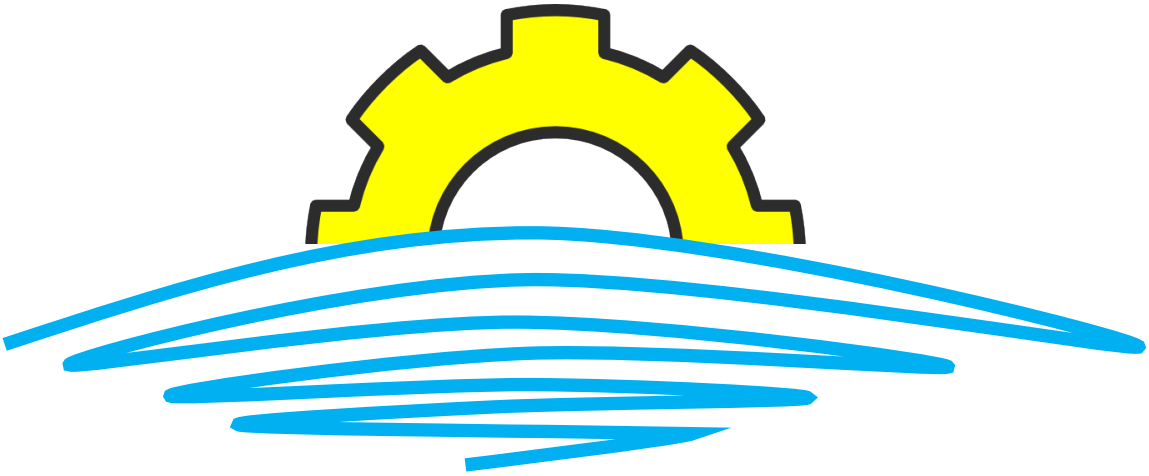
Technology Within Secondary Education

2018 Horizon Report



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Executive Summary

The high school students of today, also referred to as "Generation Z", are different than any generation of students before them. An article from *Entrepreneur* (2016) claims that over 1/3 of Gen Zers admit to spending an average of 6-10 hours per day on their mobile devices, and according to the Pew Research Center (2018), 94% of young people today (aged 18-29, the youngest polled age group) own a smartphone. With a penchant for data consumption, online collaboration, social media, and instant gratification in the dynamic Digital Age, these students bring a unique blend of creative innovation, adaptability, and resourcefulness to contemporary classrooms.

Eager to keep up with the latest technological trends, many educators and administrators encourage the implementation of new technologies and the digitization of the classroom, but have encountered problems stemming from distractedness and overstimulation of students, tech training for faculty, and generational divides between students and teachers. This leads to the question: What are the best practices for technology use in the classroom, and how much technology is too much?

This report will seek to identify key trends driving the adoption of technology in secondary schools, significant challenges impeding that adoption, and some important educational technologies to monitor in the coming years, using research and data to justify the findings.

Key Topics

1) **Mobile technology use is at an all-time high, especially among young people.**
2) **Social media drives the majority of communication between young people.**
3) **Younger generations prefer synchronous forms of online communication.**
4) **Will MOOCs and other forms of online learning improve in secondary education?**
5) **Gamifying learning (or "edutainment") has shown to be effective for students in younger generations.**
6) **Digital preservation will become an increasingly problematic issue on a personal and institutional level in academia.**
7) **The dynamism of the Digital Age has put the role of the student and educator in flux.**
8) **Learning environments can be structured—physically and digitally—to be effective and efficient for students.**
9) **Many teachers are concerned with maintaining student motivation in the face of distraction and overstimulation.**
10) **Teachers and faculty must be better trained to implement technology into their curriculum.**

Technology Within Secondary Education
2018 Horizon Report at a Glance

Key Trends Accelerating Technology Adoption

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Mid Term	3-5 years
Online Academic Portfolios	Media Production Programs

