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NOTES

IMMERSIVE LEARNING: BARRIERS TO (VIRTUALLY) EXPLORING THE GREAT UNKNOWN

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Joshua Mannery[*]

INTRODUCTION

Mr. Huang is a public school third grade social studies teacher.[1] In his units on ocean life and history, he integrates virtual reality into the curriculum to provide an "immersive" alternative experience. Doing so, he believes, motivates and deepens an understanding of the content.[2] Using Google Expeditions, Mr. Huang emphasizes the environmental consequences of coral bleaching by having his students explore coral archipelagos and reefs. While teaching Chinese History, he has the class "visit" different parts of China, including the Forbidden City.[3] His use of virtual environments in his classroom was not without trial-and-error. Personal space and safety were huge concerns for him, and he also had to contend with the limited resources his school could provide. Through patience, reliance on technology teachers, and a strong focus on student self-efficacy, though, he has crafted a classroom unique in its potential to unlock "emotional pieces" to learning.[4] His experiences, in many ways, represent the daring, yet fruitful benefits that result from investing in virtual reality in education.[5] Mr. Huang is one of a small portion of K-12 instructors who have leveraged the still-emerging technology.[6]

Extended reality technology—encompassing virtual reality (VR), augmented reality (AR), and mixed reality (MR) technology—is currently

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[1] Kiley Sobel & Catherine Jhee, *How K-8 Teachers Are Using Virtual and Augmented Reality in Classrooms Today*, CTR. FOR INNOVATIVE RSCH. IN CYBERLEARNING (2020), https://circlcenter.org/how-k-8-teachers-are-using-vr-and-ar-in-classrooms-today/.

[2] *Id.*

[3] *Id.*

[4] *Id.*

[5] Shailaja Neelakantan, *Schools Face Barriers to VR Adoption in the Classroom*, EDTECH MAGAZINE (Dec. 2, 2019), https://edtechmagazine.com/k12/article/2019/12/schools-face-barriers-vr-adoption-classroom.

[6] Benjamin Herold, *Virtual Reality for Learning Raises High Hopes and Serious Concerns*, EDUC. WEEK (Feb. 8, 2018), https://www.edweek.org/technology/virtual-reality-for-learning-raises-high-hopes-and-serious-concerns/2018/02.

a multi-billion-dollar industry continuing to grow in prevalence.[7] By 2020, VR and AR spending was projected to reach up to $18.8 billion.[8] Meanwhile, the extended reality market size in total is predicted to reach up to $125.2 billion by 2026.[9]D Integration of the tech has permeated industries like the medical field, video gaming, and business. It has even made significant strides in education and training.[10] While entities like Facebook, Walmart, and NASA have pioneered creative applications of the tech for educational purposes, one area of the "education and training" group that is not progressing as quickly is K-12 schooling.[11] Because of the distinctive issues that come with primary and secondary education, virtual reality has made slower, more targeted strides over the course of the century. As its usage in K-12 schooling grows, teachers and administrators will have to grapple with unresolved legal questions stemming from the especially vulnerable class of children, including misuse of the technology and data privacy concerns.[12] In a landscape scarce of any substantial law or research, schools interested in integration of the emerging tech into their curriculums should adopt standards that safely retain the opportunity of active learning without endangering those who need the most protection.

Part I of this research will detail the history of extended reality technology across the twentieth and twenty-first century, particularly its commercialization and implementation into the classroom. Part II will address two current concerns regarding integration of virtual reality in school curricula: data privacy and cyberbullying. Part III will describe how data privacy and cyberbullying issues have manifested in an analog to virtual reality: school-issued technology. Part IV will propose a set of standards that, if implemented, could significantly reduce the likelihood of harm to students as schools gradually embrace extended reality technology.

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[7] Bernard Marr, *The Future of Virtual Reality*, FORBES (Dec. 18, 2020), https://www.forbes.com/sites/bernardmarr/2020/12/18/the-future-of-virtual-reality-vr/?sh=77ef9ae727be.
[8] *Virtual Reality: Another World Within Sight*, IBERDROLA, https://www.iberdrola.com/innovation/virtual-reality.
[9] Laia Tremosa, *Beyond AR vs. VR: What is the Difference between AR vs. MR vs. VR vs. XR?*, INTERACTION DESIGN FOUND. (2023), https://www.interaction-design.org/literature/article/beyond-ar-vs-vr-what-is-the-difference-between-ar-vs-mr-vs-vr-vs-xr.
[10] Marr, *supra* note 7.
[11] *Id.*
[12] Herold, *supra* note 6.

I. THE HISTORY AND IMPLEMENTATION OF EXTENDED REALITY IN EDUCATION

Extended reality encompasses virtual, augmented, and mixed reality.[13] VR uses computer-generated imagery to immerse users amongst scenes and objects that appear to be real.[14] Typically, VR technology relies upon a headset or helmet to accomplish this immersion.[15] These devices are opaque and cover the head of users fully; therefore, if the machine is turned off, it leaves participants in a blindfolded state.[16] When on, the outside world is fully replaced with video gaming, simulations, relaxing virtual spaces, or whatever else the machine is designed to accomplish. Augmented reality on the other hand supplements the user's vision rather than replacing it. Whatever the device, be it phone or headset, it is transparent, superposing images over the real world.[17] Devices are optimized for as much motion as possible, blending generated imagery as simple as app widgets or as complex as Pokémon with immediate surroundings.[18] Of note, the projected digital imaging does not interact with the physical world—it lives alongside it.[19] Mixed reality builds upon AR by allowing this interaction between digital and physical components.[20] For example, a digital pet may recognize that a door is shut, and wait for the user to open it before it moves any further. Extended reality is the umbrella term that envelops any technology that alters perceived reality via digital imaging.[21]

While its scientific basis can be traced back to as early as the 1830's, the commercialization of immersive virtual reality began with the advent of Sensorama in 1956.[22] The product was designed by Morton Heilig, a prominent cinematographer. Utilizing multiple technologies at a time to stimulate all five senses, the Sensorama booth allowed a small audience to experience the "cinema of the future." Many short films were

