as a home page, download, or social media symbol, aid memory and navigation)?
- Is the interface consistent across its own screens (i.e., are buttons and menus in the same location?) and does it use symbols and terms consistent with other similar software?
- Does the interface behave predictably? Do you know what will happen when you click a control? Can you undo if you make a mistake?

Access Across Devices and Platforms

When a tool will be used in a computer lab or on the same devices from a cart, cross-platform usability may not be an issue. However, if the tool is being used in environments where multiple kinds of devices are being used, or if students

will use this tool on personal devices, it is important it operates well across different platforms. Therefore, when evaluating the user experience, it is helpful to determine how the tool or app can be accessed.

Try the Tool on Different Devices and Browsers

Test the tool on the operating system(s) (e.g., Windows, iOS, Android) your students will use either at home or in class to access it. For web-based digital tools, test whether the tool works on different browsers (e.g., Firefox, Safari, Chrome, Edge).

Evaluate Mobile Access

Students often use mobile devices to complete school work. If you will be assigning a digital tool to be used at home or if you allow students to use their phones during class time, make sure the tool is compatible with mobile devices.

Search for the tool in app stores to see whether there is a mobile app version. For web-based tools without a mobile app, test the compatibility for mobile devices on a computer by **shrinking the screen** to see whether the page layout changes (this is called mobile responsiveness) (see GIF below). Also check buttons and icons on the mobile version and make sure students can find the features easily.
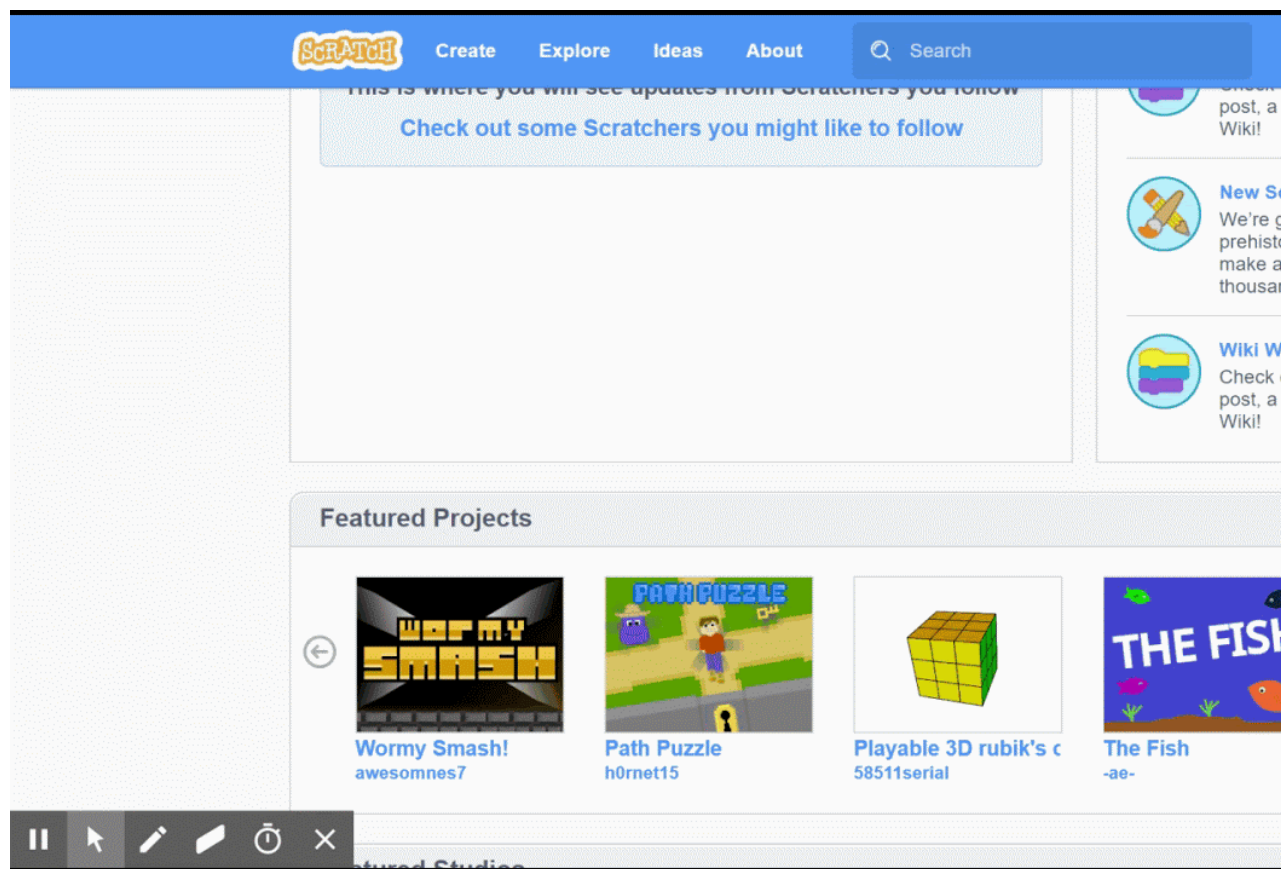
Confirm Students Have Access

Before assigning tools and apps for homework that require access to a personal computer, tablet, mobile phone, and/or the Internet make sure every student in the class has ready access to the necessary device and Internet (here's an example Google Form check in survey).

In some households, everyone shares a single device or students may only have access to devices provided by the school or available in public libraries. Some students may not have high-speed Internet access (or any access at all) to be able to stream class lecture videos or download interactive simulations. Check whether students have Wi-Fi at home and search mobile hotspots available as an alternative.

Diversity and Language Support

Before using a tool in the classroom, you should examine whether it supports diverse learners. Make sure students can choose diverse icons, flags, gender marks, and characters without additional payment (paid membership or fees).

Eric Velasquez, award winning author and illustrator of children's books, commented that "once children see themselves represented in books, their existence is validated, and they feel that they are part of the world" (as cited in McDonald, 2020, para. 1). The same is true for edtech tools. When students are able to select and use characters and icons that **represent their culture, race, and other identifying features**, they will feel empowered rather than invisible. A good example would be Powtoon, which contains characters from different races in the free object sets.
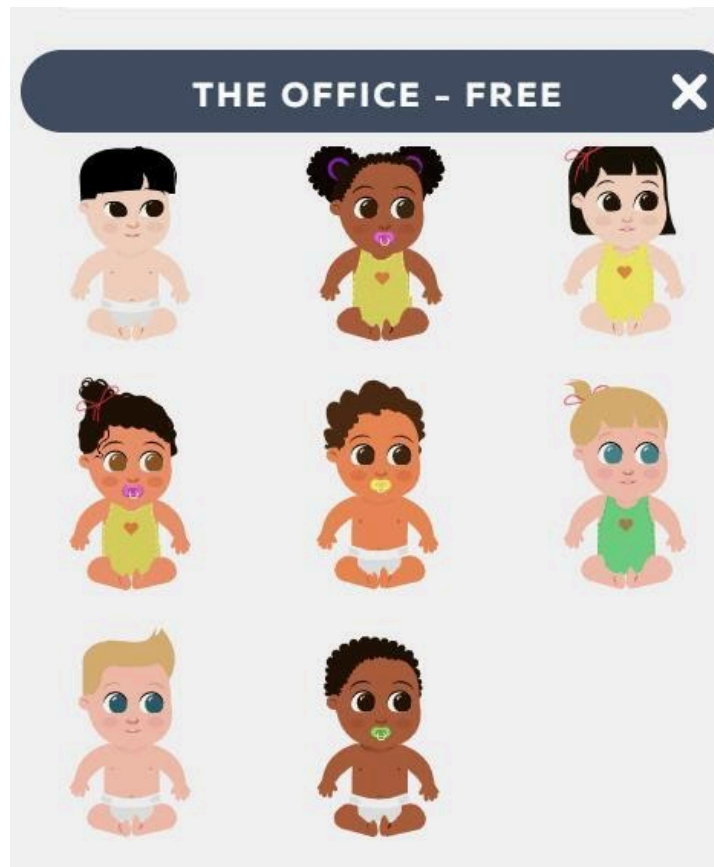
Powtoon free character set, which contains diverse skin color

In addition, English language learners (ELL) and multilingual students can benefit from tools that **feature translation support** (Knutson, 2018). Using a tool that supports multiple languages can reduce the language barriers multilingual students might face and improve engagement and learning.

Language selection can usually be found in profile/account settings, sidebars, or at the bottom of the tool webpage. For instance, at the bottom of the Scratch main page, there is a drop down box that says "English," which allows you to select from more than 60 languages. Once you select a language, the entire site will be translated into that language.
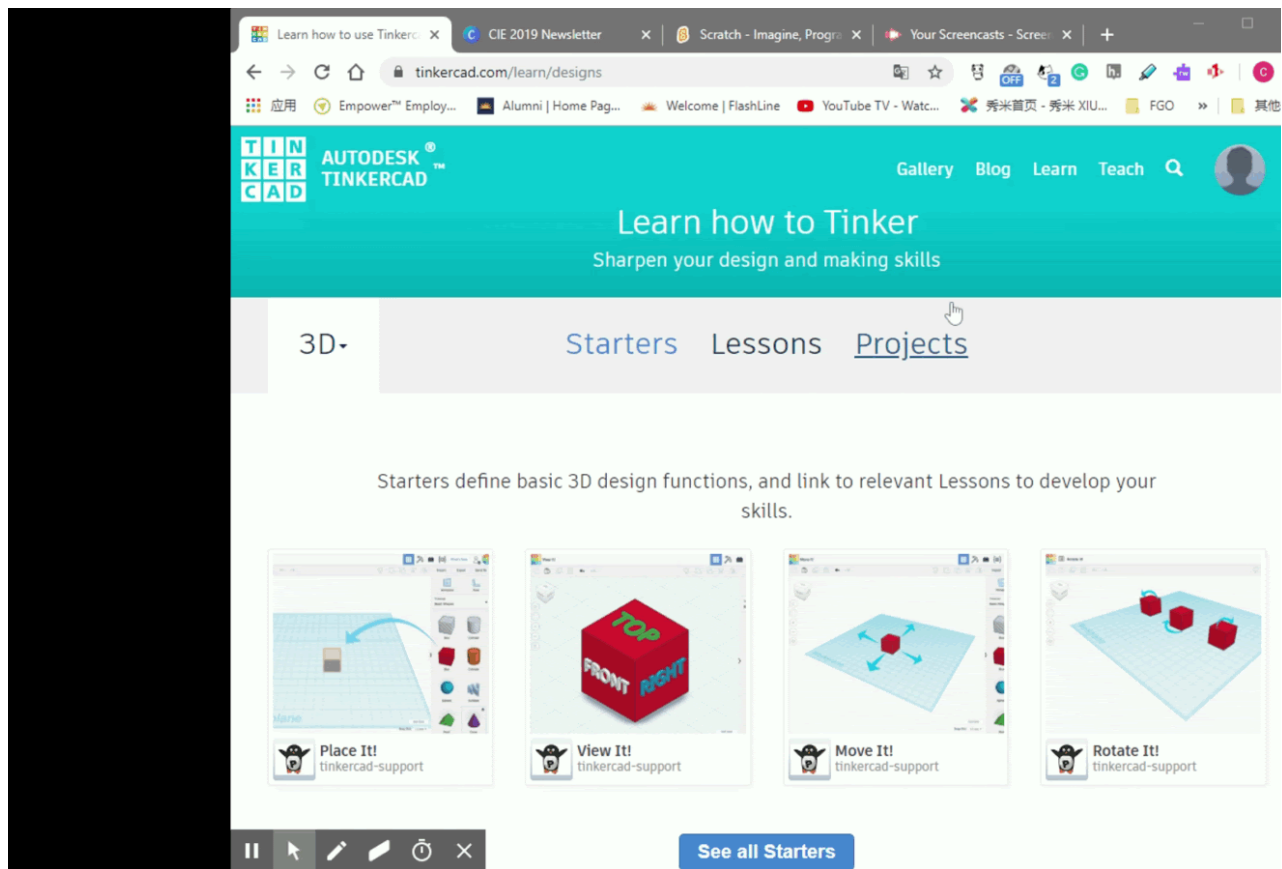
Tinkercad offers multilingual support at the bottom of its main page

Cost and Required Devices

When evaluating a digital tool, keep in mind the associated costs of using the tool. Consider whether the digital tool will cost any money upfront (e.g., paying for a monthly or yearly subscription) and whether the tool requires you to purchase equipment. If the tool is free to use, identify how the company plans to make money (e.g., upselling features, placing advertisements on the user interface, or collecting and selling user data—see the Evaluating Cost, Privacy, and Data chapter).

Purchasing tools and apps can be expensive, especially when the money comes from your own bank account. In the article, "$15 A Month is $180 a Year: How Much Do You Pay A Year for EdTech?" Alice Keeler, an edtech integration specialist, did a brief survey of the costs of paying for quality edtech tools. She wrote: "I used the checkbox feature in Google Sheets to automatically tally up how much it would cost a teacher to pay out of pocket if they were to buy several EdTech tools. It's not hard to get to $1000 quickly!" (Keeler, 2018, para. 3).

Two things you should keep in mind when examining the cost of tools and apps are the trap of the trial and required hardware devices.

1: "Trap" of trial

Some tools are free to use, but just for a limited period of time. Make sure to check what happens after the trial. Be aware that sometimes features will be lost after a trial. Sometimes the user will lose access to their projects created during the trial, or sometimes their products will be "watermarked."

Take Powtoon as an example: After the trial ends, your video will have a "PRO" mark if you used pro contents, which were free to use, during the trial.
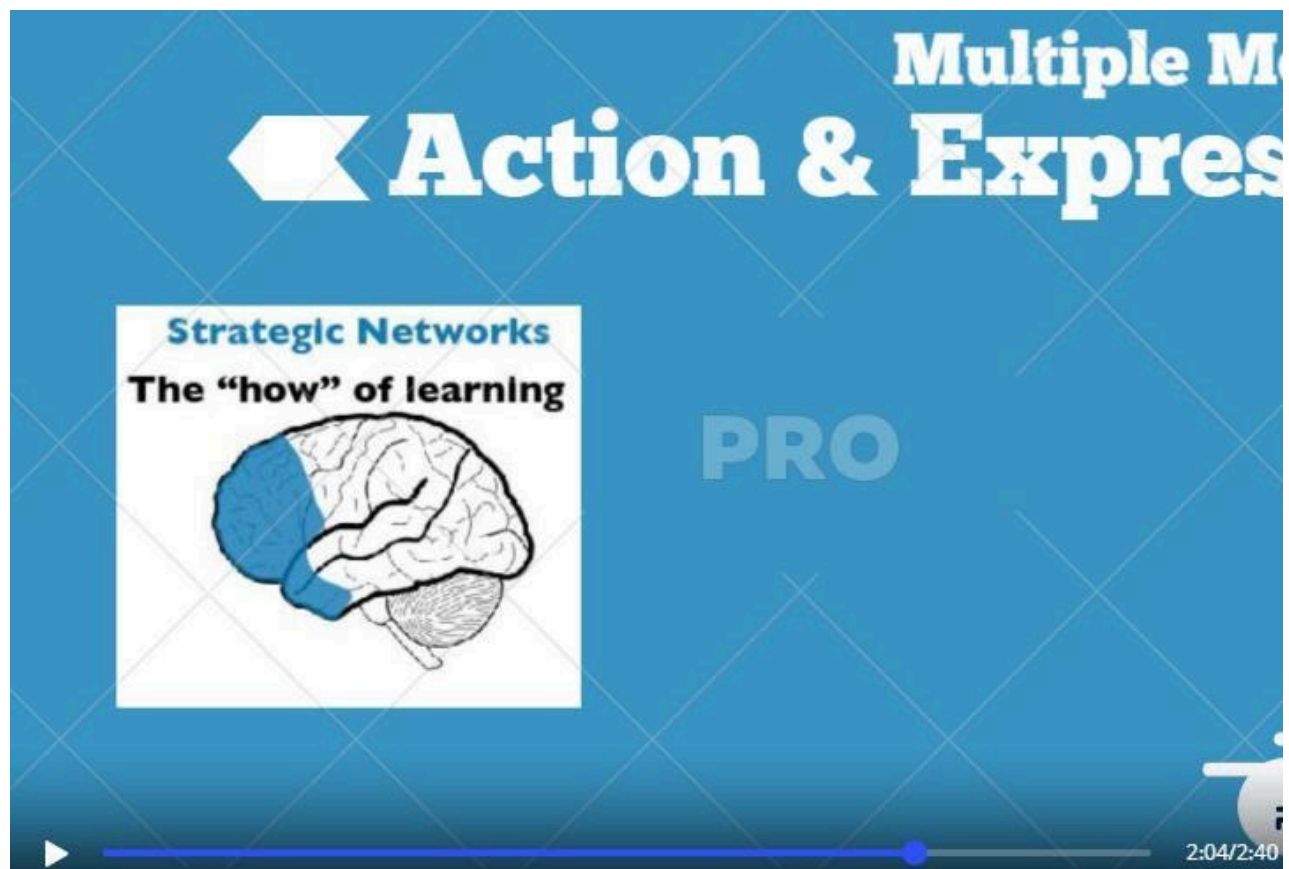
2: Hardware Devices

Sometimes the tool is free. However, to achieve the best learning outcome, you may need to purchase extra hardware (e.g., a virtual reality headset, Merge Cube for an augmented reality app, or a 3D printer for a 3D modeling tool).

Examining the costs upfront will ensure that you won't face any surprises when you go to use a tool in your classroom - like discovering that students can't export their work without paying for premium access.

If you find a tool, app, or hardware that you really want for your classroom but can't afford, check out the following article: No Begging Required: Teachers Share 5 Creative Ways to Fund Classroom Technology.

Five Edtech Tools With a Quality User Experience

Based on the evaluation standards mentioned previously, we will introduce five tools that have excellent overall user experience.

G Suite (suite of tools for productivity and collaboration)

- **Instruction:** Step-by-step text-based instruction. Separate instruction for Windows, iOS, Android.
- **Interface:** Concise layout with rich information. Icons with a high degree of identification.
- **Access:** Windows. IOS. Android. Mobile App.
- **Language Support:** Multi-language interface.
- **Cost and Devices:** Free to use all functions. However, Google collects a significant amount of data from its users (see the Evaluating Cost, Privacy, and Data chapter).

Canva (visual designing tool)

- **Instruction:** Well-divided, text-based instructions. Step-by-step tutoring, which is easy to follow.
- **Interface:** Clear UI, easy to understand. Elements are easy to manipulate with a mouse. WYSIWYG.
- **Access:** Windows. IOS. Android. Mobile App.
- **Language Support:** Multi-language interface.
- **Cost and Devices:** Extra templates and graphics for premium members ($12.95 per month).
- **Diverse Character/Icon Selection:** Canva uses Pixabay and Pexels to provide some (but not many) diverse and multicultural images. On the other hand, there are limitations in the diversity of icons offered.