Long Term	5-7 years
Augmented Reality	Artificial Intelligence

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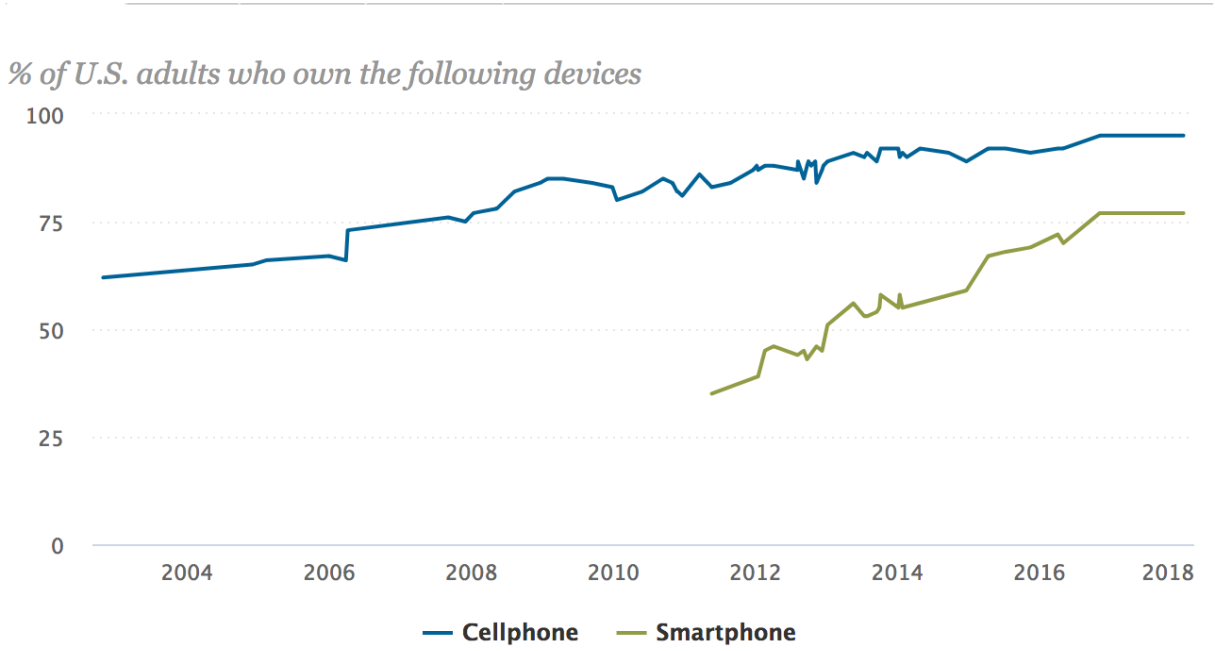
Key Trends Accelerating the Adoption of Technology in Secondary Education

Short Term

❖ Mobile Technology

- Smartphones, tablets, and other mobile devices have become ubiquitous in modern society, especially among younger generations, and current high school students have spent most of their lives under the influence of these mobile internet technologies. Nearly every student has a mobile device of some kind, and most spend as many hours using those devices as sleeping each day. The versatility of these devices is unquestionable, but students often have problems balancing and regulating their use.



Source: Surveys conducted 2002-2018.

PEW RESEARCH CENTER

- According to the Pew Research Center (seen above), smartphone ownership in the U.S. has skyrocketed in recent years, and the percentage of adults who own a smartphone has doubled since 2012. These numbers

skew more heavily toward younger generations, as shown by the accompanying dataset:

% of U.S. adults who own the following devices

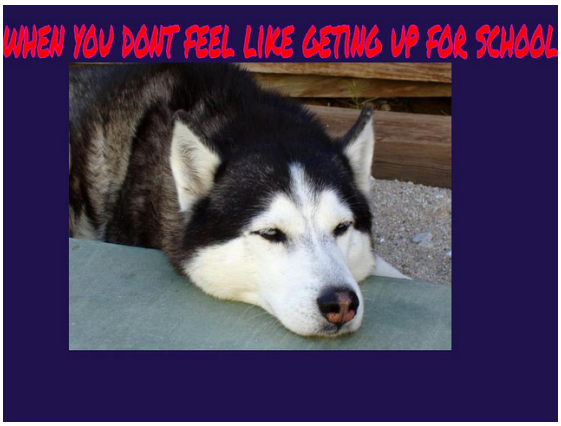
	Any cellphone	Smartphone	Cellphone, but not smartphone
Total	95%	77%	17%
Men	95%	80%	16%
Women	94%	75%	19%
Ages 18-29	100%	94%	6%
30-49	98%	89%	9%
50-64	94%	73%	21%
65+	85%	46%	40%