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[13] Marr, *supra* note 7.
[14] *Virtual Reality: Another World Within Sight*, *supra* note 8.
[15] *Id.*
[16] Will Greenwald, *Augmented Reality (AR) vs. Virtual Reality (VR): What's the Difference?*, PCMAG (last updated June 6, 2023), https://www.pcmag.com/news/augmented-reality-ar-vs-virtual-reality-vr-whats-the-difference.
[17] *Id.*
[18] *Id.*
[19] Tremosa, *supra* note 9.
[20] *Id.*
[21] *Id.*
[22] Zahira Merchant et al., *Effectiveness of Virtual Reality-Based Instruction on Students' Learning Outcomes in K-12 and Higher Education: A Meta-Analysis*, 70 COMPUTS. & EDUC. 29 (2014).

developed to take advantage of the innovation.[23] Heilig would also patent the Telesphere Mask, the first recognized head-mounted display.[24] Over the next two decades, virtual reality technologies blossomed across many different industries, from its roots in entertainment to professional education and training.[25] For example, in 1966, the United States Air Force developed a flight simulator designed for training purposes.[26] The Massachusetts Institute of Technology, meanwhile, developed Aspen Movie Map in 1977.[27] The program provided users the opportunity to virtually explore Aspen City in different seasons, serving as a bit of a precursor to Google Street View. While it lacked a head-mounted display, it was the first of its kind to suggest that virtual reality could transport consumers to other locations.[28]

Integration of virtual reality technology into K-12 and higher education took root in the early 1990's with the introduction of projects such as Science Space, Safety World, Global Change, Virtual Gorilla Exhibit, Atom World, and Cell Biology.[29] These were all pre-developed VR applications designed specifically for either practical classroom usage or as vehicles for research.[30] Specifically, the first exhibit use out of the above programs came in 1993, functioning as a supplemental educational tool for learning-disabled students.[31] Over the next couple of years, application of these projects gradually increased over the decade, albeit falling short of resembling large-scale commercialization.[32] Various peripheral devices were employed to craft immersive learning experiences for students, and for schools that could obtain them, virtual reality usage in education yielded positive results.[33] Notwithstanding the beneficial impact of immersive learning, VR encountered many

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[23] Dom Barnard, *History of VR - Timeline of Events and Tech Development*, VIRTUALSPEECH (June 14, 2023), https://virtualspeech.com/blog/history-of-vr.
[24] *Id.*
[25] Merchant et al., *supra* note 22, at 29.
[26] Sam Kavanagh et al., *A Systematic Review of Virtual Reality in Education*, 10 THEMES SCI. & TECH. EDUC. 85 (2017).
[27] Barnard, *supra* note 23.
[28] *Id.*
[29] Merchant et al., *supra* note 22, at 29.
[30] Christine Youngblut, *Educational Uses of Virtual Reality Technology*, INST. FOR DEFENSE ANALYSES, 1, 16 (1998), http://www.dtic.mil/dtic/tr/fulltext/u2/a339438.pdf.
[31] Merchant et al., *supra* note 22, at 30.
[32] *Virtual reality (VR) in Natural & Cultural History Education*, STORYTOGO CLASSROOM (2021), https://storytogo.ca/classroom/course/immersive-experiences-in-natural-and-cultural-history/lessons/virtual-reality-vr-in-natural-cultural-history-education/ [hereinafter STORYTOGO CLASSROOM].
[33] Kavanagh et al., *supra* note 26, at 85.

challenges that impeded its proliferation.[34] Primarily, educational institutions nationally were not financially equipped to handle the procurement and operational costs of the emerging technology.[35] Furthermore, without the luxury of the resources and advancements that modern manufacturers enjoy, companies were producing consoles and hardware that encumbered students with physical and psychological discomfort.[36] Implementation issues such as these demonstrate how immersive products, very similar to its performance in the gaming industry then, were slightly ahead of their time.[37] Following the creation of less strenuous, desktop-based experiences over the course of the early 2000's, virtual reality in its purest form would take a backseat in classrooms for a few years. [38]

The advent of the Oculus Rift in 2010 sparked a rejuvenation of the VR market that continues to gain steam to this day.[39] Now a multi-billion-dollar industry, some have poured into what they believe to be the tech of the future,[40] including Facebook and its 'Metaverse' project. At a bare minimum, the immediate limitations affecting older devices of previous decades are no more. Sleeker designs, more acute disclaimers, and cost-effective options have contributed to the commercialization of these products like never before. Its reintroduction into K-12 and higher education illustrates the newfound successes of the newer hardware.[41] Over fifteen percent of U.S. schools were predicted to incorporate virtual reality classroom kits by 2021.[42] Furthermore, a forecast by ABI Research projected the total value of VR in education to be approximately $5.3 billion. Of this amount, $640 million would reflect the costs of head-mounted hardware alone.[43] While not as pedagogically "necessary" in its incorporation inside the classroom as virtual learning was following the Covid-19 pandemic, virtual reality learning environments are gaining traction as a viable addition to the curriculum, offering unique pathways to building student engagement with the material.

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[34] Merchant et al., *supra* note 22, at 29–30.
[35] *Id.* at 30.
[36] *Id.*
[37] STORYTOGO CLASSROOM, *supra* note 32.
[38] Merchant et al., *supra* note 22, at 30.
[39] Barnard, *supra* note 23.
[40] *Future of Virtual Reality - Market Trends and Challenges*, SOFTWARE TESTING HELP (last updated June 23, 2023), https://www.softwaretestinghelp.com/future-of-virtual-reality/#1_Learning_Training_and_Treatments_in_VRAR.
[41] Barnard, *supra* note 23.
[42] Herold, *supra* note 6.
[43] Neelakantan, *supra* note 5.