Scratch (Coding tool)

- **Instruction:** 25 instructive animations, demonstrating most of the features and operations.
- **Interface:** Codes are integrated into blocks. Separate tabs for coding, avatars, and sound. WYSIWYG.
- **Access:** Windows. IOS. Android. Mobile App.
- **Language Support:** Multi-language interface.
- **Cost & Devices:** Free to use.
- **Diverse Character/Icon Selection:** Yes. You can select from a diverse range of sprites (characters) or create/upload your own.

Adobe Creative Cloud Express (formerly AdobeSpark) (graphic and video designing tool)

- **Instruction:** Step-by-step instruction. Formatting and editing help offered too.
- **Interface:** Clear user interface with distinct tabs for all three different modes. Individual features highlighted in separate tabs.
- **Access:** Windows. IOS. Android. Mobile App.
- **Language Support:** Multi-language interface.
- **Cost and Devices:** Starter plan is free. Advanced individual plan is $99.99 yearly.
- **Diverse Character/Icon Selection:** If you search for free photos, Adobe will use Pixabay and Unsplash to provide a wide range of image options which offer diverse and multicultural selections. On the other hand, there are limitations in the diversity of icons offered.

TinkerCAD (printable 3D model designing tool)

- **Instruction:** Instruction for basic operation and specific functions. Interactive and multimodal.
- **Interface:** Clear interface, elements are organized well in the sidebar. Layout is straightforward and easy to understand.
- **Access:** Windows. IOS. Android.
- **Language Support:** Multi-language interface.
- **Cost and Devices:** Free to use. 3D printer required for physical model.

Conclusion

We hope this chapter helped you identify criteria and features to evaluate in order to select the best tools for your learners. When evaluating digital tools and apps, look for ones that feature:

1. Interactive, multimodal **user instruction** that is easy to follow and understand.
2. A simple, easy to navigate **user interface**.
3. **Sharing** capabilities and multiple output formats.
4. **Accessibility across** devices and platforms.
5. **Diverse character** selection and **multilingual interface**.

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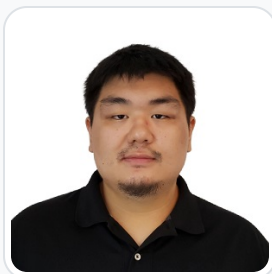
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Shaunak Shah

Evaluating the Learning Experience

Madeleine Olson & Kiel Maurath

> ### Hypothes.is Social Annotation
>
> This chapter is annotated every year as part of an undergraduate/graduate class on Teaching and Learning with Technology. To turn off the highlighted text, click on the "eye" icon in the top right corner of the browser screen.

Introduction

Imagine you are a new eighth-grade civics teacher. Your students are struggling to understand how the Constitution influences present day U.S. society. Students have read the Constitution, reviewed videos highlighting important aspects of the U.S. government, and discussed their learning with classmates, yet they are still struggling to connect aspects of the Constitution to contemporary life.

Luckily, there are hundreds of digital tools available that can help solve these types of educational challenges. So, **how do you find the right tool to create a learning experience** that will help your students successfully achieve the lesson or unit learning objectives?

In this chapter, we will discuss how you can use **learning theories, Bloom's taxonomy,** and the **ISTE Standards for Students** as a guide for evaluating and determining which tool to use based on the learning experience you'd like to provide for your students. Before you get started, watch the [Introduction to Evaluating the Learning Experience Provided by Digital Tools and Apps](#) video embedded below for a brief overview of the chapter content.
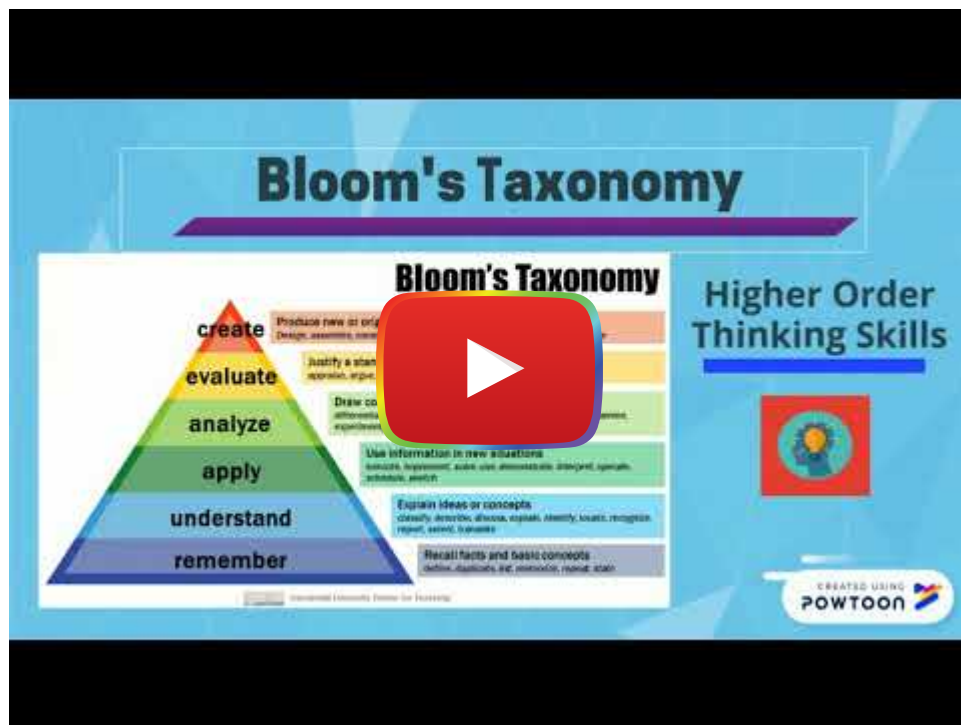
Consider the Learning Theory

Learning theories are **models, ideas, or frameworks for understanding and examining how people learn**. Various theories have been developed, refined, and built upon over the years by scholars who studied how people acquired, processed, and created knowledge. In the blog post "Why We Need Learning Theories," Learning and Performance Specialist Taruna Goel (2017) noted that:

> Theories provide a basis to understand how people learn and a way to explain, describe, analyze and predict learning. In that sense, a theory helps us **make more informed decisions** around the design, development and delivery of learning. (para. 4)

When integrating technology into your classroom, learning theories can serve as a guide for selecting and identifying the most appropriate digital tools and apps for the type of learning experience you want to create for your students.

In the following section, we will discuss popular learning theories and provide examples of digital tools and apps that you can use based on the learning theory you select for a given activity (see Table 1 for an overview of the theories and tools).

Behaviorism

Behaviorism refers to learning that occurs "when a proper response is demonstrated following the presentation of a specific environmental stimulus" (Ertmer & Newby, 2018, para. 18). For example, when you touch a hot stove (environmental stimulus) you may quickly learn not to touch the stove again (response).

In educational settings, behaviorism is most closely connected to positive and negative reinforcement, like when a student gets immediate feedback ("you are correct! Great job!") on their behavior (solving a math equation). Digital games, flashcards, and interactive quiz tools are well-suited for behaviorist learning experiences since they support **stimulus-response learning** through immediate feedback.

When determining whether to use a behaviorist approach for a lesson or activity, consider whether the information the students need to learn is invariable, since behaviorism stems from the idea that knowledge is objective and there is **one right answer** ([Keramida, 2015](#)). Behaviorism would be a useful approach to helping students **memorize and recall terms and facts** about the U.S. Bill of Rights. However, a behaviorist approach would not be suitable for asking students to connect their knowledge of the U.S. Bill of Rights to real-life issues.

- **Digital Tool in Practice:** [Kahoot!](#) is a game-based student response tool. Educators can design or use predesigned Kahoot! games to help students memorize Constitutional terms.

Cognitivism

Cognitivism describes how **learning happens through thinking, organizing, storing, and retrieving information** (David, 2015; Ertmer & Newby, 2018). As opposed to behaviorism, which focuses on modifying behavior through the use of external stimuli, cognitivism shifts the focus of learning to the internal mental processing of new information.

According to Ertmer and Newby, "cognitive theories emphasize making knowledge meaningful and helping learners organize and relate new information to existing knowledge in memory. **Instruction must be based on a student's existing mental structures, or schema, to be effective**" (para. 38).

Mind map image by [Gerd Altmann](#) from [Pixabay](#)

For example, say you want students to identify the purpose of the three branches of the U.S. government. You might ask students to create a mind map to help them organize the information so they can build their mental schema or you might ask students to come up with a mnemonic device to facilitate the encoding and recall of the information.

- **Digital Tool in Practice:** [Google Drawings](#) allows students to collaboratively design interactive concept maps, mind maps, and flow charts.

Constructivism

Constructivism refers to **learning that occurs by creating meaning from experience**. As opposed to behaviorism and cognitivism, in which "goal of instruction is to map the structure of the [objective] world onto the learner" (Jonassen as cited in Ertmer & Newby, 2018, para. 41), constructivism focuses on how **learners generate their own meaning from within**.

That is, learners are not blank slates that absorb information from the external world. Nor are they simply processing objective information within their own minds. Rather, they "**build personal interpretations of the world** based on individual experiences and interactions" (Ertmer & Newby, para. 43).

In educational settings, constructivist learning activities and environments allow students to build their own knowledge, understandings, and interpretations of information. Constructivist learning experiences are well-suited for advanced knowledge building, such as analyzing and interpreting ideas, rather than foundational knowledge acquisition (e.g., memorizing facts and terms) (Jonassen as cited in Ertmer & Newby, 2018). For instance, say you want your students to draw connections between Shays' Rebellion and today's disagreements on the role of government. A constructivist approach would allow students to generate new knowledge related to their current political landscape, and thus, construct meaning from experience.

- **Digital Tool in Practice:** [Google Tour Builder](#) is a knowledge-building tool allowing students to construct interactive virtual tours using Google Earth. Students could create a virtual tour of key places during Shays' Rebellion and insert links, videos, and text descriptions to draw connections to a present-day governmental protest.

Constructionism

Constructionism describes how learning happens through **playful building of an object, artifact, or idea that can be seen by and shared with others**. Papert and Harel (1991) describe constructionism as "learning-by-making" (para. 1).

Similar to constructi**v**ism, constructio**n**ism focuses on the individuals' development of knowledge through meaning making and the interpretation of information, rather than the absorption of objective external information. Papert and Harel noted that constructionist learning, "happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe" (para. 2). Through hands-on, minds-on building, **learning is an interactive process of creating knowledge structures**.

In classroom settings, constructionism fits well with advanced knowledge acquisition where students are asked to build or create something based on the foundational knowledge they developed. For example, you might ask students to create a 3D model to represent the Declaration of Independence (see [example lesson plan](#)). In order to create this model, students need to explore, analyze, and interpret information regarding the purpose of the Declaration of Independence and what it means in present day society.

- **Digital Tool in Practice:** [Tinkercad](#) is a digital 3D modeling tool that students can use to construct or modify historical 3D models.

Social Learning

According to Vygotsky (1978), learning happens on two planes: (1) between people and (2) in one's own mind. That is, **we learn by observing others'** actions and by interacting with others who offer more knowledge or diverse perspectives and ideas. Then, we **internalize these social experiences** to reflect upon, develop, or modify our own knowledge.

In classroom settings, students learn behaviors by watching other students and adults. They discover new information by reading books and watching videos created by others. They acquire knowledge and skills by communicating with peers, engaging in group activities, and sharing their thoughts and getting feedback. They learn by listening to the teacher, other adults and experts, and their peers. They build their understanding by trying out ideas or behaviors and modifying them based on the responses from their peers.

Ultimately, learning and development are social processes that happen all the time, including during formal classroom instruction and informal play time during recess or an after school club.

When selecting digital tools and apps, look for ones that support multiple types of social learning (beyond just reading text written by others). There are tools that allow students to collaborate in real-time with peers, engage in conversations with experts across the country or around the world, and share their ideas and get feedback from individuals within and beyond the classroom. In a social studies classroom, students could engage in a debate about free speech using Flipgrid and then invite parents, guardians, and other students in the school to watch and reply to their videos.

- **Digital Tool in Practice:** Twitter is an educational social networking tool where students and educators can participate in Twitter Chats organized by topic hashtags (e.g., #SSchat) to discuss current educational challenges like media literacy in the age of "fake news."

Table 1. Overview of Learning Theories with Examples of Digital Tools

Theory	Definition	Example Tools	Relation to Learning Theory
Behaviorism	Learning happens by responding to an external stimulus	Kahoot, EdPuzzle, Nearpod, Peardeck	Multiple choice questions with immediate feedback, quick response, and memorization of facts
Cognitivism	Learning happens by organizing and processing information	Google Drawings, MindMup 2, YouTube Playlists	Organization of concepts and information
Constructivism	Learning occurs through meaning-making and the interpretation of information	Twitter, Google Tour Builder, PhET Simulations	Participation and immersion in a learning experience; learning by "doing"
Constructionism	Learning happens through building tangible things	Scratch, Pencil Code, Tinkercad, Wix	Learning through producing a physical artifact as a way to build one's own knowledge structures
Social Learning	Learning happens through observing, communicating, collaborating, and interacting with others	Twitter, Scratch, Flipgrid, Instagram	Opportunities to communicate with, and learn from, others

To discover and explore more digital tools, visit the Online Tools for Teaching and Learning blog created by Dr. Torrey Trust and her students at the University of Massachusetts Amherst.

Bloom's Taxonomy: Moving Toward Higher Order Thinking Skills

Another way to evaluate and identify appropriate digital tools and apps for learning is to use Bloom's taxonomy - a **hierarchical model of cognitive skills**.

Bloom's taxonomy (1956) was originally "published as a kind of classification of learning outcomes and objectives that have, in the more than half-century since, been used for everything from framing digital tasks and evaluating apps to writing questions and assessments" (Heick, 2020, para. 3).

When selecting digital tools and apps for a particular learning experience, it's best to start with the learning objectives, goals, or outcomes, which is where Bloom's taxonomy comes into play. You can use Bloom's taxonomy as a guide for defining appropriate, measurable learning objectives for your students and then select the best tools and apps to help students meet the objectives.

Watch the YouTube Video [What is Bloom's Digital Taxonomy](#) (featured below) to learn how educators use this framework to create high quality digital learning experiences.
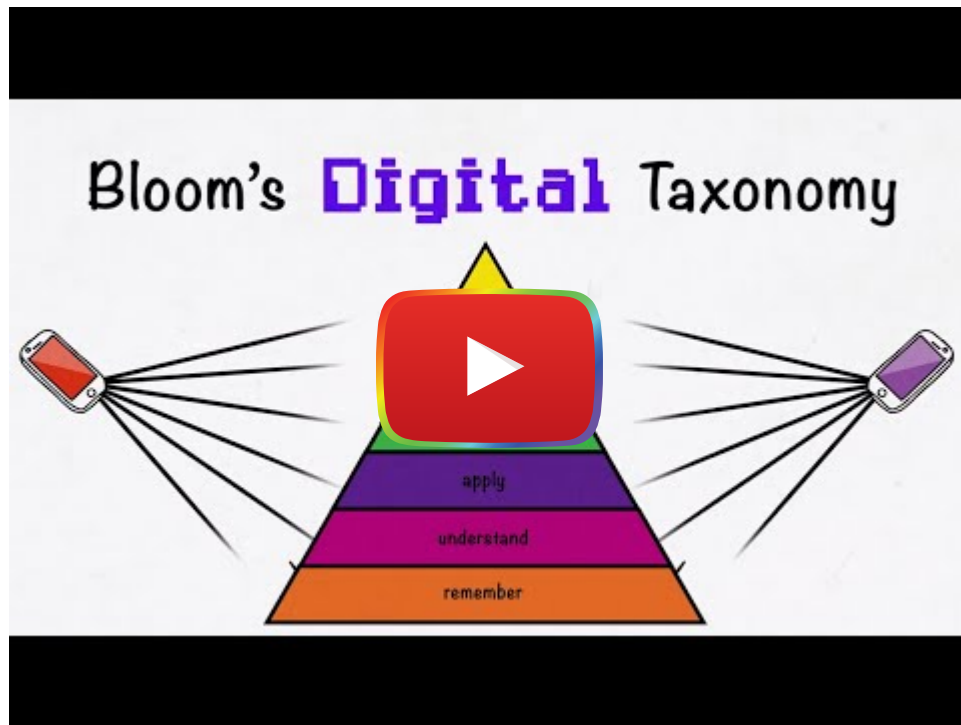
[Watch on YouTube](#)

The revised Bloom's taxonomy (2001) is organized into six categories (see Figure 1) ([Armstrong, 2019](#); [Shabatura, 2018](#)). The first category, "**remember,**" refers to the recognition and recall of information, like reciting facts about the legislative branch. The second category, "**understand,**" relates to the learners' ability to interpret, summarize, and explain information. For instance, a civics student might explain how a bill becomes a law. The third category, "**apply,**" involves the use or modeling of information, like demonstrating the process of passing a present-day bill.