- To help round out these statistics, a 2017 study by Global Web Index revealed that 98% of Gen Z (aged 16-20) own a smartphone in the U.S.
- Clearly, mobile technology (particularly the smartphone) is the preferred mode of communication and entertainment within Generation Z. However, since many young people now conduct much of their social lives on these versatile technologies, in addition to playing games, watching movies, listening to music, etc., it can be very difficult to incorporate classroom work into their daily use. Combining work and play on the same device is possible, but can be tricky, and educators should be mindful of this when deciding which technologies to implement in their classroom, and how.

❖ Social Media

- Teens are using social media for about 3 hours per day (Granados, 2017)
- Social media has become an online public sphere that Gen Z utilizes to find news, build relationships, share information in fun and creative ways, and even to explore their own identities.

- **Uses and Gratifications Theory**
  - In 1972, Denis McQuail and his colleagues organized the needs and gratifications of the audience into four categories (West & Turner, 2014, p. 406):
    - Diversion
    - Personal relationships
    - Personal identity
    - Surveillance
      - **Social media satisfies all four of these needs simultaneously on the same platform**
  - Sundar and Limparos recently identified four "technological affordances that should theoretically give rise to particular gratifications" (Perloff, 2015, p. 549):
    - Modality
    - Agency
    - Interactivity
    - Navigability
- Plenty of time can be wasted on social media, but if harnessed correctly in the classroom, it could be used as a tool to present and deliver material in new and engaging ways, such as creating a mock Facebook profile for an important literary character, or retelling a historical event in the form of a SnapChat story or Instagram post(s). Combining simple media production with social sharing can turn most classroom curriculum into a fun and creative experience for students.
- As Daniel Stapp, an English teacher at Forest Grove High School in Forest Grove, Oregon, explained, "Communication is just a different thing. Emojis and memes…I've been made into a dozen different memes, with or without my permission, and that's not going to stop. But these are modes of communication— they're not just jokes—that have implications to them, it's not clear communication, you have to interpret it. Like text messages, the interpretations are different between the sender and receiver. Communication as a whole is changing, and emojis are like modern hieroglyphics in their own way."
  - Teachers should embrace these changes in communication and encourage students to reflect on new modes of interaction.



❖ Digital Literacy & Presence

- The world is changing, and quickly. The Digital Age has drastically altered the way in which people communicate, the way in which they learn, and has even changed the broader concept of knowledge.

  - In the past, one would be considered knowledgeable for having facts and information memorized; that internalized knowledge was a marketable skill. As the internet has become more ubiquitous, and facts have become more easily accessible, this notion has changed. With this overload of information at our fingertips, it's now important to be able to navigate the web to find accurate facts from credible sources, to separate quality from quantity, and to be resourceful in searching for relevant information.
  - Educators should focus on teaching their students how to effectively navigate the web in search of accurate information, rather than how to memorize trivial names, dates, formulas or factoids to regurgitate on a test.
- Furthermore, educators are responsible for teaching students how to be responsible internet users. A positive digital presence is increasingly important for future job prospects and overall social standing, which can be easily overlooked by young students. A student's ability to present themselves in a positive light, to participate in cordial online discourse, and to avoid suspicious or malicious online behavior is a very marketable skill, and should be a focus of classroom conversation.

❖ Online Coursework, Learning Management Systems (LMS) and Massive Open Online Courses (MOOCs)

- Traditional online courses are generally for class credit, cost money (especially in higher education), and are often associated with a learning management system (or LMS) such as Blackboard, Canvas, Moodle, etc.
- MOOCs appeared in 2006 and were popularized in 2012, primarily by higher education institutions. There has been less enthusiasm for online coursework and MOOCs lately, because of mixed opinions (and results) by students and faculty who use them.