Some of the chief objectives of leveraging virtual reality inside the classroom revolve around four areas: simulation, training, distance learning, and access.[44] Aligning with its central purpose in other industries, VR hardware in the classroom creates unique opportunities for students to participate in realistic simulations and explorations that they otherwise feasibly could not.[45] In part, many schools, particularly public, don't have the capacity to organize travel efforts on the level that this tech provides. Popular VR applications now allow for visits to European museums, or travel to the sites of famous historical landmarks and events.[46] At a school in Milwaukee, a special education teacher was able to virtually take her students along with the school on a field trip, eliminating prior longstanding barriers that existed.[47] VR simulations also offer students the chance to experience otherwise inaccessible locations, whether they be historical, imaginary, or dangerous. Mr. Huang's guided tour of coral reefs under the sea reflect this idea, deepening his class's understanding of the location in a way textbooks currently can't.[48]

Adjacent to VR's transfer of knowledge is its ability to transfer skills.[49] Like the Air Force flight simulator, certain applications provide training to students, imparting practical and professional skills alike.[50] The U.S. Department of Education's Office of Special Education recognized this when it invested nearly $3 million into a program structured around incubating the necessary soft skills students need to succeed in school and beyond.[51] The project, called Virtual Reality Opportunities to Integrate Social Skills, developed various virtual environments for students with high-functioning autism to communicate with computer-driven avatars in a safe space. This would allow them to internalize the consequences of interactions, ideally bolstering their willingness to talk and collaborate with other students.[52] Another prevalent training application is utilized by medical instructors to reconstruct various medical activities, including surgery and

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[44] Kavanagh et al., *supra* note 26, at 92–94.
[45] Merchant et al., *supra* note 22, at 29.
[46] STORYTOGO CLASSROOM, *supra* note 32.
[47] Eli Zimmerman, *AR/VR in K–12: Schools Use Immersive Technology for Assistive Learning*, EDTECHMAGAZINE (Aug. 22, 2019), https://edtechmagazine.com/k12/article/2019/08/arvr-k-12-schools-use-immersive-technology-assistive-learning-perfcon.
[48] Sobel & Jhee, *supra* note 1.
[49] Kavanagh et al., *supra* note 26, at 92.
[50] *Id.*
[51] Zimmerman, supra note 47.
[52] *Id.*

rehabilitation. Because they are only simulations, the skill transfer is maintained while shedding the risks inherently involved in the activities.[53]

Before distance learning became synonymous with remote learning following the Covid pandemic, it was one of the recognized instructional benefits of virtual reality in the classroom.[54] Because of the immersive experiences of VR tech, physical presence in a classroom is not always essential to accomplish learning objectives. With the recent introduction of more nontraditional methods of learning, distance learning has only increased in relevance. There have been several instances of academics reconstructing realistic learning environments as a proxy. Researchers in one area created a system that taught students with cerebral palsy how to perform their rehabilitation exercises independently. Video tutorials had been available, but their motion-sensing instrument allowed for real-time feedback alongside the exercises.[55] In another area, the use of Second Life, a three-dimensional virtual reality program, was used to administer mock oral examinations to students. Students assumed the role of the head doctor, while the examiners took up the role of the patients. Over 70% of students found the environment to be more realistic in comparison to the traditional examination.[56] If nothing else, as the processing power of virtual reality increases, the capabilities of realistic environments for students to inhabit will continue to expand.[57]

The last major objective virtual reality targets is providing access to otherwise limited resources.[58] While occupying a similar benefit as the holistic immersive quality of digital worlds, this impact is particularly valuable to institutions with smaller budgets.[59] Funding limitations cut both ways: often, schools who can't afford grade-wide travel are not in the position to purchase certain materials for their students. Virtual reality accords instructors with a method of advancing curriculum at minimum sacrifice. A study in one school for instance compensated for the minimal availability of laboratory equipment by developing a virtual

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[53] Kavanagh et al., *supra* note 26, at 92.
[54] *Id.* at 93.
[55] Chien-Yu Lin & Yu-Ming Chang, *Increase in Physical Activities in Kindergarten Children with Cerebral Palsy by Employing MaKey–MaKey-Based Task Systems*, 35 RSCH. IN DEVELOPMENTAL DISABILITIES 1963, 1963–64 (2014).
[56] Jillian Schwaab et al., *Using Second Life Virtual Simulation Environment for Mock Oral Emergency Medicine Examination*, 18 ACAD. EMERGENCY MED. 559, 559–60 (2011).
[57] Merchant et al., *supra* note 22, at 29.
[58] Kavanagh et al., *supra* note 26, at 93.
[59] *Id.*

lab where the students could interact with real instruments from remote locations. The students found the opportunity "as useful" as the alternative.[60] In environments like this, what was "limited" becomes "limitless."

Despite these advantages, extended reality technologies still face obstacles in the school setting. The funding challenge continues to create a barrier for its large-scale implementation.[61] There are certainly more inexpensive options available, such as the Google Cardboard sets. Relative to its competitors, the hardware is hundreds of dollars cheaper, sacrificing processing power for accessibility.[62] However, if school districts want to utilize VR tech to its fullest potential, they will have to invest in the much more expensive options.[63] Additionally, the relatively fresh commercialization of virtual reality comes with a vast amount of unanswered questions about long-term effects on students.[64] Unsurprisingly, schools hesitant to make the investment are much more common than those who aren't. In tandem with the health concerns is the "value-versus-cost standoff."[65] Effective adoption of unfamiliar technology requires curriculum changes at a high-level to enable their growth, but administrators are anxious to manipulate their curriculum until VR is proven to be effective.[66] This counter-intuitive mindset can only be broken if decisionmakers themselves confirm the value the hardware brings to the classroom.[67] Two specific issues will influence the legal landscape surrounding immersive education over the next years: data privacy and cyberbullying. For any educational institutions seeking to affirm the merits of this tech, proactivity in these areas will alleviate potentially inhibiting disputes in the future.