The fourth category, "**analyze,**" refers to breaking down, differentiating, and classifying information. For example, learners could compare and contrast different types of legislation. The fifth category, "**evaluate,**" involves critiquing, assessing, defending, and comparing information, like arguing for or against a particular piece of legislation. Lastly, the sixth category, "**creating**" refers to designing, inventing, or creating new knowledge. For instance, students could write and present their own bill.
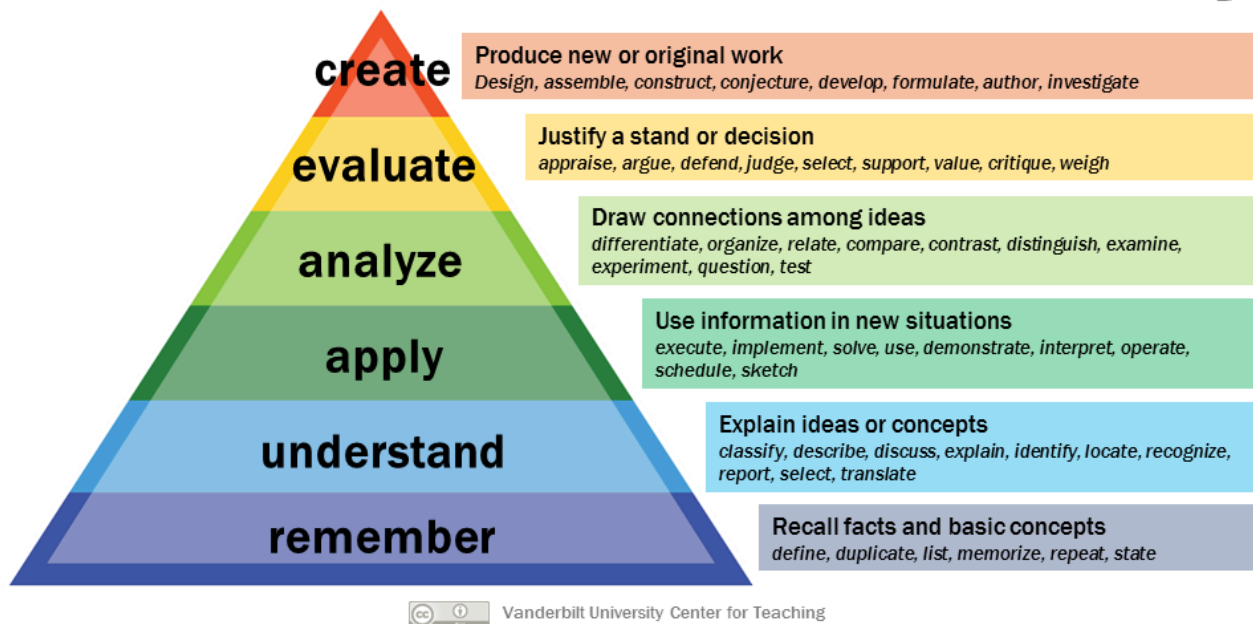
Figure 1. "Bloom's taxonomy" by Vanderbilt University Center for Teaching licensed under CC BY 2.0

Types of Knowledge

The authors of the revised Bloom's taxonomy presented a separate taxonomy for the different types of knowledge used during cognitive processing (Armstrong, 2019; Iowa State University, 2020):

- **Factual Knowledge** - basic, objective, foundational information
- **Conceptual Knowledge** - knowledge of theories, models, principles, and classifications
- **Procedural Knowledge** - knowledge about how to do something
- **Metacognitive Knowledge** - awareness of one's own cognition

These four types of knowledge can be developed within each of the six categories of Bloom's taxonomy. For instance, at the remember level, a learner could list facts about the news (**remember + factual**), recognize the elements of a newspaper (**remember + conceptual**), recall how to write a news story (**remember + procedural**), and identify strategies for recalling information, such as developing a mnemonic (**remember + metacognitive**).

To see additional examples of the different types of knowledge and how they can be embedded within Bloom's taxonomy, visit Iowa State University Center for Excellence in Learning and Teaching's (2020) Revised Bloom's Taxonomy webpage.

When designing learning activities, consider how you might select different tools and apps based on the type of knowledge you want students to develop. For example, flashcards might work best for factual knowledge, while a spreadsheet tool might be more useful for planning and creating strategies for metacognitive knowledge.

In Table 2, we provide examples of how to create digital learning experiences based on Bloom's taxonomy, the learning theories previously discussed, and the different knowledge types.

Table 2

Bloom's Taxonomy – From Learning Objective to Digital Learning Experience

Bloom's Taxonomy Category	Description	Learning Theories	Digital Learning Experience Example
Remember	Recall, recite, list, or identify information	Behaviorism	Teacher creates a flashcard deck on Quizlet for students to review, play games, and take a practice assessment about U.S. Constitutional facts (**remember + factual**)
Understand	Explain key concepts and ideas (including summarizing, comparing, and inferring information)	Cognitivism	Students use Google Drawing to create a visual summary of the expansion of voting rights in the U.S. Constitution (**understand + conceptual**)
Apply	Demonstrate, model, solve, interpret, predict, or present information	Cognitivism Constructivism	Students use Google Trends to interpret present-day First Amendment issues (i.e., "freedom of speech," "search and seizure") (**apply + procedura**l)
Analyze	Making connections or differentiating between ideas; deconstructing information	Constructivism	Students use Piktochart to compare and contrast a Founding Father with a modern presidential candidate (**analyze + conceptual**)
Evaluate	Make a judgment based on specific evidence and reasoning	Constructivism Social Learning	Students create videos on Flipgrid to reflect on their progress as learners (**evaluate + metacognitive**)
Create	Invent a product, construct a new idea, or remix something created by others	Constructivism Constructionism Social Learning	Students use Tinkercad to create a statue for a Founding Father that represents their biggest contribution to present-day society (**create + conceptual**)

Note. Adapted from "Bloom's Taxonomy: The Ultimate Guide," by C. Persaud, 2018.

For more examples connecting Bloom's taxonomy to digital tools, visit Bloomin' Apps from Kathy Schrock's Guide to Everything.

Higher Order Thinking

As a hierarchical model, **the six categories in Bloom's taxonomy build upon one another**, "meaning that learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels" (Shabatura, 2018, para. 3). For example, to effectively *evaluate* a new bill, students first have to *remember* what a bill is, *understand* the purpose of a bill, *apply* their knowledge of the bill creation process to the design of a new bill, and *analyze* the different types of bills in order to make an informed judgment.

When focusing on the upper levels of Bloom's taxonomy, often referred to as **higher order thinking skills**, students are building upon lower level skills (Jshabatu, 2018). Higher order thinking skills (analyzing, evaluating, and creating) require more cognitive processing compared to lower level skills (e.g., remembering, understanding).

Students must use higher order thinking skills (HOTS) to solve problems, make decisions, and design products (Tankersley, 2005). These skills require a student to be a critical, creative, and innovative thinker. Giving students the opportunity to engage in higher order thinking activities helps develop their capacity as citizens and professionals who can make informed decisions, create new knowledge and ideas, and justify their opinions.

ISTE Standards for Students

One additional framework to keep in mind when evaluating the learning experience of digital tools and apps is the International Society for Technology in Education (ISTE) [Standards for Students](). Given the rapidly shifting technological landscape of present-day society, **students need technology-rich learning experiences that can prepare them "for work and life in this uncertain future"** ([ISTE, 2016, p. 2]()).

ISTE revised their Standards for Students in 2016 to focus on the use of technology to "amplify learning" and to "support students as they become agentic, future-focused and adaptable" (p. 2). These standards emphasize the use of technology to help students develop higher-order thinking skills and the capacity to succeed as learners, citizens, and professionals. There are seven standards, which we will detail in the following section. For a visual overview, explore the [ISTE Standards for Students infographic]().

Empowered Learner

Students use technology for self-directed learning (e.g., setting and achieving their personal learning goals). Students cultivate digitally enhanced personal learning networks and seek feedback to improve their knowledge and skills. Additionally, they demonstrate a willingness to try out, learn how to use, and troubleshoot current and emerging technologies.

- **Digital Tools in Practice:** Students use [Feedly]() - a RSS reader and information aggregator - to follow news topics and blogs that support their personal learning and growth.

Digital Citizen

Students' digital actions are safe, legal, positive, and ethical to protect themselves from harm and to ensure that their actions do not harm others. That is, they refrain from cyberbullying, hacking, trolling, and using copyrighted material without permission. Students cultivate a digital reputation and online identity that will positively impact their academic and career goals. They demonstrate an ability to manage their personal data and examine how it is being used and tracked by others.

- **Digital Tool in Practice:** Students use [Hypothes.is]() to annotate a privacy policy for Tik-Tok, Snapchat, or another social media tool to develop their awareness of data collection and privacy rights when using digital tools and apps.

Knowledge Constructor

Students demonstrate an ability to conduct research, find and evaluate information, and curate information and resources. They create collections of materials (e.g., articles, videos, podcasts, digital timelines) to expand their knowledge and support their learning. They build their knowledge by exploring real-world issues and developing ideas for solutions.

- **Digital Tool in Practice:** Students use [Wakelet]() to curate "wakes" - collections of news articles, blog posts, videos, podcasts, and other online resources - to draw connections between current issues and class topics.

Innovative Designer

Students engage in a design thinking or an instructional design process to identify and solve problems with technology. They generate ideas, test out theories and prototypes, and create artifacts to solve real-world problems. Students develop a capacity to deal with complex problems and engage in multiple iterations of trial and error.

- **Digital Tool in Practice:** Students use Tinkercad to design a water conservation tool for their school or home.

Computational Thinker

Students showcase an ability to think and solve problems like a computer. They break down complex problems into smaller tasks, analyze and identify patterns in data, draw connections to similar problems, and use algorithmic thinking to design technology-based solutions.

- **Digital Tool in Practice:** Students use Google Forms to collect data about an authentic problem or issue in their community. They analyze the data to determine how design solutions.

Creative Communicator

Students craft messages, express their knowledge and opinions, and communicate complex ideas using a variety of tools (e.g., cameras, audio equipment, design software) and platforms (e.g., blogs, social media sites, YouTube channels). They tailor communication to different platforms and audiences. They legally and responsibly remix digital resources created by others into new creative products.

- **Digital Tool in Practice:** Students use Adobe Spark to create memes, posters, infographics, websites, and videos that educate the public about an important social issue.

Global Collaborator

Students use technology to connect and learn with individuals from around the world who present unique insights and diverse perspectives. They collaboratively work with others using digital technologies and contribute to project teams in meaningful ways. They identify and investigate local and global issues and work with others to devise solutions.

- **Digital Tool in Practice:** Students use Slack to collaborate on real world projects with classmates, community members, peers at other schools, and professionals in the field.

The ISTE Standards for Students can serve as a guide for evaluating digital tools and apps to **determine whether, and how, tools might amplify and enrich the student learning experience** and provide students with opportunity to develop their knowledge, skills, and capacity as learners. Let's return to the example from the beginning of the chapter - your students are struggling to understand how the Constitution influences present day U.S. society. You recently discovered Wakelet (a digital curation tool) and wondered if it could be used to create a learning experience to support students' achievement of the learning objective (drawing connections between the Constitution and present-day U.S. society).

Reflecting upon the ISTE Standards for Students, you realize that rather than creating a Wakelet of digital resources for your students, you could have them create their own personal wakes of current news articles and multimodal resources for each of the Articles in the Constitution. Shifting from a teacher-centered use of Wakelet to a student-driven learning activity allows students to become **_knowledge constructors_** and **_creative communicators_**. Using the ISTE Standards for Students as a lens for evaluating and using digital tools allows you to identify which tools to use and ways to use tools and apps to create 21st century learning experiences that prepare students for the future.

Practice Quiz

1. Which learning theories would be most appropriate to guide the design of an activity to help students meet the following objective: "Evaluate the benefits and challenges of digital news and social media to a democratic society." (Massachusetts Curriculum Framework for History and Social Studies) [8.T7.4]? (Select all that apply)

- [ ] Behaviorism
- [ ] Cognitivism
- [ ] Social Learning
- [ ] Constructivism
- [ ] Constructionism

2. Which of the following categories of Bloom's Taxonomy require higher-order thinking skills? (Select one):

- [ ] Understand
- [ ] Remember
- [ ] Create
- [ ] Evaluate
- [ ] Apply
- [ ] Analyze

3. Which ISTE Standards for Students would be most appropriate to guide the design of an activity to help students meet the following objective: "Explain methods for evaluating information and opinion in print and online media. (Massachusetts Curriculum Framework for History and Social Studies)" [8.T7.5]

	Empowered Learner
☐	Digital Citizen
☐	Knowledge Constructor
☐	Innovative Designer
☐	Computational Thinker
☐	Creative Communicator
☐	Global Collaborator

Conclusion

Throughout this chapter, we have described different lenses to evaluate digital tools and apps based on the learning experiences they might provide. Learning theories and Bloom's taxonomy can serve as guides for selecting digital tools and apps that will provide the learning experiences students need based on the type and complexity of the knowledge and skills they have to acquire. While the ISTE Standards for Students provide a framework for evaluating and using digital tools and apps to create technology-rich, 21st century learning experiences for students.

As you design learning activities, lessons, and environments for students, consider how digital tools and apps can help students develop **higher-order thinking skills, technology competencies, and different types of knowledge** (i.e., factual, conceptual, procedural, metacognitive) to develop their capacity for success in a continuously changing technological global landscape.

Checklist of Five Questions for Evaluating Digital Tools

1. What type of learning experience can this digital tool provide?
2. Which learning theory (or theories) is most appropriate for this digital tool?
3. How might this digital tool be used to support higher order thinking skills?
4. How might this digital tool be used to facilitate the development of different types of knowledge (i.e., factual, conceptual, procedural, metacognitive)?
5. Does this tool support students in achieving one or more of the ISTE Standards for Students?

Application Exercise

Take a couple minutes and think about a recent class activity or lesson where you used a digital tool that didn't work out as well as you had hoped. Based on this chapter, how might you adjust your use of the tool in the future to create an innovative learning experience to help students meet their learning goals?

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Evaluating Cost, Privacy, and Data

Matthew Checrallah, Caroline Sonnett, & Jacob Desgres

> ## Hypothes.is Social Annotation
>
> This chapter is annotated every year as part of an undergraduate/graduate class on Teaching and Learning with Technology. To turn off the highlighted text, click on the "eye" icon in the top right corner of the browser screen.

Introduction

In today's advanced technological landscape, can you really have privacy?

Do you currently have a GPS, a smartphone or tablet, or apps that track your location? Do you have an artificial intelligence (AI) device, like SIRI, Alexa, or Cortana, that records what you say? Have you ever had your password stolen or your personal information hacked from a site that you joined? Have you ever signed up for a tool or downloaded an app without reading the terms of service or privacy policy? Have you ever signed up for an online course (e.g., Coursera, WGU, Udacity) without realizing they are tracking and sharing your data, including recording your mouse and keystrokes?

In this chapter, we will explore how educational technology (edtech) tools are constantly collecting, using, and sharing personal information, what this means for you as an educator, and how you can better protect your students.

> ### *The Markup*: This Private Equity Firm Is Amassing Companies That Collect Data on America's Children
>
> "We found that the companies, collectively, gather everything from basic demographic information—entered automatically when a student enrolls in school—to data about students' citizenship status, religious affiliation, school disciplinary records, medical diagnoses, what speed they read and type at, the full text of answers they give on tests, the pictures they draw for assignments, whether they live in a two-parent household, whether they've used drugs, been the victim of a crime, or expressed interest in LGBTQ+ groups, among hundreds of other data points" (Feathers, 2022, para. 11).

The Underlying Costs of Free Tools

Although free edtech tools and applications (apps) can be used to enrich, and even transform, teaching and learning, it is important to remember the old adage, "If something seems too good to be true, it probably is." This is not to say free edtech tools have no place in the classroom, but it is important to understand the true cost behind employing such technology when it is presented as being "free." To get started, watch the following video Adam Ruins Everything - The Terrifying Cost of "Free" Websites:

Watch on YouTube

Apps and digital tools targeted to teachers as "free" often come with underlying costs. Many tools used in the classroom, such as Canva, a graphic illustrator tool, or Wakelet, a digital curation app, require you to register for an account to use the tool. When you register for an account, you are usually asked to share **personally identifiable information**, like your name, email address, age, and/or gender. You will also be asked to review and accept the **end-user license agreement** or **terms of service**, which may involve giving away even more data, such as your IP address, device information, browser information, geolocation, and Internet browsing data.

DATA COLLECTION   SCORE: 60%

What data does it collect?

- ⚠ Personally identifiable information (PII) is collected.
- • The categories of collected personally identifiable information are indicated.
- ✔ Collection or use of data is limited to product requirements.
- ⚠ Geolocation data are collected.

Continue reading ⌄

DATA SHARING   SCORE: 80%

What data does it share?

- • Collected information is shared with third parties.
- • The categories of information shared with third parties are indicated.
- • The purpose for sharing a user's personal information with third parties is indicated.

Continue reading ⌄

DATA SECURITY   SCORE: 95%

How does it secure data?

- ⚠ A user's identity is verified with additional personal information.
- • Account creation is required.
- • Parental controls or managed accounts are available.
- ✔ Two-factor account protection is available.

Continue reading ⌄

DATA RIGHTS   SCORE: 95%

What rights do I have to the data?

- ✔ Opt-in consent is requested from users at the time personal information is collected.
- ✔ Users can control their information through privacy settings.
- ⚠ Users can create or upload content.
- ✔ Users retain ownership of their data.

Continue reading ⌄

The Common Sense Media organization created an evaluation tool to help you assess the privacy of digital tools and apps, including what data is collected and shared, how data is secured, and what data rights you have. Learn more here: Common Sense Privacy Program.

Some tools allow you to use a **single sign on** from third party companies, such as Google or Facebook, to create an account, which gives the tool partial or full access to the data from these third party companies. This can be problematic when the third-party company gives away too much information. For example, when the augmented reality game Pokemon Go first launched in 2016, the only way to create an account was through Google single sign on. However, this process granted the app "**full access to your Google account.** That means the developer of Pokemon Go, Niantic, may have access to your emails, Google Drive, calendar, contacts, photos, Chrome browsing history, search history, Maps data... and, well, anything else linked to your Google account" (Cipriani, 2016, para. 3). As educators, it is important to understand that asking students to use apps or digital tools for learning activities **gives companies the opportunity to collect data on them**.

Companies use the data they collect in a variety of ways, including tailoring advertisements (ads) to you, marketing, developing or improving services offered within the app, and sharing or selling the data to third-party companies. Take a look at the Snapchat Privacy Policy (2019), for example, and you'll see that Snapchat is collecting a significant amount of data, including usage, content, device, and location information, and using that data to "Develop, operate, improve, deliver, maintain, and protect our products and services," "personalize our services," and "provide and improve our advertising services, ad targeting, and ad measurement" (para. 20). Additionally, the privacy policy indicates that **Snapchat may share your data** with other Snapchatters, business partners, the general public, affiliates, and third parties.