- MOOCs aim to increase participation in online learning environments by increasing access and interactivity.
- Traditional online courses are more of a passive experience for students, where they read materials, watch videos, and participate in tutorials. MOOCs try to make the experience more active, with a focus on self-guided learning and collaboration with peers

- Secondary education has a unique opportunity to use MOOCs on a smaller scale, possibly collaborating with other similar high schools in nearby areas, to make the experience more personalized for students while still maintaining the benefits mentioned above
- There was a 2014 study conducted on MOOCs in secondary education by researchers in Barcelona, Spain
  - The more students enrolled, the higher the volume of interaction produced (Filva, Guerrero & Forment, 2014, p. 401)
  - High dropout rate for students with low performance scores (Filva, Guerrero & Forment, 2014, p. 401)
- By collaborating with similar institutions, secondary schools could use MOOCs to encourage their students to become a part of a larger academic community
  - The challenge will be keeping students engaged with the materials, even in the face of academic adversity. Possible solutions may include reward-based lessons and assessment and/or continuous feedback on the site

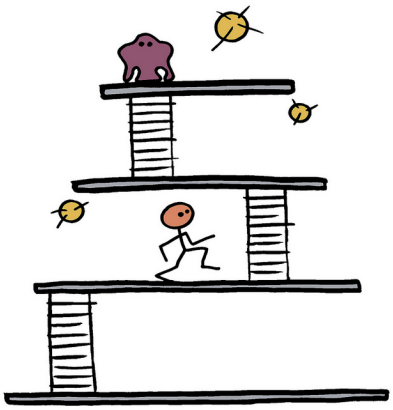
Mid Term

❖ Synchronous vs. Asynchronous Communication

- **Synchronous online communication** occurs when both (or all) parties are online simultaneously. Examples would be internet telephony (Skype, FaceTime, Zoom, etc.) and many instant messaging platforms.
- **Asynchronous online communication** doesn't require parties to be connected simultaneously, such as emails, blog posts, and voicemails.

- Studies have shown that younger generations prefer ***synchronous forms of media*** when communicating, and this factor is actually what distinguishes the generations, rather than general internet usage (Taipale, 2015, p. 90).
- **Modality Switching**
  - "Collaborative partnerships developed via text-based computer-mediated communication (CMC) commonly shift interactions to alternative formats" (Ramirez & Zhang, 2007, p. 90).
  - "Modality switching can have profound positive and negative effects on relational outcomes" (Ramirez & Zhang, 2007, p. 287)
- By focusing on the forms of media used to communicate with students, teachers can more effectively connect with their class

❖ Gamifying Learning, or "Edutainment"



- Current examples include elements of Moodle (the LMS program), Kahoot! (the online classroom trivia quiz game), Quizlet (an online program for studying with flashcards, diagrams, and games), etc.
- Educators have used popular games to teach their classroom lessons, such as using Angry Birds to explain physics, or SimCity to explain system interactions, or MineCraft to demonstrate societal structure and online etiquette (Sheehy, 2011).
- Reward-based gamification would be an effective way of improving student performance in their interaction with the curriculum. This might include the elements of instant gratification, continuous assessment and feedback, and progressive advancement through the material (level ups, unlockables, missions, sagas, etc.)
- Allowing students to create a classroom gaming profile with an avatar would increase socialization and allow for self-reflection and identity forming through that medium.