II. UNRESOLVED LEGAL ISSUES

A. Data Privacy Concerns

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[60] A. N. Hristov et al., *Special Topics — Mitigation of Methane and Nitrous Oxide Emissions From Animal Operations: A Review of Enteric Methane Mitigation Options*, 91 J. ANIMAL SCI. 5045, 5045–47 (2013).
[61] Neelakantan, *supra* note 5.
[62] Nate Ralph, *Google Cardboard Review: The Cheapest Ticket to Mars*, CNET (June 6, 2015), https://www.cnet.com/reviews/google-cardboard-review/.
[63] Neelakantan, *supra* note 5.
[64] Herold, *supra* note 6.
[65] Neelakantan, *supra* note 5.
[66] *Id.*
[67] *Id.*

Consumer concerns regarding data privacy are nothing new: as far back as the late 20th century, advocates have demanded more secure protection of the data being collected from them.[68] Today, almost 70% of consumers have expressed concern regarding how their information is obtained and stored by companies, particularly mobile apps.[69] Whereas the general public paid little attention to such processes in the past, in the wake of large-scale data breaches like the Cambridge Analytica Scandal, ignorance is no longer a fortune that can be afforded.[70] K-12 and higher education have not been insulated from these cybersecurity attacks. A ransomware attack on December 1, 2021, left the personal information of over half a million Chicago Public Students and employees compromised. Even worse, the school district was only informed about the attack by their data storage vendor the following April. While nothing came of the information released, parents were put on notice that an already vulnerable population was not safe from digital abuse.[71] Lincoln College did not fare so well. One of Illinois' Historical Black Colleges and Universities, the school was already struggling to stay afloat amidst combating its second global pandemic (having survived the Spanish Flu). However, in December 2021, it too was hit with a ransomware attack; this took the form of a lock of critical systems the schools needed for admissions, financial aid, and other important offices. The hackers placed a $100,000 ransom on these systems, but after paying it, the institution could not afford operation any longer.[72] These breaches illustrate a snapshot of the risks of weak cybersecurity, but don't even begin to encompass the scope of the issues virtual reality presents.

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[68] Swish Goswami, *The Rising Concern Around Consumer Data and Privacy*, FORBES (Dec. 14, 2020), https://www.forbes.com/sites/forbestechcouncil/2020/12/14/the-rising-concern-around-consumer-data-and-privacy/?sh=123b658487e8.

[69] *The Trust Opportunity: Exploring Consumer Attitudes to the Internet of Things*, INTERNET SOC'Y (May 1, 2019), https://www.internetsociety.org/resources/doc/2019/trust-opportunity-exploring-consumer-attitudes-to-iot/.

[70] Tatum Hunter, *Surveillance Will Follow Us into 'The Metaverse,' and Our Bodies Could Be its New Data Source*, WASH. POST (Jan 13, 2022, 8:00AM), https://www.washingtonpost.com/technology/2022/01/13/privacy-vr-metaverse/.

[71] *Breach Exposed Data of Half-Million Chicago Students, Staff*, ASSOCIATED PRESS (May 21, 2022, 3:02 PM), https://apnews.com/article/technology-chicago-education-data-privacy-4013e749b2d1cd57604b3e5e1db7f30e.

[72] Scott Ikeda, *Double Blow of Ransomware Attack and Covid-19 Pandemic Shutters 157-year-old Lincoln College*, CPO MAG. (May 19, 2022), https://www.cpomagazine.com/cyber-security/double-blow-of-ransomware-attack-and-covid-19-pandemic-shutters-157-year-old-lincoln-college/.

AR/VR technology collects a treasure trove of personal information inferred, provided, and generated by consumers.[73] A combination of sensors, displays, and cameras working in tandem to create immersion, this technology utilizes basic provided personal information to develop a feedback loop constantly obtaining new data to further its virtual worlds.[74] While some of this data is also collected in other user devices, extended reality stores sensitive information unique to the hardware. And unlike other consumer devices, this sensitive information gathering is essential to the tech's operation.[75] Given that students would be the primary audience, understanding what makes the innovations of unregulated extended reality so dangerous is crucial for school success. Of notable unresolved consideration is the potential for these devices to ultimately be taken home by students, only exacerbating the accumulated risks.

The type of user data collected by VR/AR technology can broadly be categorized into four categories: observable, observed, computed, and associated.[76] The first two are particularly relevant. Observable data allows for the production of the immersive space, enabling consumers to construct their virtual presence.[77] It comprises any data directly viewable by a third party, including communications and media.[78] Depending on the tech being utilized, the data privacy concern shifts slightly. Consider that the function of augmented reality technology is to overlay digital content over a physical space.[79] In a classroom setting, this amounts to educational content such as historical locales or realistic animals hovering above desks and bookshelves. Moreso than its VR counterpart, this allows AR technologies to directly view the environment a user is in.[80] The privacy considerations then become massive. The nature of the content alone is vulnerable enough, given the insight into classrooms it provides, but compounding upon that risk are the general knowledge gaps about how AR technologies actually function. How do companies use the data they collect? Is the data stored indefinitely? If so, is it local

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[73] Ellysse Dick, *Balancing User Privacy and Innovation in Augmented and Virtual Reality*, INFO.TECH.& INNOVATION FOUND. (Mar. 4, 2021), https://itif.org/publications/2021/03/04/balancing-user-privacy-and-innovation-augmented-and-virtual-reality/.
[74] *Id.*
[75] *Id.*
[76] *Id.*
[77] *Id.*
[78] *Id.*
[79] Tremosa, *supra* note 9.
[80] Greenwald, *supra* note 16.

or in the cloud?[81] These are questions that teachers are likely not debating the merits of when they utilize educational material in the classroom. For virtual reality tech, anything produced by or within the ambit of the hardware in effect becomes observable data.[82] If, for example, students create virtual avatars to navigate digital worlds, the stronger the real-life likeness is, the more attributable it is to them as users. Or, if during the course of use in a classroom, students communicate with others, that could be recorded and stored by companies. While the risks may not be as immediate as AR, observable data collected by VR tech can, alongside other sensitive information, create tangible threats if not protected.