Similar to Snapchat, Twitter collects, uses, and shares a significant amount of data from users. Take a look at the Twitter Privacy Policy Overview video embedded below and you'll discover that Twitter even collects and analyzes "private" direct messages with other users.
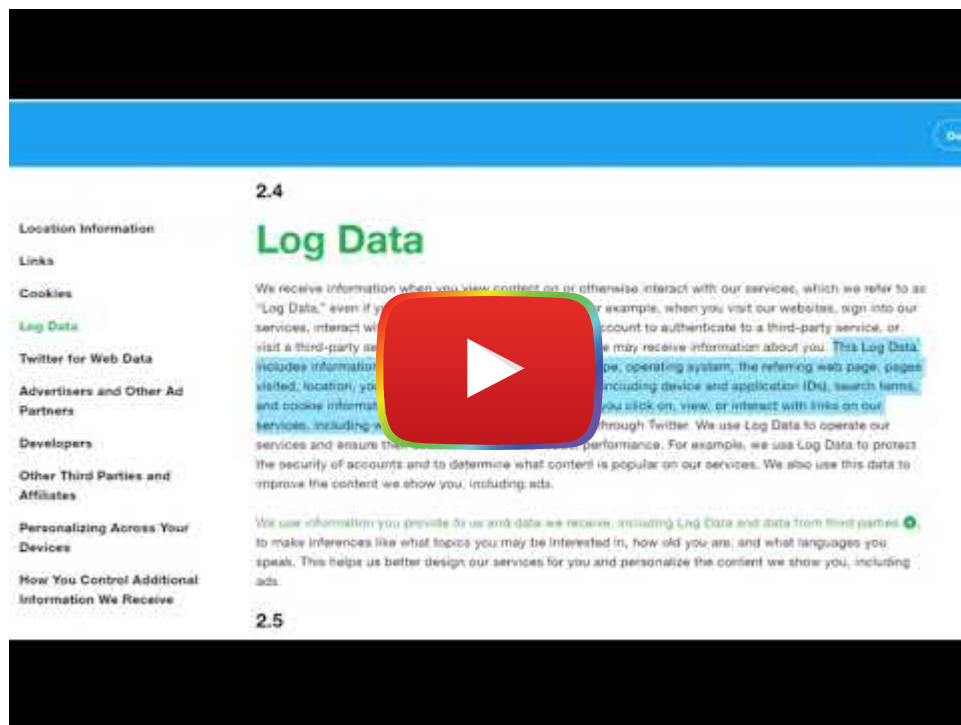
Ultimately, companies use the information and data they collect from you **to make money**, whether through advertisements, developing or improving services, or creating a profile with your data to sell to other companies. So, while it may be free to register and use a digital tool or app, you are paying for it by sharing your data and giving up your privacy.

How do you feel about giving up your data and privacy? Try out the Technoethics DigCiz tool "**Data, Privacy, and Identity Drag and Drop Cards**."

Even if you as an individual user may be okay with sharing your data for "free" tools, when you assign a tool to students you are asking them to share their data, whether they want to or not.

Additional Resources to Explore

- [Common Sense Privacy Evaluations](#)
- [Student Privacy Training for Educators](#)
- [2018 State of Edtech Privacy Report](#)
- [Educator Toolkit for Teacher and Student Privacy](#)
- [Schools Do Not Have to Sacrifice Students' Privacy to Continue Schooling](#)
- [A Security Checklist for School-Provided Technology](#)
- [Protecting Student Privacy (U.S. Department of Education)](#)

Data Collection & Privacy

Privacy is the "freedom from unauthorized intrusion" ([Merriam-Webster, 2020](#), para 2). The **right to privacy** means "a person has the right to determine what sort of information about them is collected and how that information is used"

([Sharp](#), 2013, para. 14). Yet, in today's digital age, apps, websites, and online tools are collecting, using, and sharing private personal data to make money. The companies that make these digital tools and apps get away with infringing on peoples' right to privacy by using confusing legal jargon, obscure terms, and abstract statements in their privacy policies ([Moretti & Naughton, 2014](#)). According to Moretti and Naughton, "Taken together, the way America's most popular websites write their privacy policies makes it almost **impossible in practice for people to be fully informed** about their Internet use and how their data is collected" (para. 13).

Similarly, end-user license agreements (EULA) and terms of service (TOS) agreements feature opaque language that may cause you to give away your right to privacy without truly understanding what you are doing when you click "I agree."

A EULA or TOS is a contract with which you have to agree to use an app, tool, or website. You may come across one when downloading an app, opening an app for the first time, reinstalling or updating an app, registering to use a digital tool, or at the bottom of a webpage. The methods used to ask for user consent differ, as there is no national standard for how to acquire consent. It can either be attained in "browsewrap" where you never click any "I Agree" buttons, but there is text on the screen that states, "By using this site, you agree to our Terms of Service." In a clickwrap form, the site will prevent you from entering until you check the "I Agree" button. Browsewrap may not be as intrusive, but they may still be capturing data from the user (Pegarella, 2016).

> ## Visualizing Terms of Service
>
> According to [LePan (2020)](#), "Even the shortest terms and conditions for popular online services are a few thousand words long. 97% of people in the 18-34 age group agree to conditions without reading them" (para. 1). LePan's article features an **[infographic displaying the length of each TOS for 14 popular apps](#)**, with Instagram at the shortest read time of 9 minutes and 42 seconds and Microsoft's TOS at more than an hour of read time (15,260 words).

It is common practice to give consent ("I Agree") without reading the EULA, TOS, or privacy policy. However, this can have negative consequences for you and your students' privacy. Reading through the EULA or TOS and privacy policy is always good practice and can raise **red flags**, like Snapchat - here is a statement from their [Terms of Service](#) (2019):

> When you appear in, create, upload, post, or send Public Content, you also grant Snap Inc., our affiliates, and our business partners the **unrestricted**, worldwide, **perpetual right** and license to use your name, likeness, and voice, including in connection with commercial or sponsored content.

This kind of blank check usage of your data is not unusual for agreements and should be a warning sign for you as an educator when examining how the use of a tool might affect your students' privacy.

Google `Class C`

- This service may collect, use, and share location data
- The service can read your private messages
- You agree to defend, indemnify, and hold the service harmless in case of a claim related to your use of the service
- This service tracks you on other websites
- Limited copyright license to operate and improve all Google Services

More details

YouTube `Class D`

- Terms may be changed any time at their discretion, without notice the user
- Processes a personal information (email, id but also device info, location)
- Users should revisit the terms periodically, although in case of mat changes, the service will notify
- If you are the target of a copyright claim, your content may be rem
- The service is not responsible for linked or (clearly) quoted content from third-party content providers

More details

Amazon `Class C`

- Terms may be changed any time at their discretion, without notice to the user
- The service can delete your account without prior notice and without a reason
- This service tracks you on other websites
- This service forces users into binding arbitration in the case of disputes
- Blocking cookies may limit your ability to use the service

More details

twitter `Class D`

- Very broad copyright license on your content
- Third party cookies
- This service ignores the Do Not Track (DNT) header and tracks use anyway even if they set this header.
- The service can delete your account without prior notice and witho reason
- This service reserves the right to disclose your personal informatio without notifying you

More details

The Terms of Service; Didn't Read Extension/Add-On allows you to quickly assess a digital tool or website before using it (https://tosdr.org)

Before you download or use another app or digital tool:

1. **Read the Terms of Service or End-User License Agreement**

   - What rights are you granting the company?
   - How might the company infringe on your privacy? (e.g., Snapchat TOS states: "While we're not required to do so, we may access, review, screen, and delete your content at any time and for any reason")

2. **Read the privacy policy**

   - Start by watching "How to read privacy policies like a lawyer"
   - What data are collected? Take a look at UMass Amherst's Data Classification categories to help you evaluate the type of data collected by the app or tool (e.g., restricted, confidential, operational use only, or unclassified).
   - How are data used?
   - How are data shared?
   - How does the company ensure the security of your data?
   - What happens if there is a data breach and your data is stolen?

> *The Markup*: [What Does It Actually Mean When a Company Says, 'We Do Not Sell Your Data'?](#)
>
> "The next time you look at a privacy policy, which few people ever really do, don't just focus on whether or not the company says it sells your data. That's not necessarily the best way to assess how your information is traveling and being used. And even if a privacy policy says that it doesn't share private information beyond company walls, the data collected can still be used for purposes you might feel uncomfortable with, like training internal algorithms and machine learning models. (See Facebook's use of one billion pictures from Instagram, which it owns, to improve its image recognition capability.) Consumers should look for deletion and retention policies instead" ([Ng, 2021, para. 38-40](#)).

3. **Follow the money**

   - How does the company make money?
   - Does the company buy your data from third-party companies to improve its own services and ads?
   - Does the company sell your data to others?

4. **Examine the purpose**

   - To whom is the digital tool or app catered?
   - Does the tool or company have a specific goal?

5. **Check with your district tech/IT support professionals**

   - Does your school or district have a contract with the tool or app that protects student data and privacy (see [K-12 School Service Provider Pledge to Safeguard Student Privacy](#))?
   - Or, if you ask students to use single sign on their their school email accounts, will that protect students when they use the tool or put their educational records at risk?
   - If not, would your school or district tech/IT support professionals be willing to review the privacy policy/TOS of the edtech tool and let you know whether/how you should use the tool in your classroom?

6. **Look for alternatives**

   - Is there another tool/app that will do the same job that is more protective of your students' privacy? For example, [Pencil Code](#), a coding tool, does not collect or allow the sharing of any personally identifiable information. Tools funded by external sources (e.g., grants) may not collect personally identifiable data because they are not expecting a return on investment.

7. **Ask the Company to Protect Your Students' Personal Information**

   - "Thanks to a California law that went into effect in January 2020, you and your family have new rights to protect your personal information if you are California residents" (Common Sense, 2020, para. 1). Learn more: https://www.donotsell.org/

Educator's Guide to Student Data Privacy

In the Educator's Guide to Student Data Privacy by ConnectSafely you will find a list of questions to help you quickly evaluate an edtech tool for student privacy.

As an educator, it is important to know what type of data will be collected when using an educational app, digital tool, or AI device (e.g, Amazon Echo) in your classroom. It is equally important to understand the privacy concerns that exist as a result of that data being used and/or shared.

The Washington Post: Remote learning apps shared children's data at a 'dizzying scale'

"School districts and public authorities that had recommended the tools, Han wrote, had 'offloaded the true costs of providing education online onto children, who were forced to **pay for their learning with their fundamental rights to privacy**.'" (Harwell, 2022, para. 17).

In a New York Times interactive feature, "Your Apps Know Where You Were Last Night, and They're Not Keeping It Secret," Valentino-DeVries, Singer, Keller, and Krolik (2018) described how a math teacher with multiple **location-tracking apps on her phone had her location recorded more than 8,600 times in four months**, including when she was in school, how long she was at her dermatologist's office, and when she went to a Weight Watchers meeting.

It seems like nowadays most apps, websites, and digital tools ask for permission to use your location, whether it's to locate the closest store for you, track your running or biking route, or to provide local news or weather alerts. However, what you may not realize is that the **geolocation data collected about you is often shared or sold to other companies**. For instance, Valentino-DeVries and colleagues described how a sports app that used location data to identify local sports teams, "passed precise [user location] coordinates to 16 advertising and location companies" (para. 37). App developers "make money by directly selling their data, or by sharing it for location-based ads, which command a premium. Location data companies pay half a cent to two cents per user per month" (Valentino-DeVries et al., para. 50).

Many users give apps permission to use their location with the understanding the data will be anonymized. However, Paul Ohm, a law professor and privacy researcher at the Georgetown University Law Center, noted that "really precise, longitudinal geolocation information is absolutely impossible to anonymize" (as cited in One Nation, Tracked by Thompson & Warzel, 2019). And, while individual apps may indicate that they anonymize your data, they often send the data to the same location data companies that curate the data into large databases. When these companies receive multiple pieces of information from the various apps installed on your device, it is easy to connect the dots of your habits and routines. Should this data get breached or used in the wrong way (e.g., monitoring who attended a protest), **imagine the impact it might have on your own life or your students' rights and freedom**.

> ### *The New York Times*: [ONE NATION, TRACKED](#)
>
> **An Investigation into the Smartphone Tracking Industry from Times Opinion**
>
> "It originated from a location data company, one of dozens quietly collecting precise movements using software slipped onto mobile phone apps. You've probably never heard of most of the companies — and yet to anyone who has access to this data, your life is an open book. They can see the places you go every moment of the day, whom you meet with or spend the night with, where you pray, whether you visit a methadone clinic, a psychiatrist's office or a massage parlor" ([Thompson & Warzel, 2019, para. 7](#)).

> ### Placed at the Scene of a Crime due to a Location Tracking App
>
> In the article, "[Google tracked his bike ride past a burglarized home. That made him a suspect.](#)" Zachary McCoy discusses how his use of the exercise tracking app, RunKeeper, to track his bike rides resulted in him being considered a suspect in a crime. When the local police obtained a geofence warrant ("a police surveillance tool that casts a virtual dragnet over crime scenes, sweeping up Google location data — drawn from users' GPS, Bluetooth, Wi-Fi and cellular connections — from everyone nearby") it tied McCoy to the scene of a local robbery even though he had simply just been on a bike ride near the robbery at the same time ([Schuppe, 2020, para. 9](#)).

> ### *The Markup*: [Your Location Is a Universal Identifier](#)
>
> "We wanted to develop a statistical approach to quantify what it would take, on average, to identify someone from an anonymous location dataset, and we were able to show that **four data points of approximate place and time of where someone was was enough**, in a data set of 1.5 million people, to uniquely identify someone 95 percent of the time" ([Angwin, 2022, para. 13](#)).

Student Data Collection and Use

Data are commonly collected about students through administrative management systems, tracking systems, and learning management systems. Systems like these collect personally identifiable information, such as names, addresses, dates of birth, grades, location, behavior, and/or attendance. School-assigned devices, such as laptops or tablets, as well as school wifi, can potentially collect additional data, including location, device usage data, browsing history, and communications with other students. Data collection can be beneficial in schools because it gives educators the ability to tailor educational programming to the specific needs of students and reduce negative outcomes, like dropout numbers and cyberbullying.

However, there is a tradeoff when collecting information on students. With more data collected on students than ever before, educators can track the progress of students, design personalized learning experiences, and project where students may encounter difficulty in schools. However, this same data could be **misinterpreted, perpetuate stereotypes** about certain student profiles, be shared with local authorities and increase interactions between police and students from traditionally marginalized backgrounds, and even be used to limit opportunities for students in the future ([Educator Toolkit for Teacher and Student Privacy, 2018](#)). Even worse, when algorithms are used to analyze student datasets, it is

"even more likely that they will **reinforce the education system's existing biases** rather than radically upend them" (Watters, 2017, para. 39). Ultimately, the data collected on students could actually **negatively impact student learning** - the opposite of the intended purpose.

The74: **[Survey Reveals Extent that Cops Surveil Students Online — in School and at Home](#)**

"The tools, offered by a handful of tech companies, can sift through students' social media posts, follow their digital movements in real-time and scan files on school-issued laptops — from classroom assignments to journal entries — in search of warning signs. Educators say the tools help them identify youth who are struggling and get them the mental health care they need at a time when youth depression and anxiety are spiraling. But the survey suggests an alternate reality: Instead of getting help, many **students are being punished** for breaking school rules. And in some cases, survey results suggest, **students are being subjected to discrimination**" (Keierleber, 2022, para. 44).

Education Week: [Using Student Data to Identify Future Criminals: A Privacy Debacle](#)

"Experts on data privacy and student security are calling for investigations and parents are expressing alarm after a news report last week revealed that a county police department in Florida uses sensitive data from the local school district to keep a secret list of middle and high school students it deems as potential future criminals" ([Lieberman, 2020, para. 1](#)).

The sensitive data collected on students, whether from management systems, school devices, or classroom apps/tools, can put students in a **vulnerable position** if the data collected are not adequately protected. For instance, in 2017, a hacker group called "The Dark Overlord" engaged in ransomware attacks on student systems and gained access to personal information of many students. With this information, they sent threatening texts to students until demands were met ([Educator Toolkit for Teacher and Student Privacy, 2018](#), p. 2). Cyber attacks on schools tripled in 2019 (Klein, 2020). According to Klein, "Schools were most likely to experience data breaches and other unauthorized disclosures" (para. 4). Additionally, hackers stole user data and passwords from more than 77 million teachers, students, and parents/guardians who were using Edmodo ([Cluley, 2017](#)).

When using data collection systems and edtech tools, educators and administrators should carefully examine the EULA/TOS and privacy policy to identify what information might be collected, used, shared, sold, or stolen and how that information is protected from misuse or data breaches.

Digital Tools & Apps That Focus on Privacy

While the extent to which data is collected, shared, sold, and used varies quite a bit from tool to tool, there are several tools that either do not collect a lot of information (to support users' privacy) or have privacy policies that are designed with students' privacy rights in mind. Here are a few examples*:

- [Code.org](#)
  - [Common Sense Education Privacy Rating](#): 96%.
  - Online Tools for Teaching & Learning Site Evaluation: N/A.
  - Details: Collection or use of data is limited to product requirements.
- [Data Basic.io](#)
  - Common Sense Education Privacy Rating: N/A.
  - [Online Tools for Teaching & Learning Site Evaluation](#): 5 Stars.
  - Details: "The Data Basic website stores information uploaded only for the amount of time it takes users to analyze the data, and then it deletes it. The aggregate results shown on the website (metadata) are kept for 60 days, and then are deleted."
- [Formative](#)
  - [Common Sense Education Privacy Rating](#): 93%.
  - [Online Tools for Teaching & Learning Site Evaluation](#): 5 Stars.
  - Details: Collection or use of data is limited to product requirements. Users can control how their data is displayed. Privacy policy states: "We strive to adhere to U.S. federal, certain state, and certain international regulations. This includes (but may not be limited to) FERPA, COPPA, GDPR, and California AB 1584."
- [Pencil Code](#)
  - Common Sense Education Privacy Rating: N/A.
  - [Online Tools for Teaching & Learning Site Evaluation](#): 5 Stars.
  - Details: "Pencil Code does not collect personally identifiable information, and our Terms of Service expressly prohibit posting personally identifiable information."
- [PhET Simulations](#)
  - [Common Sense Education Privacy Rating](#): 22% (this rating is for the University of Colorado's privacy policy and not the PhET simulations privacy settings).
  - [Online Tools for Teaching & Learning Site Evaluation](#): 5 Stars.
  - Details: "In connection with your use of the PhET Simulations Android app, NO personally identifiable information is collected by the CU PhET team. The PhET Simulations Android app is meant to provide educational simulations to a wide audience. As we strive to collect the minimum amount of information needed to advance our educational mission, we have determined that there is no need for the collection of personal data within this app."
- [Remind](#)
  - [Common Sense Education Privacy Rating](#): 94%
  - [Online Tools for Teaching & Learning Site Evaluation](#): 5 Stars
  - Details: Abides by GDPR. Awarded the iKeepSafe COPPA Safe Harbor Seal.

This list is not meant to be an exhaustive list of digital tools and apps that seek to protect users' privacy. There are several tools that have recently changed their privacy policies to be more protective of users' privacy and to abide by privacy laws, such as the [GDPR](#) and [CCPA](#). Therefore, it is important to continually (at least once a year) check the privacy policies of digital tools and apps that you use for teaching and learning for any changes or updates.

*This list was curated by Ana Paula Dornelles Schantz.

If you are concerned about a data breach, the loss of your (or your students') data, or the sharing of your (or your students') information without permission, watch the Above the Noise's 5 Tips to Protect Your Privacy Online video. This video discusses threat modeling, passwords, online tracking, surveillance at schools, encryption, and open wifi networks.