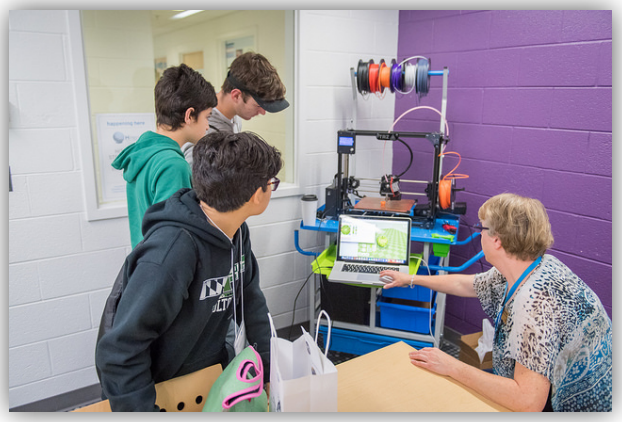
Long Term

❖ Class Structure & Learning Environments

- **Digital vs. Traditional**
  - As the Digital Age continues to produce exciting new technologies with potential classroom utility, teachers and administration must find a balance between online and offline classroom activity: between the novel technologies, old technologies that have proven effective, and traditional modes of teaching (oration, handwritten assignments, etc.) that many teachers from previous generations were raised on and are comfortable delivering.

- According to Daniel Stapp from FGHS, "Technology is a useful tool, but there's this idea that it has inherent value in and of itself, and I don't find that to be the case….The content is what you are teaching, and if [technology] helps you deliver the content in a more meaningful way then it has value, and if it doesn't, then it just increases the time of what you're trying to do."

- **Collaborative vs. Independent Learning**



  - The more that education moves online, the more teachers will need to balance how students learn and interact with the curriculum. Some online education, such as modules and walkthroughs, encourage self-guided, independent learning, while some online features, such as MOOCs, Google Docs, Zoom conferences, and discussion boards encourage collaborative interaction between students.
  - With Gen Z's penchant for synchronous online communication, collaborative learning is trending upward in education. This is expected to lead to a more project-based approach in the classroom, instead of an exam-based approach. One challenge presented by this change in format is a need for alternative methods of assessment and grading for group-based project deliverables.
  - Mike Britland (2013), a writer for *The Guardian*, put it this way: "Making use of technology to allow students the freedom to discover solutions to problems both independently and collaboratively is a force for good. As educators we strive for students to engage with our subject beyond a superficial level. We want them to be active learners, learners who have a thirst for discovery and knowledge."

- **Systemic Educational Change**
  - In the transition to a school system that is more online-based and personalized, important changes may be made to the ways in which we teach and assess students.
  - According to an article on personalized learning by the Association of Wisconsin School Administrators (AWSA), "In recent years, our schools have begun to undergo a massive transformation, not dissimilar to the periods of rapid change the United States

witnessed during the shift toward an apprenticeship system during the Agricultural Age and a movement toward a compulsory, modern education to meet the needs of the Industrial Age. Each of these educational paradigms were designed to meet the ask of their respective society (Smith, Chavez, Seaman 2014)."

❖ The Role of the Educator

- **Teaching Information vs. Facilitating Learning**
  - With a change in the structure of classrooms and learning environments comes a change in the role of teachers and students alike. Educators are abandoning the old "sage on a stage" model of teaching in an effort to become more of a guide in the learning process, as students become more independent and self-sufficient through their use of technology.
  - According to Mike Britland (2013), "We all feel the stresses of getting students through exam courses and allowing them the freedom to wander is sometimes too much for some to allow. However, in my experience allowing the freedom to search and discover the subject through technology has fostered a love for my subject."
  - This transformation will not come easy for many teachers, especially those groomed in a more traditional era of education. A strong network of support will be needed within each institution to ensure that the changing dynamics of this field are smooth and effective.

Significant Challenges Impeding Technology Adoption in Secondary Education

Solvable Challenges

❖ Student Motivation

- Depending on the subject matter, student motivation can range from a solvable challenge to a wicked one, and has been perplexing teachers since the earliest years of education.

Today, in the dynamic Digital Age, this issue can seem even more frustrating, with the omnipresence of screens and tools and gadgets, vying for students' (and teachers') attention and disrupting their focus. According to Adam Karp, a math teacher at Forest Grove High School in Forest Grove, Oregon, "Every generation of kids has more cool stuff than the generation before. In the 80s, I had great things my parents never had…but it's all relative. I guess the downside is the management of it all."