While observable data constructs the virtual imagery consumers engage with, observed data influences the experiences a user has with the digital product. This data is user-generated and user-provided, covering information like "personal preferences and behavioral data, affiliations and identity traits, geolocation or other metadata."[83] Where AR and VR overlap in this realm is positioning. AR needs to understand where a user is in order to project pertinent digital imagery, whereas VR manages the physical safety of users to ensure they aren't operating outside of clear preset boundaries.[84] Both accomplish these goals by relying on information gathered through everything from GPS to external data observed through sensors and cameras.[85] The two technologies differ significantly when it comes to risks though. Virtual reality by far eclipses its counterpart in its collection of personally identifiable information, particularly biometric date, to replicate user action. This biometric data can include "iris or retina scans, fingerprints and handprints, face geometry, and voiceprints."[86] Precise reconstruction of human sensation is required for strong immersive experiences. Eye-tracking technology, for instance, uses internal cameras and sensors to craft more responsive environments.[87] Studies have shown that this level of precision poses significant threats in the hands of malicious actors with competence in

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[81] *What are the Security and Privacy Risks of VR and AR*, KASPERSKY, https://usa.kaspersky.com/resource-center/threats/security-and-privacy-risks-of-ar-and-vr (last visited Oct. 15, 2023) [hereinafter KASPERSKY].
[82] Dick, *supra* note 73, at 6.
[83] *Id.* at 9.
[84] Tremosa, *supra* note 9, at 9.
[85] Dick, *supra* note 73, at 9.
[86] KASPERSKY, *supra* note 81.
[87] *Id.*

reconfiguring data.[88] Because of the degree to which personal information is obtained, anonymizing this tracking data becomes increasingly challenging.[89] Any focused attack on a school relying on extended reality technology could be harmful to the protection of its students. To corroborate findings of security vulnerabilities, researchers developed "Face-Mic," an eavesdropping attack aimed at headset hardware. The software concentrated on the "facial dynamics" accompanying speech while utilizing AR/VR headsets. The team concluded that sensitive speech and speaker information are both capable of exploitation in all four of the major VR headsets.[90] The "Face-Mic" research is a snapshot into the danger mismanagement of extended reality hardware poses. The promulgation of strong protections for consumers in this industry is failing to match the significant growth of the VR/AR market.[91] If not addressed, its potential to flourish in educational spaces will be perpetually restricted.

B. Potential for Cyberbullying

In 2021, the nonprofit The Center for Countering Digital Hate (CCDH) spent eleven and a half hours inside VRChat, one of Meta's most reviewed social apps.[92] The app allows users to create virtual avatars, explore community-created worlds, interact virtually with friends and strangers alike, and express themselves with gestures and emojis.[93] Meta enforces VR policies that explicitly prohibit various forms of harassment, abuse, and deception. Of particular significance is the policy's strong emphasis against sexualizing or abusing minors, bullying or harassing behavior, coordination or promotion of physical harm, and any form of non-consensual intimate activity.[94] The policy further provides reporting

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[88] Ken Pfeuffer et al., *Behavioral Biometrics in VR*: *Identifying People from Body Motion and Relations in Virtual Reality* (CHI '19: CHI Conf. on Hum. Factors in Computing Sys., 2019).
[89] KASPERSKY, *supra* note 81.
[90] *See* Cong Shi, et al., *Face-Mic*: *Inferring Live Speech and Speaker Identity via Subtle Facial Dynamics Captured by AR/VR Motion Sensors*, PROCEEDINGS OF THE 27TH ANNUAL INTERNATIONAL CONFERENCE ON MOBILE COMPUTING AND NETWORKING (2021) (regarding the four major headsets: Oculus, Sony, HTC, Pimax).
[91] KASPERSKY, *supra* note 81.
[92] *New Research Shows Metaverse is Not Safe for Kids*, CCDH CTR. FOR COUNTERING DIGIT. HATE (Dec. 30, 2022), https://counterhate.com/blog/new-research-shows-metaverse-is-not-safe-for-kids/ (noting that since Meta does not reveal total app downloads, using a "most reviewed" metric is the next best method).
[93] *Id.*
[94] *Code of Conduct for Virtual Experiences*, META, https://www.meta.com/help/quest/articles/accounts/privacy-information-and-settings/conduct-in-vr-policy/.

options that Meta commits to take seriously in investigating.[95] Despite such warranty, the CCDH reported that during their time in the program, they identified 100 potential violations of Meta's VR guidelines, finding the platform "rife with abuse, harassment, racism and pornographic content."[96] Put another way, they determined that every seven minutes, users, including minors, are subjected to abusive behavior. Only 51 of these potential violations were reportable, although the CCDH noted none were actually responded to.[97]

Ongoing harassment struggles faced by large VR companies like Meta and Google introduce an important digital distinction: cybersecurity and cyberbullying. Fundamentally, the two concepts are different, and represent two unique areas in which these companies must offer protection. Cybersecurity broadly encompasses data and privacy concerns, as well as the safeguards in place to ensure the safety of this data.[98] Cyberbullying, on the other hand, is bullying beyond a physical space. It includes digital harassment and humiliation, deception and identity fraud, and cyberstalking. Most importantly, it isn't confined to school or school-adjacent forums, as the Internet vastly increases access to other exploitable areas.[99] Therefore, a cyberbully can just as often be a complete stranger as it could be another student.[100] The two intersect. Crimes like identity theft or cyberstalking typically require breaches of cybersecurity to occur.[101] Either way, cyberbullying has risen in concern across the country.

There are two primary sources of federally-collected data regarding cyberbullying: the 2019 School Crime Supplement to the National Crime Victimization Survey and the 2019 Youth Risk Behavior Surveillance System.[102] The former reported that "about 22 percent of students ages 12–18 reported being bullied at school during the school year…[and] about 16 percent of students in grades 9–12 reported being electronically bullied during the previous 12 months."[103] The latter indicates that about 16% of surveyed high school students were bullied

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[95] *Id.*
[96] Lawson, *supra* note 92.
[97] *Id.*
[98] Devin Morrisey, *Cyberbullying and Cybersecurity: How are they Connected?*, AT&T CYBERSECURITY (Aug. 21, 2019), https://cybersecurity.att.com/blogs/security-essentials/cyberbullying-and-cybersecurity-how-are-they-connected.
[99] *Id.*
[100] *What is Cyberbullying?*, STOPBULLYING (Nov. 5, 2021), https://www.stopbullying.gov/cyberbullying/what-is-it.
[101] Lawson, *supra* note 92.
[102] *What is Cyberbullying?*, *supra* note 100.
[103] *Bullying at School and Electronic Bullying*, NAT'L CTR. FOR EDUC. STAT. (May 2021), https://nces.ed.gov/programs/coe/indicator/a10.

during the year before the survey.[104] Together, the numbers stand for the proposition that almost 2.5 million high schoolers encounter cyberbullying at any given time. These numbers don't account for the rest of the K-12 population, so they stand only to become more inflated. All states, having unanimously enacted bullying laws in the past, have gradually begun to respond to the increasing threat of cyberbullying. No federal law has been enacted though. Only when bullying overlaps with harassment due to a protected class like race or religion may the federal government become involved.[105] States have not had the opportunity to articulate the risks of extended reality technology nor discuss methods to curb the rampant harassment inside the tech. This fact largely stems from cyberbullying policy being a relatively young area.[106] Therefore, charting a path forward for the hardware inside schools will be completely new territory for educators.