[Watch on YouTube](#)

Laws About Privacy and Data

There are a number of laws in place to protect students' privacy. If you, or your school district, were to use a digital tool, website, or app that violates one of these laws, it can cause serious legal trouble. Similarly, if companies violate these laws, they too must face the consequences. For instance, Google and YouTube had to pay a $170 million fine for illegally collecting, using, and sharing personal information from children under 13 years old without their consent, violating the Children's Online Privacy Protection Act (FTC, 2019). In the following section, we will detail some of the most important laws to keep in mind when evaluating the privacy, cost, and data use of apps and online sites/tools.

The Family Educational Rights and Privacy Act (FERPA)

The Family Educational Rights and Privacy Act (FERPA), passed in 1974 and last updated in 1992, **protects a student's personal information and educational records from unauthorized disclosure**. This law gives students "access to their education records, an opportunity to seek to have the records amended, and some control over the disclosure of information from the records " (Drake, 2014, para. 12). Educators and administrators must have the consent of the student and their guardian (if they are under 18 years old) before they can share student information or records.

Returning to the Pokemon Go example earlier in this chapter, this could have been a potential FERPA violation since Niantic was given full access to students' school Google accounts through the single sign on process. While Niantic

was quick to change what data they collected from Google to provide more protections to users, you can't assume companies have the users' best interests or right to privacy in mind when you ask students to register or sign in to a tool or app.

FERPA can also potentially be violated when requiring students to use social media for a class assignment. You must ensure that students' personal information and education records are protected from the public. For example, don't require them to post on Twitter with their actual name using a school hashtag, instead allow them to use a pseudonym and then submit screenshots of their tweets to you for assessment. You also shouldn't ever post information related to students' grades, course enrollments, classes, or other educational records on social media (i.e., don't post a student's grade directly on their public blog) (for more information, read Is Your Use of Social Media FERPA Compliant?).

Learn more about FERPA from the U.S. Department of Education: Protecting Student Privacy While Using Online Educational Services: Requirements and Best Practices.

Remote Learning Tip

If you record or take a screenshot of a class virtual meeting that displays students' images and/or personally identifiable information, this becomes an educational record protected under FERPA and must be stored and used in a way that protects the students' privacy (see FERPA Faculty/Staff FAQs by Rice University).

Note: Sharing a screenshot of your 4th grade class Zoom session (featuring student names and images) on Twitter is a FERPA violation because you are sharing an educational record without students' or parents/guardians' permission. Learn more: The 3 Biggest Remote Teaching Concerns We Need to Solve Now.

The Children's Online Privacy Protection Act (COPPA)

The Children's Online Privacy Protection Act (COPPA, 1998) was created to **regulate technology companies' collection and use of data from children under the age of 13**. According to the Federal Trade Commission (2015), "The primary goal of COPPA is to place parents in control over what information is collected from their young children online" (para. 4). Under COPPA, website operators, online services, and app developers need to:

- Post a detailed privacy policy that indicates how personal information is collected online from kids under 13;
- Giving parents direct notice and obtain consent before collecting information from their children;
- Give parents the option of consenting to the companies' collection and use of information about their children;
- Prevent the disclosure of information collected from children to third-party companies (unless it's necessary for the site or service; in this case it has to be made clear to parents);
- Allow parents to review the information collected about their children, request the data be deleted, and opt out of future collection; and
- Keep the information secure and delete it once it is no longer necessary.

Schools can provide consent for the parent when sites, services, tools, or apps are used for educational purposes only and the personal information collected about students is not used for commercial purposes.

Before you introduce an app, online site, or tool into your classroom, do a quick Internet search for the name of the app/site/tool + "COPPA" to see if it has a COPPA policy in place or adheres to COPPA. While most edtech tools are not COPPA compliant (e.g., Thousands of apps in Google Play Store may be illegally tracking children, study finds), some educational tools are starting to indicate their compliance with COPPA in their privacy policies or EULA/TOS or on their website. Some edtech companies make it clear and easy to understand their COPPA compliance (e.g., Pencil Code

[Privacy Policy](#)), however, others are less transparent or put the responsibility on the educator or school to adhere to COPPA (e.g., [Adobe & Student Privacy](#), [Lucidchart](#), [Flipgrid Privacy Policy](#)).

Children's Internet Protection Act

The [Children's Internet Protection Act](#) (CIPA), passed in 2000, **protects children from obscene or harmful content on the Internet**. CIPA is the reason sites like YouTube, social media, and even Internet searches may be blocked or filtered in schools. Schools and libraries that are part of the [E-rate program](#) (discounted telecommunications and Internet access) must comply with CIPA. According to the Federal Communications Commission (2019), schools and libraries subject to CIPA must create and adhere to an Internet safety policy addressing how they:

- Restrict students from accessing obscene or harmful information/materials and child pornography;
- Ensure the safety and security of minors when they engage in digital communications (email, chat rooms);
- Prevent unauthorized disclosure of students' personal information;
- Prevent minors from engaging in illegal behaviors, such as hacking.

CIPA may impact whether you can use certain digital tools, websites, and apps. For instance, you might want to show a YouTube video in class, only to find out that YouTube is banned on the school network. Or, you might ask your students to search for an image, but Google image search is blocked. Thus, when evaluating a digital tool, online resource, or app, you should test whether it can be used on the school network. You may also want to explore whether the tool violates CIPA. For example, even though [Pixabay](#) (a website featuring high quality free stock photos) has a SafeSearch feature, the website states that the SafeSearch filter isn't 100% accurate. Also, viewing adult content on Pixabay is easily done with the click of a button. While Pixabay may not be banned by your school administrators or IT staff, the use of it in your classroom could potentially violate CIPA.

State Laws on Privacy

Be sure to familiarize yourself with your state's laws on privacy. Many new state privacy laws have been passed since 2014, including the Student Online Personal Information Protection Act (SOPIPA) and the [California Consumer Privacy Act (CCPA)](#).

Explore the [Privacy Bills by State Chart](#) from the Parent Coalition for Student Privacy and the [U.S. state comprehensive privacy law comparison website](#).

Conclusion

Before you introduce a new tool, online resource, or app into your classroom, start by reading the end-user license agreement/terms of service and privacy policy (don't just click "I Agree" without actually reading the terms!). Knowing what personal rights and private data you have to give up to use a new tool or app in your classroom can help you weigh the pros and cons of whether the new technology is actually worth it. It will also help you protect your own and your students' privacy.

In this chapter, we discussed the underlying costs of using "free" tools, how to assess edtech tools to protect student privacy, and federal and state privacy laws that impact the use of edtech tools in classrooms and school. The goal of this chapter was to provide a brief overview of student privacy, data, and the cost of tools. We hope that you continue to build your knowledge of this topic by exploring resources and keeping up to date on the latest changes in privacy laws.

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Evaluating Accessibility

Alyssa Federico, Khizar Shaikh, & Manrong Wang

Introduction

Imagine you are searching the web and find the perfect video to explain a topic your students have difficulty understanding. You go to work the next day prepared to show the video at the beginning of class, hoping to clear up any confusion. However, when you start the video in class, most students cannot hear it because the audio is too low and the volume of the computer speakers cannot be increased. And you find out that the closed captions in the video are inaccurate. Only the students closest to the computer speakers and those with exceptional hearing capabilities are able to benefit from the video, leaving most of the class feeling more lost than they were before.

How can you prevent a scenario like this from happening in the future?

How do you ensure all students have equitable access to learning?

Let's talk about evaluating the accessibility of digital tools and apps. **Accessibility** is described by the Office of Civil Rights as:

> When a person with a disability is afforded the opportunity to acquire the same information, engage in the same interactions, and enjoy the same services as a person without a disability in an equally integrated and equally effective manner, with substantially equivalent ease of use. (as cited in Curry, 2018, para. 2)

As educators, we must strive to **create fully accessible learning environments** for our students. This requires designing inclusive learning environments and evaluating the accessibility of digital tools and apps before using them in the classroom to ensure all learners have the same opportunities to access and engage with course content.

In this chapter, we will first discuss how to design accessible and inclusive learning environments with technology. Then, we will introduce you to the POUR model for assessing the accessibility of digital tools and apps to use in your practice. We will showcase how to evaluate digital tools and apps for different types of disabilities. Finally, we will conclude the chapter with an overview of free, easy-to-use assistive technology tools for designing accessible learning environments and experiences. Before you get started exploring the chapter, watch the Evaluating Accessibility of Digital Tools and Apps video embedded below for a brief overview of the chapter content.

Watch on YouTube

Universal Design for Learning

When designing instruction, the universal design for learning framework (Center for Applied Special Technology [CAST], 2020) can serve as a guide to support the development of accessible and meaningful technology-rich learning experiences. The term **universal design**, coined by Ronald Mace, was originally developed as a response to inaccessible built environments (Burgstahler, 2019). Mace and his colleagues defined universal design as:

> The design of products and environments to be usable by all people, to the greatest extent possible, **without the need for adaptation or specialized design**. (NC State University, The Center for Universal Design, 1997, para. 1)

For example, sidewalks with curb cuts (i.e., a small ramp or graded slope down to the street) make it easier for everyone to access the street, including individuals who use wheelchairs and those who are on bikes.

> ## The Curb-cut Effect and Championing Equity
>
> "In a highly cited 2017 article in the *Stanford Social Innovation Review*, lawyer, activist and policy expert Angela Glover Blackwell highlights the curb-cut effect as a framework for understanding the community-wide benefits of any innovation specifically designed to achieve equity for an underserved group. 'There's an ingrained societal suspicion that intentionally supporting one group hurts another. That equity is a zero-sum game," writes Blackwell. "In fact, when the nation targets support where it is needed most—when we create the circumstances that allow those who have been left behind to participate and contribute fully—everyone wins'" (Collins, 2021, paras. 13-14).

The concept of **universal design for learning (UDL)** expands this idea to the design of learning experiences and environments. CAST developed three guiding UDL principles to assist educators in developing accessible learning experiences:

- **Multiple Means of Engagement** refers to designing learning experiences based on students' interests and motivations (e.g., giving students choice in their learning experience, the content, and the technologies they use).
- **Multiple Means of Representation** means providing more than one way to access and learn the content (e.g., an e-book that features text, embedded videos, and virtual manipulatives).
- **Multiple Means of Action and Expression** provides students with multiple ways to show their understanding of the content (e.g., giving them a digital media choice board).

Learning experiences and environments that are flexible, multimodal, and student centered are more equitable, accessible, and inclusive. Watch the UDL at a glance video by CAST to learn more about the design of quality learning for all.

You may be thinking, "I don't have the time, resources, or ability to differentiate learning for all 30 (or 150) students." That's where technology, including digital tools and apps, come into play!

Using technology, you can offer multiple ways to learn. For example, you could setup QR codes that students can scan based on how they want to learn about a topic (e.g., view a virtual tour, listen to a podcast, or read an e-book). You can create opportunities for student choice and support flexible learning pathways (explore the Teaching with Digital Tools & Apps chapter for more information about playlists, hyperdocs, menus, and choice boards).

However, **many digital tools and apps are not designed with accessibility in mind**, and introducing a new digital tool in your classroom that is not accessible can be a barrier to learning. So, before you start redesigning your lessons to feature a variety of digital tools and apps, it is important to learn how to evaluate these technologies for accessibility.

Evaluating Digital Tools and Apps

The easiest way to start with your evaluation is to look for an **accessibility statement** or Voluntary Product Accessibility Template (VPAT) for the digital tool or app. For example, Flipgrid's accessibility page states it features closed captions, integration with Immersive Reader (a tool that makes reading more accessible), and text with video. Additionally, Flipgrid can be navigated by keyboard, voiceover, and screen reader technology. Another good example is Kahoot's Inclusion and Accessibility Policy. However, it is important to note, even when there is an accessibility statement or VPAT, these are often self-reported by the company and can be limited by the knowledge of accessibility of the person(s) creating it.

Unfortunately, many tools and apps do not provide accessibility information. Even worse, many tools and apps have not been designed with accessibility in mind. This leaves it up to you, the educator, to evaluate whether a tool is accessible. While evaluating an app for accessibility can be time consuming, it is critical to ensuring students have accessible and equitable learning experiences. And, the more you practice assessing accessibility, the easier it will become.

The POUR Model

One popular model for evaluating accessibility is **[POUR (Perceivable, Operable, Understandable, and Robust)](#)** (National Center on Accessible Educational Materials, n.d.). Keeping this acronym in mind can help you remember what to look for when evaluating digital tools and apps.

Watch the [POURing Over Your Website: An Introduction to Digital Accessibility](#) video below and read on to learn more about each of the four components of the POUR model.

[Watch on YouTube](#)

Perceivable

The first letter in the POUR model, "P," stands for perceivable. When evaluating a digital tool, you should examine whether **all students can interpret and access all information** provided by the tool.

For example, most PDFs are not designed with accessibility in mind, leaving students who use [screen readers](#) (i.e., an assistive technology device that conveys on-screen information through speech) unable to access information from a

PDF. Similarly, many design-based digital tools, such as 3D modeling tools and infographic creators, do not interface with screen readers, making them inaccessible to students who are visually impaired. When color is used to differentiate text or signal key information, individuals who are colorblind may struggle to know where to focus their attention or find information. These are all things that can negatively impact the perceivability of a digital tool.

Closed Captions in Every Language

If a digital tool or app has embedded videos or audio files, or if it has a video-based help center (e.g., YouTube channel), take a close look at the closed captions. Are they 100% accurate in English? Are they available and accurate in other languages as well?

Image by [PublicDomainPictures](#) from Pixabay

Keep in mind your non-English and non-native-English speaking students when evaluating the perceivability of digital tools and apps. If you have a class with one or more students whose native language is not English, see if the digital tool or app has media with closed captions that can be translated into other languages.

Remember, [video captions benefit everyone:](#) "Captions are particularly beneficial for persons watching videos in their non-native language, for children and adults learning to read, and for persons who are D/deaf or hard of hearing" (Gernsbacher, 2015, p. 195).

Bonus Tip: Look for tools that support real-time auto-translation of information, like [PowerPoint, which offers real-time translation](#) of what a presenter says in more than 60 different languages. Learn more about multilingual support of digital tools and apps in the [Evaluating the User Experience chapter](#).

*This callout box was written by Joanne Patalano.

Perceivability Activity

Take a look at the [Perceivability examples from the University of Iowa website](#).

Then, examine at least one the following three tools for their perceivability:

- [Tiki Toki](#) (a timeline creation tool)
- [Piktochart](#)
- [Scratch](#)

Reflect: What did you notice? Did you look for an accessibility statement or VPAT? Is information presented in multiple ways (e.g., text and visuals)? Would students face any barriers to using these tools?

Operable

Watch the "[Hungry Fish: Common Accessibility Issues](#)" for an example of an inaccessible app that does not interface with VoiceOver and learn more from the blog post "[How to Check for App Accessibility](#)."

Disabled students may need to use assistive technology, such as screen readers, voice control, head pointers, specialized keyboards, or mouth sticks, to use and navigate a tool. Unfortunately, some tools are not designed to be accessible by everyone, including individuals who use assistive technology.

For example, many digital tools, online resources, flash-based games, and websites require precise mouse movements, which prevents visually impaired users from navigating the tool with a keyboard or voice control. This also prevents users with loss of motor functioning skills from operating the tool with their assistive technology (e.g., mouth stick, head pointer). Some tools are designed with small-sized buttons or input features that cannot be enlarged, which makes it hard for a user with dexterity issues or a mouth stick to interact with the tool. These are all things that can negatively impact the operability of a digital tool.

Watch the "[Hungry Fish: Common Accessibility Issues](#)" for an example of an inaccesible app for VoiceOver below and learn more from the blog post "[How to Check for App Accessibility](#)."

[Watch on YouTube](#)

Operability Activity

Step 1: Select a digital tool from the [Online Tools for Teaching and Learning website](#) and complete the **[No Mouse Challenge](#)**.

Step 2: Use the tool with a **screen reader enabled** on your device and pay close attention to what information from the screen is read aloud to you ([Voiceover on Apple](#); [TalkBack on Android](#); [Narrator on Windows](#)).

Step 3: Try to operate the tool using only **voice control** ([Voice Control on Apple](#); [Voice Access on Android](#); [Windows Speech Recognition](#)).

Reflect: Was the tool operable? Would all students be able to easily navigate and use the tool?

Understandable

The third letter in the POUR model, "U", stands for understandable. Understandable tools **present information and navigation features in a way that is easy to comprehend and remember**.

For example, text-based information should be presented in a clear and concise manner. Technical and academic jargon should be limited. Complex language or terms should be scaffolded (e.g., providing links or pop-up boxes to definitions of hard-to-understand words and/or providing the information in multiple formats, including text, illustrations, graphics, videos, and/or audio).

The design of the tool plays an important role in understandability as well. Tools and apps should not provide too much information at once (causing cognitive overload) or feature advertisements or extraneous materials that can distract

the learner. Additionally, the tool navigation should be consistent, simple, and easy to follow and remember. **Well-designed, understandable tools allow the user to focus their attention on learning** rather than navigating or remembering how to navigate the tool.

> ### **Understandability** Activity
>
> Explore one of the following tools with a focus on whether it would be understandable for all learners:
>
> - [Worldometer](#)
> - [Scratch](#)
> - [History Pin](#)
>
> **Reflect:** Was the information provided easy to understand? Was complex language scaffolded? Were directions or instructions provided in a clear, concise, and simple manner? Was the tool well designed? Were you able to navigate the tool with ease? Could you quickly figure out how to use the tool? Were you able to locate where you were within a tool and navigate to other features or pages with ease?

Robust

The final letter in the POUR model, "R," stands for robust. Robust tools are **compatible with all technologies**. Robust tools can be accessed and used on any device and browser, new or old. They allow for integration with assistive technologies, such as screen readers, voice control, and specialized keyboards.

Unfortunately, many tools are not robust. For example, you might find the perfect app for your students only to discover it works solely on iPads, and your students have Chromebooks. Or, you may come across an excellent Flash-based math game, but it cannot be accessed on iPhones or iPads without paying for a Flash-based browser like Puffin. Or, you might find a captivating geography app, but it isn't compatible with your students' older tablets.

There are a number of tools and apps that do not integrate with screen readers, voice control, older devices, or certain browsers. Evaluating how robust a tool or app is before asking students to use it can prevent the frustration that comes along when some, or all, students realize they can't access it.

> ### Robust Activity
>
> Select an app from [Common Sense Media](#).
>
> Try out and evaluate whether the app can be used on multiple devices and browsers. Examine whether the app integrates with assistive technology.
>
> **Reflect:** What did you learn? Were you able to find a robust app? Why do you think most digital tools and apps are not robust?