- There are several ways to help students engage better with classroom materials and remain focused and motivated on the task(s) at hand
  - Continuous, multi-modal feedback
    - Letting students know where they stand and how they're progressing is critical to keeping them motivated, and utilizing multiple modes of communication (online, verbal, written, etc.) will keep them engaged and help them to avoid complacency.
  - Engaging, topical curriculum
    - Keeping information relevant to students' lives and interests is imperative to inspiring motivation. By adjusting classroom material to stay novel and relatable for students, teachers will see increased buy-in and more active engagement in classroom interactions.

❖ Improving Digital Literacy

- For students AND teachers
  - This can be a reciprocal process. Students must learn how to become responsible internet users and effective online communicators, and teachers (especially from older generations) must learn how to effectively use technology to engage their students. Oftentimes, students are more familiar with—or at least better at navigating—new technologies, and can help their teacher get the most out of the many attributes and features of each device or program. Teachers can share their knowledge of online etiquette and digital resourcefulness with students to make them better students and more effective digital citizens.
- Tech Equity, or TECHquity
  - As mentioned in Section 1, about 98% of Generation Z have a smartphone. However, teachers must be aware of the technology and internet access that their students have outside of class before taking too much of the curriculum online, especially in low-income and underprivileged areas.

  - According to Daniel Stapp from FGHS, "We've got a lot of students who are living out of cars or living in migrant facilities and they just don't have the technology access that some of the other students have and it brings so many other disadvantages into play. It's to the point where if I'm asking anybody to do anything with tech at home, I feel like I am putting them at an increased disadvantage…I don't want my information to be more accessible to the people who have more advantages and less accessible to the people who have the least advantages."

Difficult Challenges

❖ Technology Training for Teachers and Faculty

- More and more technology initiatives are being adopted by secondary schools, and teachers often feel underprepared and undertrained when asked to implement these new technological devices and programs in their classroom. Many teachers attribute this to a lack of time for adequate training and development.
- "The level of expectation placed on teachers is ridiculous…I teach five classes of 35 kids who are always writing essays, and the expectation of my school is that I'm using TurnItIn.com. But they gave us training on [TurnItIn] on one of our Grading Days, where we have contracted time to grade…it was 'volunteer training.'" – Daniel Stapp, FGHS

- "If you want to be trained in these new apps or devices or whatever, it's not time that's carved out, it's extra time we're expected to give up." – Daniel Stapp, FGHS

❖ Digital Preservation

- With the perpetual and exponential advancement of technology and software, older files and programs risk becoming obsolete and inaccessible in the coming years. For example, how difficult would it be to retrieve information from a floppy disk today? Some older versions of software can no longer function on newer devices. After a while, many people can't remember passwords of academic LMS accounts to retroactively access old documents, grades, or assignments. So much of our data, information, and personal memories have been outsourced and stored in computers and programs that the loss or expiration of that information could be catastrophic on both a personal and societal level, and could very severely impact the education system, and the digital academic records of each institution.

- One possible solution to this concern would be an increase in cloud-based file storage in schools, and saving documents, files, and records in different formats to ensure their accessibility.
- The advent of online personal academic portfolios could also help with this problem. A centralized, cloud-based personal digital profile to store students' academic work and records across institutions may be on the horizon for the field of education.

Wicked Challenges

❖ Distraction and Overstimulation

- According to an article on Generation Z and devices in the classroom by the Chronicle of Higher Education, studies show that modern students stray off-task more than they think they do and perform slightly worse academically than students who don't use technological devices in class (Gose, 2017).
  - "Even those who use a laptop only for note-taking—with no off-task surfing or texting—perform less well than note-takers who write" (Gose, 2017).

- "Although several studies value the importance of technology in our media-enriched world and the 'learn anytime and anywhere' motto associated with mobile learning, we argue that the classroom dynamics are becoming more and more at risk with the addictive dimension brought about by the ubiquitous presence of digital devices and social media in students' lives" (Pedro, Barbosa & Santos, 2018, p. 287).
- Many teachers fall into an either/or mentality, wanting to fully embrace devices in the classroom or ban them altogether to eliminate the distractions, but students from Generation Z are so attached to their devices that the technology has practically become an aspect of their physiology. An outright ban in the classroom could lead to higher levels of anxiety, rather than increased focus (Gose, 2017).
    - "All too often bans are more about classroom management rather than a pedagogical decision. The world is changing incredibly fast. If we're not preparing students to engage with these tools, we're doing them a disservice" – Jeffery McClurken, history professor, University of Mary Washington (Gose, 2017).