VR technology primarily serves to replicate the physical world into a digital space, down to the sensory experiences of consumers.[107] Cyberbullying traditionally sacrifices the physicality of bullying to gain unfiltered, indefinite access to victims.[108] When the harassment is channeled through spaces like the Metaverse though, abusers reap the benefits of both routes.[109] Suddenly, experiences, often committed by anonymous users, come across as realistically physical, especially as full-body tracking becomes more frequent in newer hardware.[110] Participants in a Clemson study for instance reported that VR users who closed the distance and got closer to their face made them feel scared, "as it felt similar to someone doing the same thing in the offline world."[111] Because of how fundamental personalization is to socialization in these virtual environments, verbal abuse also wounds deeper, feeling remarkably similar to receiving the abuse physically.[112] Furthermore, harassment can

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[104] *What is Cyberbullying?*, *supra* note 100.
[105] *Id.*
[106] *Laws, Policies & Regulations,* STOPBULLYING (May 17, 2023), https://www.stopbullying.gov/resources/laws.
[107] *Virtual Reality: Another World Within Sight*, *supra* note 8.
[108] *Cyberbullying: What it is and How to Stop It*, UNICEF, https://www.unicef.org/end-violence/how-to-stop-cyberbullying (last visited Feb. 2023).
[109] Sheera Frenkel & Kellen Browning, *The Metaverse's Dark Side: Here Come Harassment and Assaults*, N.Y. TIMES (Dec. 30, 2021), https://www.nytimes.com/2021/12/30/technology/metaverse-harassment-assaults.html.
[110] Rachel Metz, *Harassment is a Problem in VR, and it's Likely to get Worse*, CNN (May 5, 2022, 10:01 PM), https://www.cnn.com/2022/05/05/tech/virtual-reality-harassment/index.html.
[111] *Id.*
[112] Frenkel & Browning, *supra* note 109.

materialize in new forms previously unavailable through other cyberbullying means.[113] Kelly Guillory, editor of a VR magazine, recounted her experience with a cyber-stalker. After blocking a former friend in VRChat, she could no longer see or hear him. On multiple occasions however, she was able to perceive his presence, for he would often hover around and join the same group of friends she would interact with, knowing that she was there. She felt as if he was imposing his virtual presence upon her.[114]

Separate from any legal regulations on VR technology regarding misbehavior, the companies producing the technology have made it clear that such behavior is at the forefront of their development, even if actual enforcement is still a work in progress. Andrew Bosworth, the recently appointed head of Meta's exploration into the Metaverse, himself acknowledged that "moderating how users speak and behave at any meaningful scale is practically impossible".[115] This has flowed down into the difficulties these larger companies have faced enforcing misconduct complaints. Companies currently lack the bandwidth to respond to a culture where 65% of online consumers have experienced some form of severe harassment.[116] Undoubtedly, these designers will need support and guidance from regulatory bodies to ensure the protection of users.

C. Current Regulations Surrounding Data Privacy & Cyberbullying in VR

Data privacy and cyberbullying in virtual reality present emerging, pressing concerns, considering the technology's commercial growth. How have states and the Federal Government responded to these unique issues since 2010? In sum, the same way these entities have responded to VR/AR at large: they haven't.[117] Although concepts like mixed reality and the Metaverse have expanded, the law has been stagnant in its response. To an extent, this isn't uncommon. Legal frameworks for newer

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[113] Metz, *supra* note 110.
[114] *Id.*
[115] Hannah Murphy, *How will Facebook Keep its Metaverse Safe for Users?*, FIN. TIMES (Nov. 12, 2021), https://www.ft.com/content/d72145b7-5e44-446a-819c-51d67c5471cf.
[116] *Two-Thirds of U.S. Online Gamers Have Experienced Severe Harassment, New ADL Study Finds*, ADL (July 24, 2019), https://www.adl.org/news/press-releases/two-thirds-of-us-online-gamers-have-experienced-severe-harassment-new-adl-study.
[117] *Do Real World Laws Apply to Virtual World Problems?*, HG.ORG, https://www.hg.org/legal-articles/do-real-world-laws-apply-to-virtual-world-problems-31744.

technologies often are the product of numerous long-term legislative and judicial processes and discussions.[118] Considering the robust investment into these digital environments though, the lack of any significant legal commentary surrounding extended reality technology is noticeable. The hardware saturates many major, heavily regulated industries, and presents unique legal challenges manufacturers might not always be capable of solving. Scott Evans, the vice president of mixed reality at Microsoft, flagged this very concern.[119] He noted at a VR/AR policy conference the critical role federal guidelines serve in helping shape the creation of safer applications for new technologies. He further emphasized the agency federal guidelines have in charting a path forward for mixed reality developers.[120]

Despite these sentiments, domestic governments have not adopted the same approach. It certainly is not because of a lack of opportunity either. The legal ramifications of VR/AR tech are vast.[121] Intellectual property rights will be foundational to many disputes moving forward, as questions of ownership, management of virtual assets, and exploitation of licenses will be raised in this digital-dominant era.[122] If the Metaverse succeeds, that would mean that real-life experiences are replicated virtually, including commercial transactions and workplace environments. What of issues surrounding human resource disputes, tax, and contract enforceability then?[123] This does not even factor in data privacy and conduct regulation. Suffice to say, there is no shortage of topics for legal scholars, legislators, and judicial officers to consider. It is entirely unknown to this point to what extent current legal schemes will be applicable to extended reality technology.[124] For example, there is case law surrounding "expression" in computer software and "originality" in video games. Because virtual reality is entangled in these two areas, those