Evaluating Technology for Learners With Disabilities

According to the [United Nations Convention on the Rights of Persons With Disabilities and Optional Protocol](#) (2006), "Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which

in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others" (p. 4).

While some disabilities may be visible to people (e.g., using a wheelchair), other disabilities may not (e.g., hearing loss or dyslexia). Some disabilities might be short-term, rather than long-term. There are many ways to categorize different types of disabilities. For this chapter, we will focus on the following four broad categories: physical, sensory, communication, and cognitive. These types of disabilities can influence whether a student is able to access and use digital tools and apps for learning.

Physical Disability

A physical disability is a condition that limits a person's ability to "move about, to use arms and legs effectively, to swallow food, and to breathe unaided" (as cited in ScienceDirect, 2020). There are various types of injuries and health issues that can cause physical disabilities, such as cerebral palsy, arthritis, traumatic brain injuries, or even a broken arm from playing a sport. For students with impairments in body function or mobility, it can be challenging to use digital tools and apps that require motor input.

When evaluating the accessibility of a digital tool or app for students with physical disabilities, determine whether it:

- Can be used if an individual has dexterity issues.
- Can be controlled by means other than touch, such as voice, head movement, or mouth stick.
- Is easy to operate (e.g., provides large menu buttons and text input fields).

Sensory Disability

Sensory disability is an impairment that affects one of the senses, including sight, smell, hearing, taste, and touch. Since information is traditionally presented through visual and auditory means in classroom settings, this can provide additional barriers to those with sensory disabilities, especially those who are blind, deaf, deaf/blind, or have vision or hearing loss.

When evaluating the accessibility of a digital tool or app for students with sensory disabilities, determine whether it:

- Provides information in multiple formats (e.g., text, images, and audio).
- Provides information that is perceivable (e.g., a website with infographics that are described with alt text or a video with accurate closed captions).
- Allows the learner to make changes to the audio (e.g., turning off background music or increasing the volume) or visual presentation (e.g., adjust text size, margins, background, text colors).
- Is easy to operate with the support of assistive technology, such as a screen reader and voice control.

Communication Disability

A communication disability affects how an individual interacts with others due to an impairment in their language functioning. This may be due to a cognitive disability (e.g., Autism Spectrum Disorder) or it may not be due to a cognitive disability (e.g., stroke survivor). Students with communication disabilities may struggle to speak, read, and/or comprehend verbal information. When evaluating the accessibility of a digital tool or app for students with communication disabilities, determine whether it:

- Provides information in multiple formats (e.g., text, interactive images, virtual manipulatives, audio).
- Provides information that is understandable (e.g., uses simple language rather than academic or technical jargon; allows the user to lookup words or provides words with visual definitions).
- Enables communication through the user's body language (gestures, eye gaze, vocalizations, sign language, facial expression).
- Allows the use of pictures, symbols, letters, and/or words and phrases to create messages or respond to prompts.
- Can be easily navigated and used by individuals who have speech difficulties.

Cognitive Disability

A cognitive disability, or intellectual disability, is an impairment in mental functioning. According to [WebAIM](#) (2018), "A person with a cognitive disability has greater difficulty with one or more types of mental tasks than the average person" (para. 1). Individuals with cognitive disabilities may struggle with memory, attention, reading, problem solving, linguistic and verbal comprehension, math comprehension, or visual comprehension. Students with cognitive disabilities may struggle with learning, especially when information is presented in a single format (e.g., lecturing only).

When evaluating the accessibility of a digital tool or app for students with cognitive disabilities, determine whether it:

- Is easy to understand (e.g., navigation is logically ordered; information is clear, concise, and simple).
- Provides immediate feedback and guidance (e.g., if a form is not completely filled out, the tool signals to the user what they have to do to complete the form).
- Is well designed (e.g., does not feature distracting ads or information; uses a simple interface with lots of white space).
- For content-based apps, such as math games, provides supplementary resources, activities, and information that give students additional support for developing their knowledge and skills.

[TEDx Talk: Creating an Accessible Digital Future](#)

[Watch on YouTube](#)

Assistive Technology

Assistive technology (AT) "is any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities" ([Assistive Technology Industry](#)

Association, 2020, para. 3).

Throughout this chapter, we have mentioned multiple types of AT, including screen readers, voice control, mouth sticks, specialized keyboards, and pointing devices. If you decide to incorporate a digital tool or app that is not fully accessible into your practice, it can be helpful to know about AT devices that might allow students with disabilities to engage with the tool or app.

In the following section, we will detail a few free AT tools and extensions. Of course, there are many more AT devices available. Talking with the specialists in your school or district who work with students with disabilities is a great way to learn about AT and identify ways to reduce barriers to learning for your students.

Microsoft Immersive Reader

Microsoft Immersive Reader a digital tool that supports reading comprehension. You can copy and paste text directly into the free online version of the tool or use it in most Microsoft platforms (e.g., Word, Outlook, Edge, OneNote).

Microsoft Immersive Reader allows users to have text read aloud at different speeds. It gives users control over line spacing, font, text size, and focus. It can showcase the parts of speech and syllables. And, it features a picture dictionary and translation tool. Microsoft Immersive Reader can aid students who struggle with reading, students with cognitive disabilities, and students who are visually impaired (by reading the text aloud).
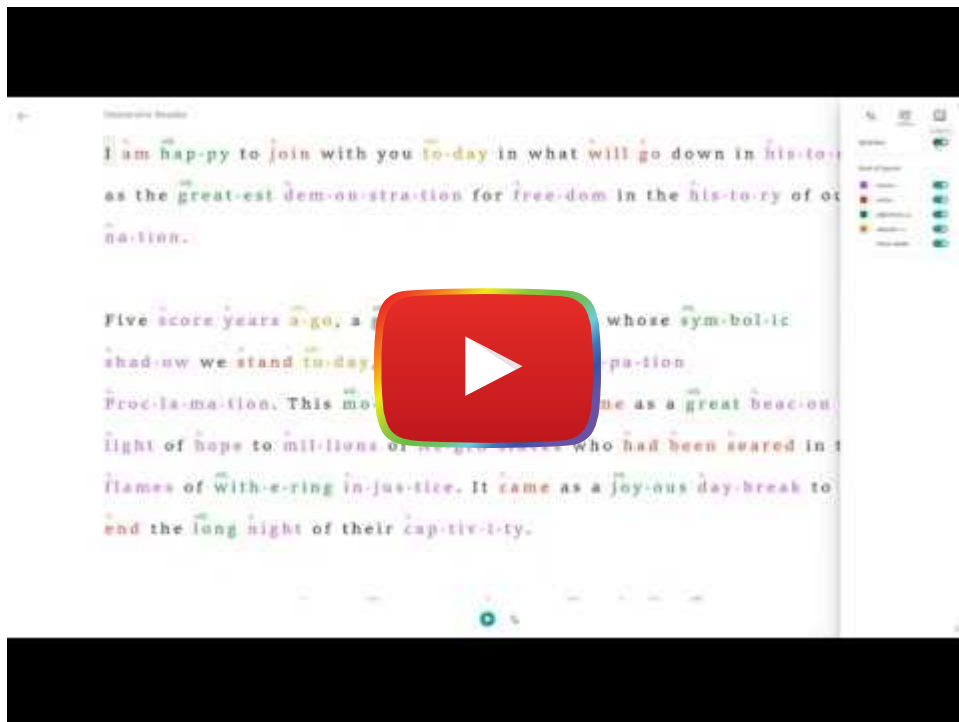
Watch on YouTube

Camera Mouse

Camera Mouse is a free downloadable software that allows the user to control the mouse pointer using the camera on their computer by moving their head. This tool is beneficial for individuals who lack the ability to control their hand movements but can control the movement of their head. According to the Camera Mouse website, "People with Cerebral Palsy, Spinal Muscular Atrophy, ALS, Multiple Sclerosis, Traumatic Brain Injury, various neurological disorders use this program and its predecessors to run all types of computer software" (para. 1).
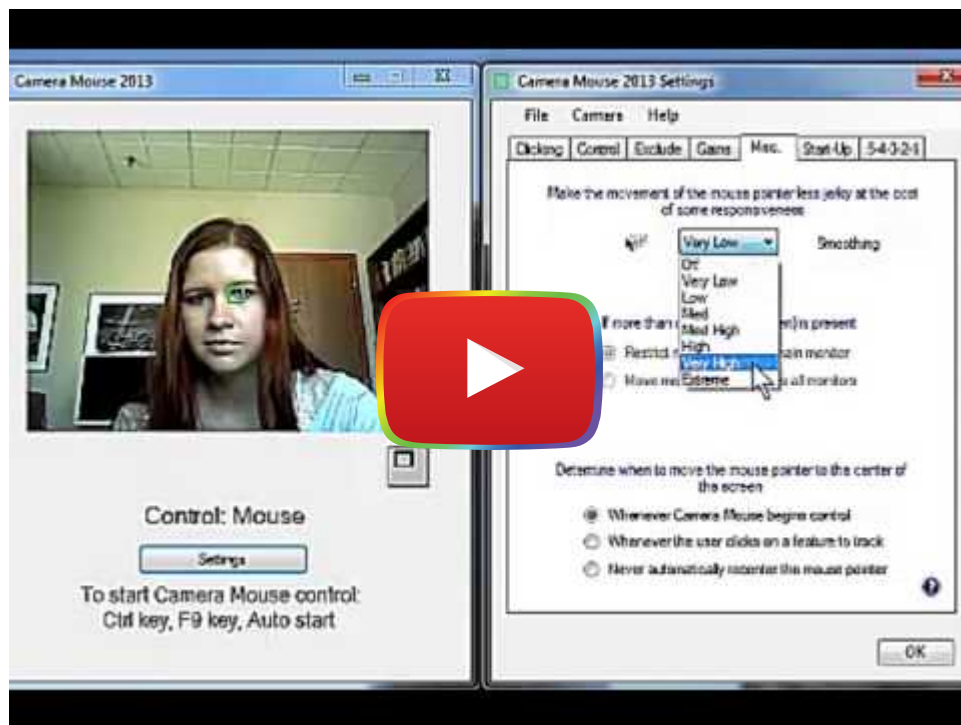
Voice Control

Voice Control is an accessibility tool built into Mac and iOS devices. This tool allows an individual to perform multiple tasks through their voice. They can simply speak out the activity they wish to complete, such as "open the Adobe Spark app," or "open photos," or "scroll up" (check out a list of Voice Control commands from Tech Talk America). Voice Control also allows users to dictate what they want to write within an app. This tool can be helpful for students who have a sensory or physical disability.

Note: There are similar tools for other operating systems, including Voice Access on Android and Windows Speech Recognition.

Conclusion

According to the [World Health Organization](#) (2020), disability is a "complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives. Overcoming the difficulties faced by people with disabilities requires interventions to remove environmental and social barriers" (para. 2). In education, we must identify ways to **remove barriers** and **provide support** to ensure all students can succeed.

Let's go back to the scenario at the beginning—the one where you found a perfect educational video for your students, but, upon showcasing it in class, you discovered it was not accessible. Take a moment to reflect and consider, **what might you do differently now** that you have read this chapter to prevent that from happening again?

Hopefully, this chapter has inspired you to keep accessibility in mind when finding and selecting digital tools and apps for teaching and learning. In this chapter, we discussed how to use UDL principles to create accessible, equitable, and inclusive learning experiences and environments. We introduced you to the POUR model as a guide for evaluating all digital tools and apps before using them in your classroom. We also provided an overview of broad categories of disabilities and offered tips for how to evaluate digital tools and apps based on those disabilities.

The more you practice evaluating digital tools and apps, the easier it will become. While it may take time upfront to do the evaluation, it will save you the frustration of bringing a digital tool or app into the classroom that becomes a barrier to learning. Finally, take some time to learn about the assistive technology tools you might use to create a more inclusive learning experience for your students. The more time you spend focusing on accessibility and inclusive learning, the better the learning experience will be for your students.

Additional Resources

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Teaching With Digital Tools & Apps

Michelle Barrett, Chrystal Zajchowski, & Fred Zinn

> ## Hypothes.is Social Annotation
>
> This chapter is annotated every year as part of an undergraduate/graduate class on Teaching and Learning with Technology. To turn off the highlighted text, click on the "eye" icon in the top right corner of the browser screen.

Introduction

As educators, our goal is to teach students, not just by transferring knowledge to them, but by creating meaningful learning experiences that support their knowledge and skill development. Digital tools and apps can help create these meaningful learning experiences. However, far too often, technology is used as a "$1,000 pencil" where it acts as a substitute to traditional teaching tools like pencils, paper, chalkboards, and whiteboards (November, 2013). In this chapter, we will discuss effective ways to evaluate, select, and teach with digital tools and apps. For a brief overview of key concepts from this chapter, watch the Teaching with Digital Tools and Apps video embedded below.
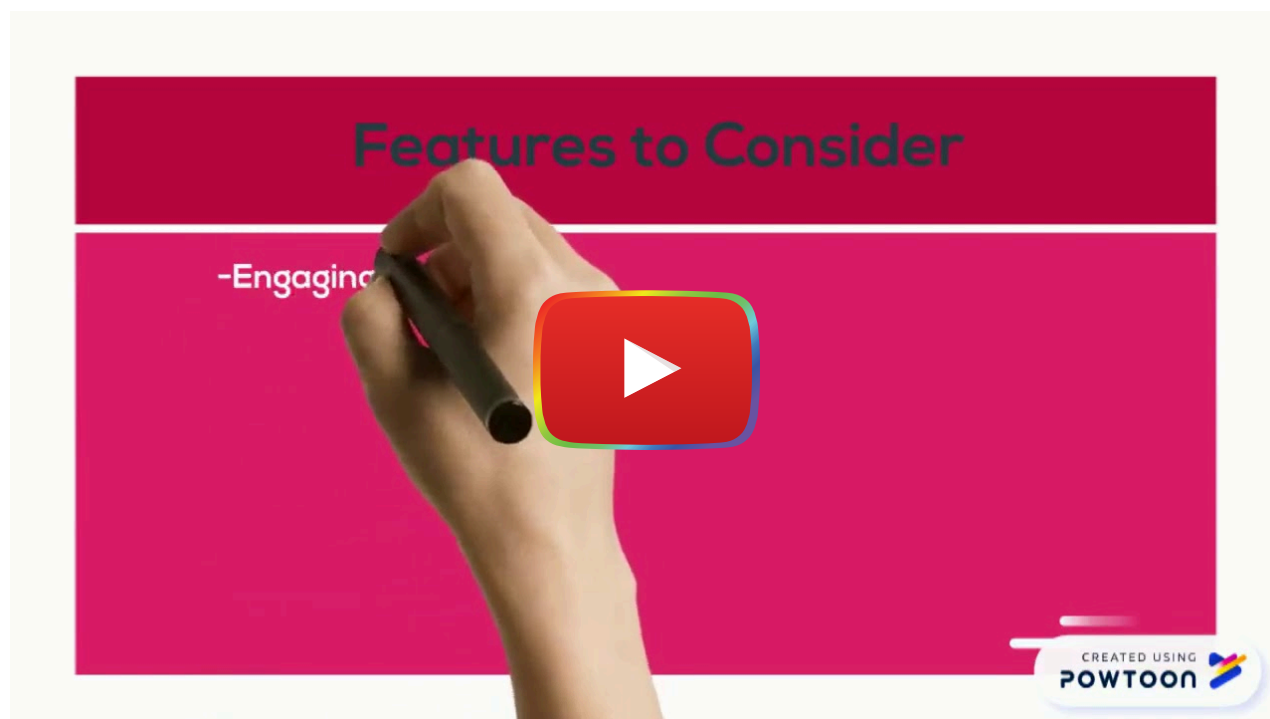
Transforming Teaching with Technology

When you are looking for a new technological tool to improve teaching and learning in your classroom, it is easy to get swept away by the bells, whistles, and promises of something shiny and new. It is important to keep your instructional goals and sound pedagogical principles front and center as you evaluate tools.

First and foremost, **do you need technology at all?** Some of the brightest and shiniest (and most expensive) educational tools merely replicate the same learning experience as a typical chalk and board classroom. **To really make a difference**, **the new tool needs to go beyond**, offering improved efficiencies, enhanced communication, increased engagement, and/or the opportunity to do something that would not even be possible without the new tool (think virtual reality tours). In the following section we will present three technology integration models that you can use to evaluate and inform how you teach with digital tools and apps: the SAMR Model, the PICRAT Matrix, and the TPACK Model.

SAMR Model

Take a moment to reflect on your teaching...Are you just substituting technology for another tool by having students type a paper rather than writing one by hand, giving students a digital handout rather than a printed handout, or asking students to create a presentation slide rather than a poster on paper? Or, are you using technology to empower your students to learn in ways that would not be possible without it?

The [SAMR model](#) can be used as a guide for evaluating and selecting digital tools and apps that will create meaningful teaching and learning experiences. Dr. Ruben Puentedura (2015) [developed the SAMR model](#) to present educators with a framework for evaluating and improving their use of technology in their practice. Although the SAMR model is not founded in educational research, the simplicity of the model has made it a popular professional development tool for teacher educators, technology coaches, administrators, and professional development specialists.