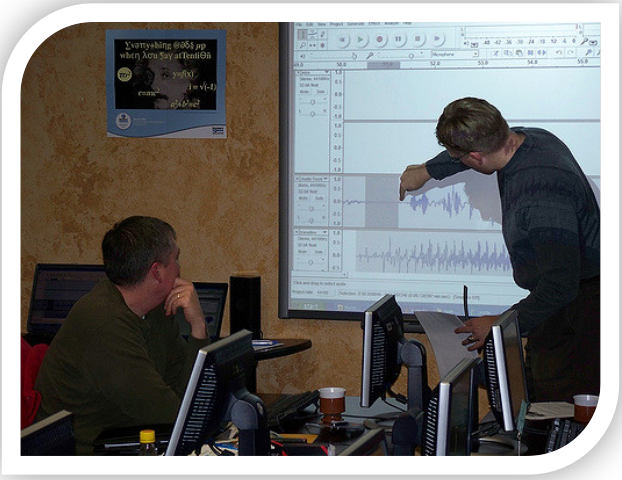
> **"If we're not preparing** students to engage with these tools, then we're doing them a disservice."

- "I think one of the biggest skills people gain from a brick-and-mortar school is interpersonal communication and relationship-building. And I think adding a layer of tech between people to do that sometimes tales away from the power of that connection. And it can add to it too, it just depends on what kind of tech you're using and how you're using it." – Daniel Stapp, FGHS
- This issue of distraction and overstimulation in the classroom will become increasingly complicated as technology continues to evolve and integrate into our daily lives and routines. It's important that teachers discuss with their students the pros and cons of using these devices in class, and come to an agreement on responsible use of devices during class time. This should include a productive balance of focused, unmediated interpersonal interaction and effective media use across different platforms, in order to better understand and navigate the devices and technology that will continue to shape the students' personal, academic and professional lives.

Technologies to Watch

Short Term (1-2 years)

- Smartboards
  - A 2017 study on smartboards cited Blau's (2011) three characteristics that transform a smartboard into an effective pedagogical tool (Davidovitch & Yavich, 2017, p. 61):
    1. "Divergent learning—the ability to skip from pages on the screen to the internet in a structured and fluid manner. This ability simulates the associative organization of the student's brain and contributes to the organization and clarity of the lesson as perceived by the student"
    2. "Smart boards serve as a cognitive tool that expand students' mind and facilitate supported joint thinking. Since some of the mental load is transferred from the students to the board, they are free to engage in higher thinking processes."
    3. "Interactive learning—smart boards enable interactions between study contents and the students themselves, both face-to-face and online."
  - "[Smartboards] are nice because you can physically manipulate the stuff that you write, and in math that comes up kind of often…the other good thing is that you can save the document, and share it and print it or whatever, so if a kid was gone, you have a perfect version of the notes right there. But mostly just for the sake of screen use and student participation, it made it more appealing for kids to come up and do things, write things, and be a part of it. Whereas writing on the [chalk]board is okay, they like this more." -Adam Karp, FGHS



  - Look for smartboards to continue to increase classroom engagement and student participation in the years to come

❖ Classroom Laptops and Tablets

- Many modern classrooms have adopted full sets of Chromebooks, iPads or other mobile technologies to distribute to students for activities and daily classwork. These devices are portable, versatile, and engaging for students, but are also expensive—even in bulk—and can be detrimental to students' attention span. Teachers must consider the variables of cost, compatibility, and usability when deciding when to use these technologies.