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[118] Karen Silverman & Thomas Campbell, *The Knotty Problem of Applying Real-World Laws to VR and AR,* WORLD ECON. F. (Aug. 24, 2021), https://www.weforum.org/agenda/2021/08/real-world-laws-ar-and-vr/.
[119] Makenzie Holland, *Calls for Federal Data Privacy Law Grow Alongside AR, VR Use,* TECHTARGET (Oct. 22, 2021), https://www.techtarget.com/searchcio/news/252508584/Calls-for-federal-data-privacy-law-grows-alongside-AR-VR-use.
[120] *Id.*
[121] Tom K. Ara, et al., *Exploring the Metaverse: What Laws will Apply?*, DLA PIPER (Feb. 22, 2022), https://www.dlapiper.com/en-ae/insights/publications/2022/02/exploring-the-metaverse.
[122] *Id.*
[123] *Id.*
[124] Jack Russo & Michael Risch, *The Law of Virtual Reality*, COMPUTERLAW GROUP LLP (1993), https://www.computerlaw.com/articles/the-law-of-virtual-reality/#2.4.

principles could easily apply as well.[125] What about state tort law though? Sensory familiarity in virtual environments exists, as Kelly Guillory recounted. Could she bring action against her former VRChat friend? Can someone be falsely imprisoned if they can simply remove their headset? How "severe or pervasive" would unwelcome conduct in a virtual working environment have to be to raise a potential Title VII harassment claim? So far, the legal landscape has deferred to the terms of conditions and similar agreements of adhesion drafted by the publishers themself.[126] The only remedy a victim of a cyber-issue has are those she (likely without knowledge) consents to. Enforcement of these remedies has been lackluster, and without more, runs the risk of stunting widespread adoption of the technology.

The lack of response to virtual reality at a federal level is especially pronounced when it comes to data privacy, considering the promulgation of strong privacy laws elsewhere. Domestically, five states—California, Colorado, Connecticut, Utah, and Virginia—have responded to the emergence of new Internet and technological advancement with their own comprehensive consumer data privacy laws. These laws will all go into effect next year and contain several provisions in common.[127] For example, The Colorado Consumer Protection Act places hard restrictions on how personal data of consumers is managed and stored, emphasizing the accountability companies will face in the wake of weak cybersecurity.[128] California meanwhile hosts an "eraser" bill aimed at protecting minors. It allows families to seek removal of personal information posted online, and prevents operators of online services from targeting minors with specified services they are legally prohibited from purchasing.[129] States are incrementally centralizing data privacy as an objective; international response to tech concerns further illustrates the federal government's inaction in this area.

Leading the foreign charge is the European Union (EU)'s General Data Protection Regulation (GDPR).[130] The law has been dubbed the "toughest privacy and security law in the world," in part because it imposes obligations domestically and internationally, so long as data

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[125] *Id.*
[126] *Do Real World Laws Apply to Virtual World Problems?*, *supra* note 117.
[127] Pam Greenberg, *State Laws Related to Digital Privacy,* NAT'L CONF. OF STATE LEGS. (June 7, 2022), https://www.ncsl.org/research/telecommunications-and-information-technology/state-laws-related-to-internet-privacy.aspx.
[128] COLO. REV. STAT. § 6-1-1301 (2023).
[129] CAL. CIV. CODE § 1798.100 (2023).
[130] Ben Wolford, *What is GDPR, the EU's New Data Protection Law?*, GDPR.EU (2022), https://gdpr.eu/what-is-gdpr/.

from EU residents is being collected or targeted.[131] Composed of 99 individual articles, the GDPR extensively outlines principles and standards for how personal data is managed, giving consumers unprecedented autonomy apropos how they are treated by "processors."[132] Notably, the GDPR classifies certain sensitive personal data such as biometric data and information about race or ethnic origin into specially defined and treated categories.[133] The EU's sharp attention to the matter is reflected in how it holds those who don't respect this set of expectations accountable. As aforementioned, compliance is a requirement for any entity in the business of processing the personal data of EU citizens, regardless of their location.[134] Fines that can reach as high as 4% of the entity's global revenue can be sanctioned, not accounting for the private right of compensation data subjects are entitled to. Companies are amerced for both security breaches and for the lack of data protection officers.[135] And, assuredly, no global company is above its latitude. Google was fined $50 million two years ago for failing to give adequate information to consumers to enable effective informed consent.[136]

To this day, there are no regulations or standards for data collected through VR, a market increasing in investment by the billions.[137] Effective oversight of the technology domestically will rely on the regulatory guidance Congress provides. States can certainly look to the comprehensive bills passed by others, or to the heavy-handed efforts of bodies like the European Union, but the full scope of legal consequences in the industry will require federal intervention. The GDPR, as firm as it may be, is imperfect.[138] Observing these flaws, including its relatively ambiguous informed consent standards in the context of virtual reality data collection, can serve the legislature in its

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[131] *Id.*
[132] Matt Burgess, *What is GDPR? The Summary Guide to GDPR Compliance in the UK*, WIRED (Mar. 24, 2020, 4:30 PM), https://www.wired.co.uk/article/what-is-gdpr-uk-eu-legislation-compliance-summary-fines-2018.
[133] *Id.*
[134] Wolford, *supra* note 130.
[135] Burgess, *supra* note 132.
[136] Paul Roberts & Chris Brook, *Google Fined $57M by Data Protection Watchdog over GDPR Violations*, DIG. GUARDIAN (Dec. 28, 2020), https://digitalguardian.com/blog/google-fined-57m-data-protection-watchdog-over-gdpr-violations.
[137] Jared Maslin, *Concerns with Privacy in Virtual Reality*, DATA SCI. W231 (Mar. 2, 2021), https://blogs.ischool.berkeley.edu/w231/2021/03/02/concerns-with-privacy-in-virtual-reality/.
[138] *Top Five Concerns with GDPR Compliance*, THOMSON REUTERS, https://legal.thomsonreuters.com/en/insights/articles/top-five-concerns-gdpr-compliance (last visited Oct. 15, 2023).

own efforts.[139] Until these efforts take shape, school districts will have to rely upon other sources for guidance on implementing VR/AR hardware into the curriculum. One is not too unfamiliar for them.