SAMR stands for **S**ubstitution, **A**ugmentation, **M**odification, and **R**edefinition and describes four means of technology integration. Watch the [What is the SAMR Model and what does it look like in schools?](#) video embedded below to learn

more about each of the four parts of the model.
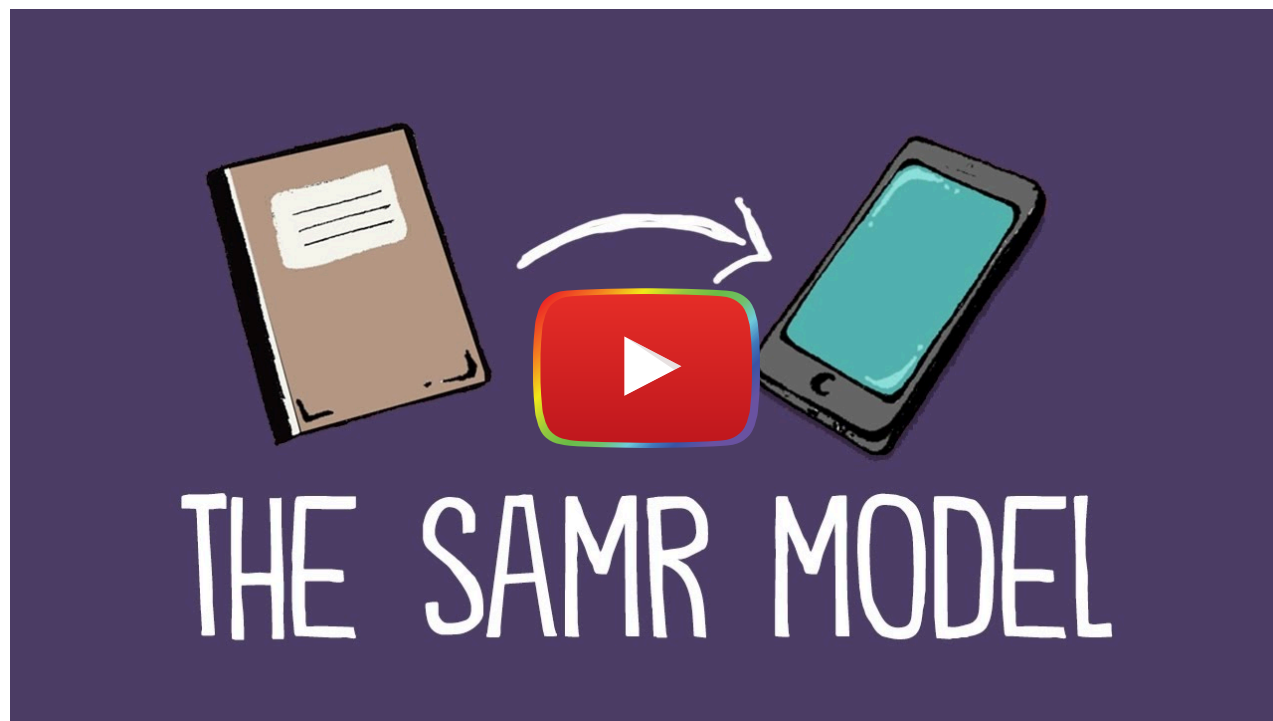
Each part of the SAMR model is valuable in different contexts. For example, a simple *substitution* can be useful in the classroom as long as there is value in making the switch, such as asking students to design 3D artifacts (e.g., molecules, historical items, solar system) with a digital 3D modeling tool, like [Tinkercad](#), rather than with arts and crafts. In this case, the substitution of a hands-on project for a digital tool offers students a new way to create and gives them 3D modeling skills that will be valuable in many future careers. The key consideration here is not to expend time and money on a new tool that does not provide an added value over the technique it replaces.

PICRAT Matrix

While the SAMR model is often used to encourage a linear progression of technology use from substitution to redefinition, the [PICRAT matrix](#), developed by Royce Kimmons, adds an additional layer of consideration: "What is the student's relationship to the technology?"

The PICRAT matrix (see Figure 1) is a grid that displays the intersection between teacher use of technology (**replace, amplify, transform**; cf. Hughes, Thomas, & Scharber, 2006) and student use of technology (**passive, interactive, creative**). According to Kimmons, "many of the most exciting and valuable uses of technology for teaching rest firmly in the top-most and right-most sections of this grid. For this reason, teachers need to be encouraged to evolve their practice to continually move from the bottom-left (PR) to the top-right (CT) of the grid" (para. 13).
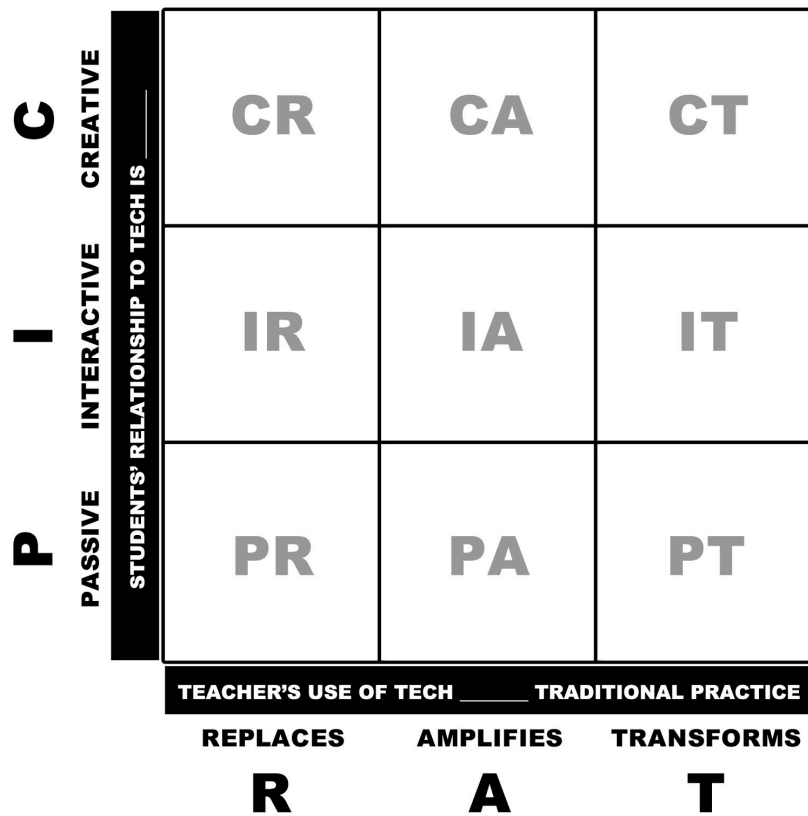
Figure 1. [PICRAT Matrix](#) by Dr. Royce Kimmons is licensed under [CC BY 3.0](#)

Consider the last time you used a digital tool or app for teaching...Where did it fall on this grid?

How might you shift your use of the tool to the top right corner of the grid? Or, is there another digital tool or app that you could use instead to provide students with transformative, creative learning experiences?

Keeping these questions in mind can help you evaluate and identify digital tools and apps that will effectively impact teaching and learning.

Learn more about the PICRAT model by exploring Kimmons, Graham, and West's article: [The PICRAT Model for Technology Integration in Teacher Preparation](#) or watching the [PICRAT for Effective Technology Integration in Teaching video](#) embedded below.

TPACK Model

The [technological pedagogical and content knowledge](#) framework (TPACK; Mishra & Koehler, 2012) provides a lens for examining the relationship among three core knowledge domains for educators: pedagogy, content, and technology.

The framework displays intersections among these three domains to represent **new types of knowledge** required of educators:

- Technological content knowledge,
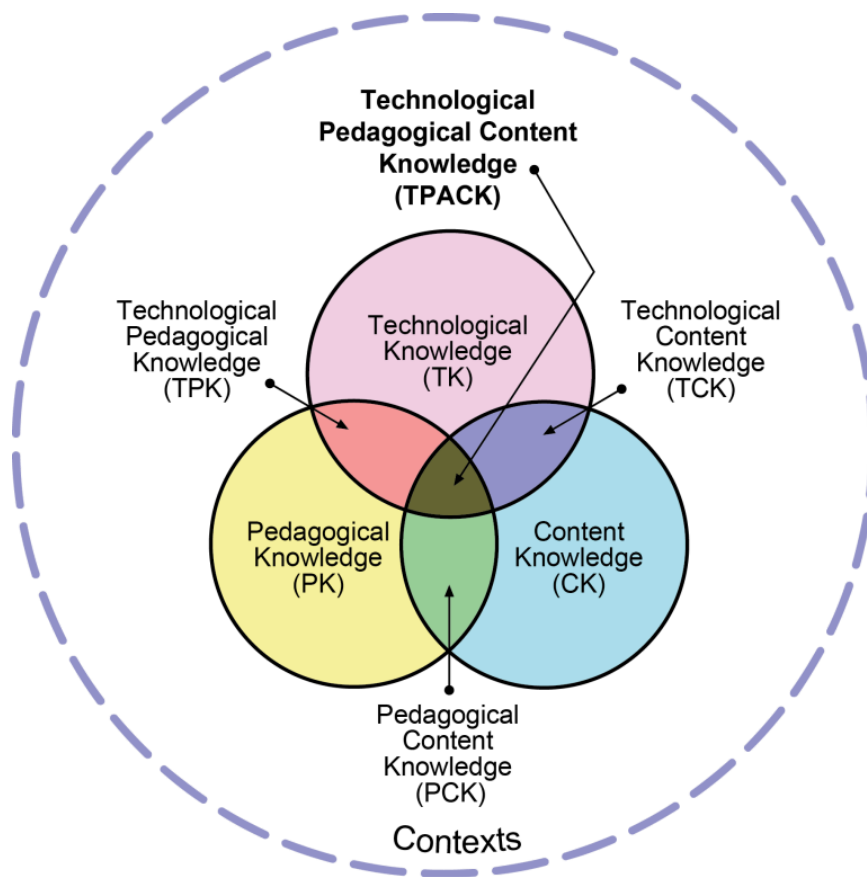- Technological pedagogical knowledge, and
- Technological pedagogical content knowledge.

Figure 2. TPACK Model. Reproduced by permission of the publisher, © 2012 by tpack.org

The TPACK framework emphasizes the importance of using your pedagogical expertise and content knowledge to evaluate and select digital tools and apps that will be the most appropriate for student learning. For example, you would not teach multiplication facts the same way you would teach geographic literacy. The same goes for using technology when teaching. Certain tools and apps are more suited for specific pedagogical approaches and subjects than others, like how having students use Canva to make a brochure about a particular country to develop their geographic knowledge is a more effective use of the tool than asking students to use Canva to memorize multiplication facts.

Learn more about this model by watching the following YouTube video "What is the TPACK Model? or exploring the website TPACK Explained.

[Watch on YouTube](#)

Using the TPACK Framework to Evaluate Content-Based Digital Tools & Apps

The TPACK Framework is particularly helpful for evaluating digital tools and apps that provide *content information* to students, such as digital tutorials and animations, virtual tours and games, interactive simulations, wikis, blogs, interactive videos, podcasts, data repositories, and virtual manipulatives.

When evaluating these types of tools and apps, you need to examine how information is presented (pedagogical features), what information is presented (content knowledge), and how the tool or app is designed to influence pedagogy and content knowledge (technology).

Pedagogy

How does the tool or app teach the material to students? We recommend trying every digital tool and app on your own first to experience it the way a student would. Then, use the following questions to evaluate the pedagogical features:

- How is the **information presented** to learners? Is the content provided in multiple formats (e.g., text, audio, video, manipulatives)? Is the information chunked and organized to facilitate learning ([Trust, 2013](#))?
- What type of **learning experience** does the tool provide? (Hint: Review the [Evaluating the Learning Experience chapter](#)).
- Does the tool provide **feedback**? If there is not some form of feedback, then how will students know whether they are understanding the topic and how to improve their actions?
- What is the **instructional quality of the feedback**? Good feedback needs to be "goal referenced, tangible and transparent, actionable, user friendly, timely, ongoing and consistent, focused, proactive, and descriptive" ([Create effective feedback with education technology, 2019](#), para. 14).
- Does the tool provide **goals and outcomes** to guide learners' progress? "A well-designed technology tool—whether it's a website, video, app, simulation, or tutorial—should display the learning goal so that students know what they need to master to achieve the goal" ([Trust, 2013](#), para. 4).
- Is the tool **developmentally appropriate** for your students? (see [Few preschool apps are developmentally appropriate, report finds](#))
- Does the tool allow students to **control the pace** of the material and **draw connections to their prior knowledge?** ([Moreno & Mayer, 2007](#)).

Content Knowledge

As you explore the app from the perspective of the learner, it is important to assess the information that is presented to determine whether it will effectively support, facilitate, and enrich students' content knowledge. Use the following questions to guide your evaluation:

- What **information** is presented to learners?
- What **type(s) of knowledge** might students acquire or develop when engaging with the tool (i.e., factual, conceptual, procedural, metacognitive - review the [Evaluating the Learning Experience chapter](#) for more information)?
- Is the information provided **accurate, trustworthy, and credible**? Are sources cited within the tool?
- Does the tool feature **up-to-date information**?
- Is text-based information **well-written** and free of errors?
- Does the tool connect content to **real world examples**? Students need to know how to apply what they learn to their daily lives.
- Can the content be **modified or remixed**? Some tools, like [NewsELA](#) allow you to modify how, and what, information is presented to support learners' understanding of the material.
- Does the tool provide links to **additional resources or materials** for further development of content knowledge?

Technology

In the previous chapters of this book, you learned how to examine the [user experience](#) and [accessibility](#) of digital tools and apps to evaluate how the technology impacts the learning experience. In addition to user experience and accessibility, you should critically examine the features and design of digital tools and apps to understand how and why they are **created to influence pedagogy and content knowledge**.

While there are thousands of digital tools and apps listed as "educational tools," not all of these are designed wholeheartedly to support educators' practices. Some tools are designed to replace teachers, like artificial intelligence teaching and grading tools. Other tools steal student work or data and sell it to make a profit (see the [Evaluating the Cost, Privacy, and Data chapter](#)). And, there are tools that use algorithms to make important decisions that can negatively influence teachers' jobs or students' academic success.

Unfortunately, "people have a tendency to treat technology and data as neutral, sterile and immune to mortal failings. Yet the digital tools we use at schools, jobs and home don't simply fall from the sky—humans produce them. And that means human biases can and do slip right into the algorithms that have increasing power over our lives" (Koenig, 2019, para. 1).

When educators fail to engage in critical digital pedagogy, "we end up with tools — like ProctorU and Turnitin — that not only try to anticipate (or invent) the needs of teachers, but ultimately do damage by working directly at odds with our pedagogies" ([Morris & Stommel, 2017](#), para. 11). Watch the video "[The Lies Edtech Companies Tell Us](#)" to learn more.

[Watch on YouTube](#)

In the article, "[A Guide for Resisting EdTech: The Case Against Turnitin](#)," Morris and Stommel provided some suggested questions and prompts to consider when evaluating technologies as teaching tools:

- What do the tool developers say the tool does? **What does it actually do**?
- **Why was the tool designed**? To replace good teachers? To make money from students?
- Does the tool rely on **artificial intelligence** (AI) to provide feedback or grade work? If so, who designed the AI program? What biases might be built into the program?
- Does the tool **negatively impact, or harm, a certain group of students** (e.g., students who do not speak "proper" English, students who are creative thinkers, students who do not have sufficient access to technology at home)?
- Does the tool **make money from students' work**?
- Does the tool **collect and record student data** without their permission (consider the use of AI tools like Amazon Echo or Siri in classrooms that are constantly recording everything that is said)?

Articles and Resources Worth Exploring

- [The extremely weird story of a remote-learning company that's making parents livid](#)
- [Remote testing monitored by AI is failing the students forced to undergo it](#)
- [The New Jim Code? Race and Discriminatory Design](#)
- [Surveillant #EdTech Harms Nursing Students, the Profession, and the Public](#)
- [Alternatives to Surveillant Pedagogies and Technologies in Online Education for Clinical Professions: A Resource Guide](#)
- [Tech companies promised schools an easy way to detect cheaters during the pandemic. Students responded by demanding schools stop policing them like criminals in the first place.](#)

Taking a look under the hood of digital tools and apps is a critical step to ensuring that you select tools that are designed to benefit you and your students, rather than take advantage of, or *benefit from*, you and your students (Morris & Stommel, 2017). Additionally, looking at the intersection among technology, pedagogy, and content (i.e., technological pedagogical content knowledge) when evaluating digital tools and apps will help you uncover the purpose and impact of tools on teaching and learning and determine which tools are the most appropriate, effective, and supportive for learners.

If you are concerned that there is a lot to keep in mind when evaluating digital tools and apps, it can be helpful to create a **checklist, or spreadsheet of criteria**, that you find to be the most important when assessing technologies. To get started, make a copy of the Evaluating Digital Tools & Apps Google Sheet. Then, add or revise the criteria to create an evaluation tool customized for you.

Designing Instruction with Technology

"Don't let technology get in the way of good teaching and learning" (Steve Wheeler, 2014, para. 9).

Now that you have explored different models and features to consider when evaluating and selecting digital tools and apps for teaching, let's discuss how you can design effective instruction with technology. According to Kurt (2017), "The instructional design process consists of determining the needs of the learners, defining the end goals and objectives of instruction, designing and planning assessment tasks, and designing teaching and learning activities to ensure the quality of instruction" (para. 3).

Instructional design models can be helpful in deciding what technology to use and how to use it to facilitate high quality student learning experiences. In this section, we will discuss three instructional design models that can guide your use of technology for teaching and learning: backward design, universal design for learning (UDL), and Bloom's taxonomy.

Backward Design

Have you ever discovered a new digital tool on social media, or from a conversation with a colleague or friend, and thought, "I'm going to use that in class tomorrow," and then designed a lesson entirely around the digital tool only to discover, after doing the exit tickets for the day, students learned more about the tool than the content? This can happen to the best of us.

A good way to avoid getting distracted by "new technology sparkles" when coming across new tools is to consider the end product that fulfills your instructional objective—a technique commonly referred to as "Backward Design" or "Understanding By Design" (Wiggins & McTighe, 1998).

Backward design (or backward planning/mapping) is about **designing with the end in mind**. Where do you want students to end up after a lesson? What knowledge and skills do they need to showcase? What are the desired results of the lesson?

By focusing on the end result, you can work backward from there to determine what content students need to learn, how to best support their learning through activities and assessments, and how they will show whether they have achieved the desired results. This instructional design process **puts the focus on learning**, especially higher order thinking, rather than on technology use or delivering instruction. Instead of starting with a digital tool or app and figuring out how to fit it into your practice, the backward design model will help you identify when and where to use technology to ensure students meet the end goals.

For example, imagine you are planning a 3D shapes lesson for your second or third graders and you want to incorporate some sort of digital tool and app. Using the backward design model, you would first decide what you want your students to know at the end of the lesson (e.g., recognize 3D shapes in the environment) and then find a digital tool or app to help achieve the goal(s). After exploring some shapes in the environment together as a class, you plan to let the students use iPads to take their own pictures of shapes in the environment that you will then showcase on the screen at

the end of the lesson. The photos will then serve as an assessment of their understanding and achievement of the desired results.

To help you get started using the backward design model, consider what you expect to see your students produce as a result of the lesson that will demonstrate they learned what you needed them to learn. Write this down, and then, as you review a possible tool, compare its capabilities and affordances to your desired outcome (see Table 1).

Table 1

Evaluating Digital Tools and Apps Using Backward Design

I want students to be able to	
This tool helps people	
Will this tool make this possible?	Yes	No
Will this tool make this easy?	Yes	No

Sometimes, the newest, most expensive tools can look promising and then not quite match the exact thing you need your students to do. Other times, tools can end up adding a level of complexity to a task that causes students to spend more time struggling with the tool than learning what you really want them to learn. **Keeping your instructional objectives in mind** will make it easier to spot tools that will work best for you.

Universal Design for Learning

If you have a goal in mind but are not sure what kind of tool could help achieve it, tables 2-4 offer examples of general instructional goals matched with the types of tools that can help achieve these goals. These categories are based on the principles of universal design for learning (UDL).