  - "Sadly enough, I've found that an individual Chromebook for every student in the room has done more harm than good. Yes, you can go online together to look at a certain thing that's been created or a certain page or a place to see your grades, but the time spent monitoring kids to make sure they're doing exactly what they should be doing on their screens and nothing else can be a lot. In a class of 30 or 40, the chance that everyone is doing what they should be doing, and no one is doing anything else… there's almost no chance that's going to occur. There's always someone that needs to be redirected." - Adam Karp, FGHS
  - In a 2018 article from *The Verge*, Shannon Liao quotes a teacher's response to using iPads in her class: "Once they're used to using the iPad, the excitement of 2D and even manipulative materials pales in comparison, and it's more difficult to engage them in activities that don't include a digital component" (Liao, 2018).
- Unless these mobile devices can become more affordable and conducive to classroom engagement on a larger scale, look for these technologies to phase out of classrooms in the near future.

❖ Online Collaborative Learning Platforms

- Online collaborative learning platforms, such as Google Classroom, Moodle, etc. are becoming increasingly popular among students of Generation Z. These programs offer increased opportunities for synchronous online communication through features such as Google Docs, where students can track edits and changes and trade messages in real time.
- According to a 2012 study regarding Online Collaborative Learning, "students' perceived satisfaction and their performance in online

collaborative learning are important factors to determine whether an e-learning approach can be applied in a sustainable way. Furthermore, the study indicates that learning with peers may benefit not only the overall individual performance, it may also enhance team performance by increasing the quality of team product. Students can learn to formulate ideas and opinions more effectively through group discussion" (Zhu, 2012, p. 134).

- As these platforms continue to grow and evolve, their use and utility will become more important to modern classrooms, and they will allow students to collaborate and communicate in new and exciting ways.

Mid Term (3-5 years)

❖ Online Academic Portfolios

- As mentioned earlier in this report, it will become increasingly important for students' personal academic records to be stored in a centralized online location, so that their information can be accessed across institutions, from secondary schools through higher education, without fear of the records becoming lost, unreadable, or inaccessible.
- With perpetual updates and improvements, older software programs, LMS technology, and other modes of data storage within academia will continue to expire within the next 3-5 years. Look for this technology to emerge within that time frame.

❖ Media Production Programs

- Media production encourages students to think creatively and to express themselves in ways that traditional writing can't offer, "providing options for learning and assessment for a wide array of students with diverse learning abilities" (Leach, 2017, p. 30).
- Media production programs are becoming more common, more affordable (many of them free), and more accessible to people of all skill levels. By implementing media production into classroom curriculum, teachers will give their students a chance to showcase their understanding of materials and apply real-world skills in the creation of their assignments.

- "Research from the fields of education into motivation, engagement, reading comprehension, positive psychology, cognitive psychology, learning analytics, and the role of technology indicate that when the

principles of [Universal Design for Learning] are incorporated into pedagogy and curricula, expanded modalities for learning, such as digital media production, benefit students" (Leach, 2017, p. 38).

Long Term (5-7 years)

❖ Augmented Reality

- Elements of augmented reality and virtual reality have already been introduced to a handful of classrooms within secondary education, but it will take several years before the technology is popularized, refined, cheap enough and accessible enough to become a common aspect of the classroom.

- The potential for this technology and the devices it will introduce is enormous. Complex topics could be more easily explained with 3D models, students could gain understanding through empathy by being (almost literally) placed in the shoes of people from history, and could even cultivate their skills in media production by using 360-degree cameras and other equipment to develop their own AR and VR projects (ThinkMobiles, 2018).
- Many educational apps for this technology already exist for Android and iOS, such as Elements 4D, Anatomy 4D, and AugThat. There are even apps in development for teaching younger children the basics of reading, math, and science.

❖ Artificial Intelligence

- Still years from being implemented in the majority of classrooms in secondary schools, artificial intelligence technology also shows tremendous promise for classroom engagement.
- AI is intuitive, data-based, and often interactive, offering the ability to give students continuous multi-modal feedback, personalized guided instruction, and more to supplement the workload of teachers
- AI technology has the potential to cause massive shifts in the pedagogical process (Wagner, 2018), many of which would tie together other elements of this Horizon Report:
  - From a stand and deliver model of teaching to facilitation/ coaching model
  - From siloed classrooms to virtual social networks
  - From textbooks and set curriculum to blended courses and customized design

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