To create authentic, meaningful, and accessible learning experiences for all students, it is a good idea to apply UDL principles as early as possible when designing instructional experiences and choosing tools. Universal design for learning has three defining principles (CAST, 2018):

1. **Multiple means of engagement:** Motivating students to engage in the learning process ("why do I need to know this?").
2. **Multiple means of representation:** Delivering content to students so it is perceivable and comprehensible ("what do I need to know").
3. **Multiple means of action and expression:** Enabling students to express what they have learned so this can be assessed ("how can I show what I know").

Learn more about the UDL guidelines by exploring this UDL overview document or watching the following video:

Engaging and Motivating Students (UDL Focus on the "Why")

These tools help get students excited about, and engaged more fully in, doing the work needed to meet the instructional goal. The "Why" in UDL often focuses on capturing students' own experience or interest in a topic and connecting it with practical "real-world" issues and applications.

Table 2

Tools for Engaging and Motivating Students

Goal Statement	Appropriate Types of Tools
I want students to show me what they already know and what interests them about this topic before we start learning about it.	Survey tools, audience response tools (clickers), meme generators, online voting, emojis/bitmojis, virtual KWL charts (Google Drawings, Padlet)
I want students to reflect on their individual needs and strengths so they can personalize how they will learn this topic.	Interactive surveys, profile slides, trading card generators, mind maps, virtual checklists
I want my students to work collaboratively with peers, and possibly outside "experts," to learn this topic.	Collaborative software, social media, project management tools, group text and voice messaging apps
I want my students to connect this topic to "real world" issues that matter to them.	Online news sources, Internet searches, personal learning networks

Deliver Content to Students (UDL Focus on the "What")

These tools help provide students with multiple, diverse ways of learning the concepts and knowledge needed to complete a lesson. The "What" of UDL encourages teachers to include more than one way for students to access what they need to know, often by offering multiple modes of delivery, such as audio, video, and images, alongside the more typical text.

Table 3

Tools for Delivering Content to Students

Goal Statement	Appropriate Types of Tools
I want students to see examples or listen to experts who I cannot bring into the classroom.	Streaming video, audio podcasts, animated explanations, video conferencing
I want students to explore the content in ways that respond to their actions and interests.	Interactive media, digital books, simulations, models, games, augmented and virtual reality, virtual manipulatives
I want students to start with a question and do research to find and assess possible answers.	Online references, data repositories, image collections, media literacy games or tutorials, social media
I want to provide students with a variety of ways to understand and experience this content.	Image search, 3D printing and modeling, online tutorials, video collections, blogs, audio podcasts, personal learning networks, accessibility tools, open educational resource repositories

Enable Students to Demonstrate Learning (UDL Focus on the "How")

These tools enable students to demonstrate what they have learned in a variety of ways. The "How" of UDL is based on encouraging students to express what they have learned by making artifacts that better match individual skills and learning preferences, meaning students can express themselves in a comfortable (or interesting) medium and thus focus on learning the new material.

Table 4

Tools for Showcasing Student Understanding

Goal Statement	Appropriate Types of Tools
I want students to respond to questions about the material and get immediate feedback.	Quiz software, online tutorials, games and puzzles, flashcard tools, interactive slides, virtual breakouts, survey forms, choose-your-own-adventure tools
I want students to create something that summarizes what they have learned.	Presentation software, meme generator, audio and video recorder, infographic generator, graphic design tool, mind map tool, 3D modeling software, virtual tour builder, comic creator, interactive timeline generator, whiteboard presentation tool, web or blog design tool, sketchnote app, screen recording software

I want students to share their own work and receive comments from classmates.	Learning management systems, online discussion forums, social media, collaborative tools, virtual bulletin boards
I want students to demonstrate they can apply what they have learned to new situations.	Simulations, online roleplay, games, project management software, presentation software, 3D modeling software, graphic and media design tools
I want students to publish and communicate their ideas to a wider audience.	Presentation software, social media, blogs, website builders, digital book design tools, multimedia production tools

Using the UDL Principles to Support Diverse Learners with Technology

One of the greatest benefits of educational technology is that you can tailor instruction to meet the diverse needs, goals, and interests of students. Today's classrooms are made up of a diverse group of learners. These students differ in terms of interests, skills and knowledge, cultural and socioeconomic backgrounds, and life experiences, to name a few. The UDL framework is an instructional design approach you can use to create learning experiences that facilitate and encourage diverse learning experiences.

Designing instruction with UDL in mind, you can use technology to:

- Increase access to learning,
- Give students choice over what and how they learn, and
- Create student-centered learning experiences.

Using Technology to Increase Access to Learning. Technology can open doors to learning and provide new ways for students to access information and show their knowledge. For example, a student who is strong in math but challenged by reading might struggle with word problems due to their reading skills (and not their math knowledge). Digital tools, like speech-to-text apps or multimodal ebooks that present information in text and video or audio formats, can eliminate the barrier of reading word problems and allow the student to excel in math.

Using Technology to Provide Students With Choices. Giving students choices in their learning is beneficial because it leads to higher levels of motivation and engagement, accounts for different needs and interests, and provides students with a sense of autonomy. Keeping UDL principles in mind, here are two ways you might use technology to give students choice:

1. **Let students choose how they want to access new information.** Instead of insisting all students learn from a textbook, give them the opportunity to watch a video or listen to a podcast related to the subject matter(s).
2. **Let students choose how to present their work.** Instead of only giving writing options or standardized quizzes and tests, provide them with the option to post a video to a forum like Flipgrid or create a slideshow, video, Powtoon, online brochure, or infographic.

Using Technology to Create Student-Centered Learning Experiences. You can create student-centered learning experiences by incorporating hyperdocs, choice boards (see Figure 4), menus, or playlists into your instruction.

Interdisciplinary STEAM Activities at Home

Designed by Torrey Trust, Ph.D.

	Science	Technology	Engineering	Arts	Math
English/ Language Arts	Take a **haiku hike** or write a **#sciku** (science haiku)	Create an **animated story** with Stop Motion Studio or Stikbot	**Invent** something (kids as inventors) and write a proposal about why this invention should be funded	Design a **Graphic Novel** or Picture Book	Write a **math comic**
World Languages	Research and **design a video** about how climate change impacts a country/region where the language is spoken	Explore a **virtual tour** of a city where the language is predominantly spoken	**Design an artifact** to represent the culture of the language (see 3D printed Alebrijes and more examples)	Create a **multimodal book** about a topic of interest written in a foreign language	Create an **interactive map** showcasing where the language is spoken (with stats about each country)
Math	Explore climate change over time through graphs	Design an **infographic** that features statistics	Create a **3D digital model** on TinkerCad	Create a funny **math meme**	Invent a **math game** (board game, quiz game, virtual game…)
Science	Participate in a **Citizen Science** project	**Juxtapose** two images that show environmental change over time	Design multiple **paper airplane prototypes** and test which features influence the flight path and length	**Make a video** featuring one of the Periodic Table of Comic Books characters	**Compare and Contrast** city data from How Much is Hotter is Your Hometown Than When You Were Born
Social Studies/ History	**Examine human impact** on the environment over time through Google Earth Timelapse	Create a **virtual tour** of a UNESCO World Heritage Site	Create a **historical timeline** of African American Inventors	Design an **editorial cartoon**	**Curate a collection of resources** about a famous women mathematician (e.g., Ada Lovelace, Women Mathematicians at NASA)

Figure 4. Example of a choice board for students

These digital student-centered learning tools/approaches allow students to take responsibility for what and how they learn. Learn more at these sites:

- Choice Boards, Menus, & Tic-Tac-Toe
- How HyperDocs Can Transform Your Practice
- Using Playlists to Differentiate Instruction

In summary, when designing instruction, you can use the UDL framework to identify tools to meet and support the diverse needs of all students. Keeping the UDL framework in mind will help you design instruction that goes far beyond the "$1,000 pencil." For more information about UDL check out Universal Design for Learning: Teacher Planning for Technology Integration, the UDL Guidelines, and a short Powtoon video we made about Universal Design for Learning.

Bloom's Taxonomy

Have you ever had your class create something (e.g., project, video, poster) and found that students remembered the information from those design projects far more than what they remembered about the text you read in class?

The revised version of Bloom's taxonomy's features the action of "creating" as the top tier of the cognitive processes as it requires the mastery of all the other tiers (Armstrong, 2019). Remembering is at the base of the six cognitive processes. Students need to approach a subject or topic from the lowest level (i.e. remembering) and master the foundational knowledge before they can move on to higher levels of thinking and advanced knowledge acquisition. This means that when you design a lesson or activity at the top of Bloom's taxonomy, students must work their way from the bottom up. That is, they must learn how to remember, explain, and apply information before they can analyze, critique, and create knowledge.

Bloom's taxonomy is a hierarchical ordering of cognitive skills. Its revised edition (2001) consists of six categories: Remember, Understand, Apply, Analyze, Evaluate, and Create (see Figure 5). According to Armstrong (2019), "These

'action words' describe the cognitive processes by which thinkers encounter and work with knowledge" (para. 9).
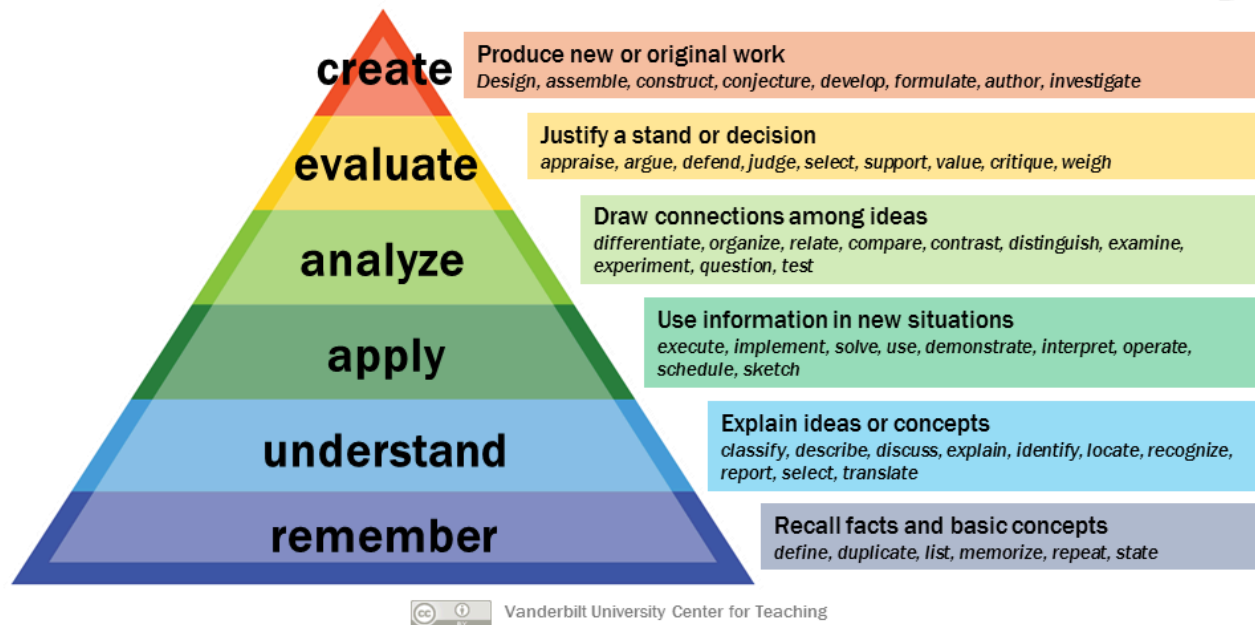

Figure 5. "Bloom's taxonomy" by Vanderbilt University Center for Teaching licensed under CC BY 2.0

Bloom's taxonomy can serve as an instructional design tool to help you select the most appropriate apps and tools based on the level and depth of cognitive knowledge students need to acquire. Take a few moments to explore Kathy Shrock's Bloomin' Apps page, which features interactive tables of apps and tools for each tier of Bloom's taxonomy, or The Padagogy Wheel V5 (see Figure 6).

As you design instruction, consider how you might start with the higher order thinking skills (analyze, evaluate, create) to encourage students to build their knowledge through active hands-on, minds-on learning experiences (visit the Evaluating the Learning Experience chapter to learn more about Bloom's Taxonomy and higher order thinking skills).
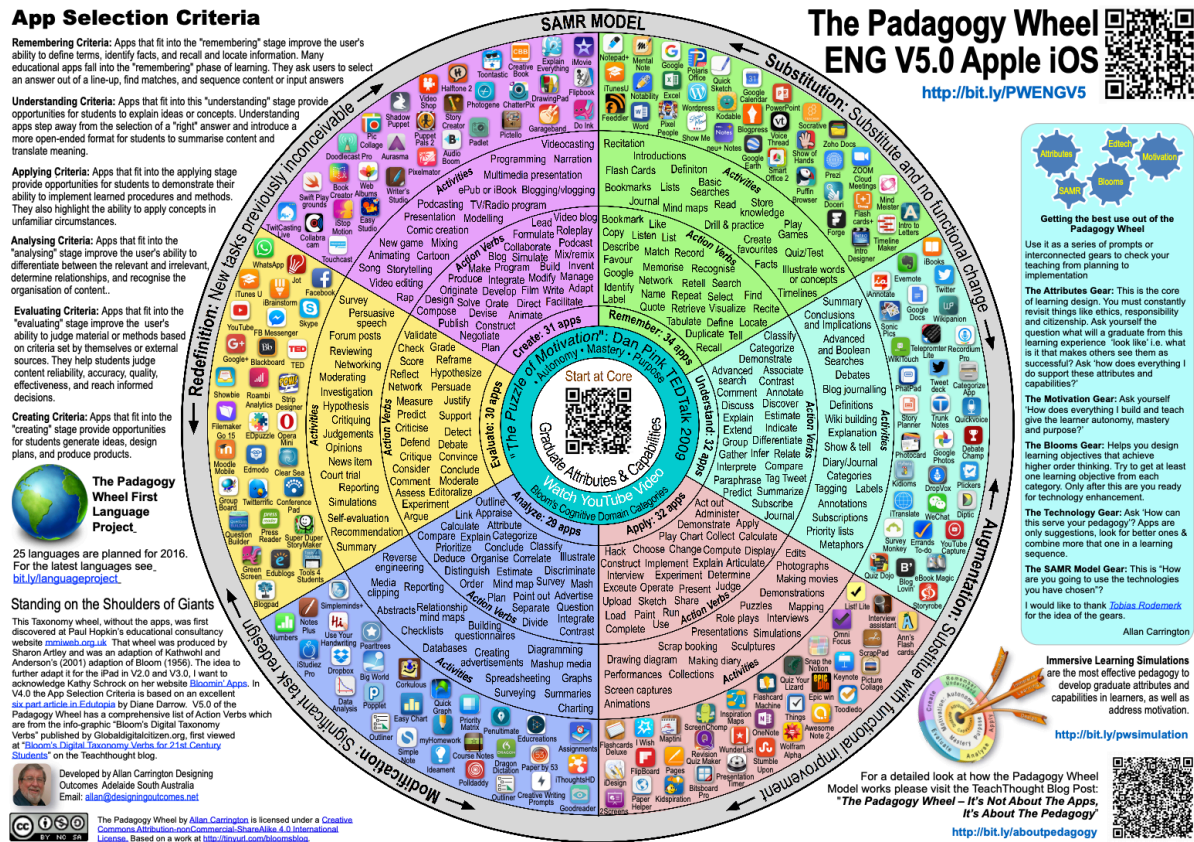
Figure 6. "The Padagogy Wheel V5" by Allan Carrington is licensed under CC BY NC SA 4.0

For more information on Bloom's taxonomy, explore Vanderbilt University Center for Teaching's guide to Bloom's Taxonomy, Iowa State University Center for Excellence in Learning and Teaching's Revised Bloom Taxonomy page, and Christine Persaud's (2018) Bloom's Taxonomy: The Ultimate Guide.

Digital Literacy and Safety

Now that you have explored ways to find, evaluate, and teach with digital tools and apps to enrich and transform student learning, you're all set! Well, almost…

When teaching with technology, you might assume that students actually know how to use digital tools and apps for their learning. While most kids and teens today are growing up using various technologies at home, they tend to use these tools for entertainment, social media, and messaging others. Unfortunately, **many students are not taught how to use technology in a safe, ethical, and legal manner to support their learning**. This can lead to a number of problems, including using technology in harmful ways that have a negative impact on their own and others' lives.

As educators, we must role model and teach digital literacy and safety when using digital tools in our classrooms. If you are not sure where to get started with teaching students how to use technology, check out the **DQ Global Standards Report 2019: Common Framework for Digital Literacy, Skills and Readiness**. This report features the Digital Intelligence (DQ) Framework, which is "a comprehensive set of technical, cognitive, meta-cognitive, and socio-emotional competencies grounded in universal moral values that enable individuals to face the challenges of digital life and adapt to its demands" (p. 12). The framework includes eight standards (see Figure 7) that can empower and encourage students to use technology to positively impact their learning and their lives: digital identity, use, safety, security, emotional intelligence, communication, literacy, and rights (DQ Institute, 2019).

Figure 7. Digital intelligence framework. Created using Visme™

When using digital tools and apps for teaching, you should aim to provide students with the opportunity to develop one or more of these global DQ standards. For example, you could have students develop a digital portfolio of their school work or engage in social media conversations with experts to create a positive digital identity. Or, you could ask students to collect and analyze numerical data about their technology use to develop a healthy, balanced technology diet.

By incorporating digital literacy and safety practices into student learning experiences, you will support their long term learning, growth, and success in an ever-changing technological landscape.

Conclusion

Ultimately, when teaching with digital tools and apps, you need to spend some time deciding which tools to use and how to use those tools to create innovative, authentic, student-centered learning experiences. In this chapter, we discussed three technology integration frameworks (SAMR, PIC-RAT, and TPACK) to guide your evaluation and selection of digital tools and apps. We hope that these frameworks will empower you to use technology to create transformative learning experiences. We also showcased how to use the TPACK model to evaluate content-based digital tools and apps. By critically evaluating the pedagogical features, content knowledge, and technology together, you can make an informed decision about which tools will positively benefit your teaching and student learning.

We discussed how to use instructional design models to guide your selection of digital tools and apps based on the desired results of the lesson and cognitive processes you want your students to develop. We also reviewed how to use these models to increase access to learning, create student-centered learning experiences, and provide students with choice over what and how they learn.

Lastly, we emphasized the importance of incorporating digital literacy and safety standards into teaching and learning to prepare students for success as learners, citizens, and professionals. The DQ framework can serve as a guide for identifying the technical, cognitive, and social-emotional competencies students need when using technology.

We hope this chapter will help you to feel more empowered and encouraged to evaluate, and teach with, digital tools and apps.

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