III. FINDING AN ANALOG IN SCHOOL-ISSUED DEVICES

While extended reality remains a relatively foreign concept in the modern classroom, the advancements and commercialization of the technology industry at large have had a clear presence in education. Even since before the turn of the century, school districts have gradually incorporated different forms of technology into curricula across the country.[140] At first, it was the Internet. When Internet access in public schools was first measured in 1994, about 35% had access.[141] By the end of 2002, that figure was at 99%.[142] While the optics of this widespread access looked different depending on the district, the focus was very much on leveraging the growth of interconnected computer networks. This rapid implementation of technology has persisted to this day. As of 2017, a third of all K-12 students in U.S. schools use school-issued devices.[143]

These devices serve various purposes. Like extended specifically, they create unique opportunities to engage students with the material.[144] Programs like Kahoot incentivize participation and retention of learned information via thought-out, competitive structures.[145] Educational games meanwhile immerse students in fully realized simulations that track progression, encourage problem-solving, and provoke long-lasting motivation with the material.[146] These devices also foster inclusion within the classroom, addressing students' needs that can sometimes not always be accounted for. For students with learning disabilities, this

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[139] Yeji Kim, *Virtual Reality Data and Its Privacy Regulatory Challenges: A Call to Move Beyond Text-Based Informed Consent*, 110 CALIF. L. REV. 225, 229 (2022).
[140] *Internet Access in U.S. Public Schools and Classrooms: 1994-2002*, NAT'L CENT. FOR EDUC. STAT., 1 (Oct. 2003).
[141] *Id.* at 3.
[142] *Id.*
[143] Gennie Gebhart et al., *Spying on Students: School-Issued Devices and Student Privacy*, ELEC. FRONTIER FOUND. (Apr. 13, 2017), https://www.eff.org/wp/school-issued-devices-and-student-privacy#transparency.
[144] *How Using Technology in Teaching Affects Classrooms*, GRAND CANYON UNIV. (Apr. 3, 2023), https://www.gcu.edu/blog/teaching-school-administration/8-benefits-of-classroom-technology.
[145] ALF INGE WANG & RABAIL TAHIR, THE EFFECT OF USING KAHOOT! FOR LEARNING – A LITERATURE REVIEW 9-10 (Elsiver Ltd. ed., 149th ed., Computers & Education) (2020).
[146] Merchant et al., *supra* note 22, at 30–31.

takes the form of assistive technology.[147] The term collectively refers to school-issued technology that "are used to increase, maintain, or improve the capabilities of a student with a disability."[148] Assistive tech significantly benefits the goal achievement of individual education plans, bypassing areas of difficulty and providing alternative means of accomplishing tasks.[149] Their form may vary, but school-issued devices are a mainstay of modern education. Between the federal government, states, and school districts, spending lands anywhere between $26 and $41 billion per year. Even at its lowest, the total number is still nearly double the previously accepted estimate.[150]

The Covid-19 pandemic has permanently altered the educational system in many ways, chief among them being the centralization of technology in many curricula. For months, traditional teaching methods were deemed too unsafe, so reliance on virtual instruction was not only the norm but the standard required by both K-12 schools and higher education.[151] As widespread as school-issued devices were in classrooms, the pandemic exposed the inequalities in access to similar devices at home. Schools out of necessity responded, investing in devices at an unparalleled rate.[152] Research conducted by the Center for Democracy and Technology (CDT) revealed that 86% of participating teachers' schools "provided tablets, laptops, or Chromebooks to students at twice the rate (43%) prior to the pandemic."[153] The Household Pulse Survey additionally indicated that 59% of parents with children enrolled in schools reported that computers in some form were being provided by

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[147] Gabrielle Young & Jeffrey MacCormack, *Assistive Technology for Students With Learning Disabilities*, LD@SCHOOL (June 10, 2014), https://www.ldatschool.ca/assistive-technology/.
[148] *Id.*
[149] *Id.*
[150] Bart Epstein, *We Have No Clue How Much the U.S. Spends on Edtech. But it's at Least 2x What Many of Us Thought*, LINKEDIN (Mar. 17, 2021), https://www.linkedin.com/pulse/we-have-clue-how-much-us-spends-edtech-its-least-2x-what-bart-epstein/.
[151] Annalise Carson, *Covid-19 Brought New Technology into Elementary School. It's Time to Remove It*, WASH. POST (Nov. 29, 2021), https://www.washingtonpost.com/education/2021/11/29/remove-technology-from-elementary-school/.
[152] Jessa Crispin, *US Schools Gave Kids Laptops During the Pandemic. Then They Spied on Them*, GUARDIAN (Oct. 11, 2021), https://www.theguardian.com/commentisfree/2021/oct/11/us-students-digital-surveillance-schools.
[153] HANKERSON ET AL., STUDENT PRIVACY IMPLICATIONS OF SCHOOL-ISSUED DEVICES AND STUDENT ACTIVITY MONITORING SOFTWARE 6 (Center for Democracy and Technology) (2021).

the school.[154] Districts invested heavily in addressing existing technological disparities, and despite the pandemic seemingly in the past, the effects of these radical efforts remain—the technological infrastructure introduced in many schools has yet to be eliminated. For instance, hybrid learning, a creation of the pandemic, combines face-to-face classroom instruction with significant online components.[155] One out of ten school districts participating in a Rand Corporation survey expressed their plans to continue hybrid learning.[156] In the same study, one out of five have already made virtual classes permanent within the curriculum, or at least plan to.[157] Going forward, school-issued devices, even with their learning critics, appear to be a mainstay of the educational experience. Their challenges, weaknesses, and applications will play a central role in comprehensive regulation of immersive devices over the next few years.

A. School Misuse of Student Data

Katherine W. was assigned her first Google Chromebook in the third grade. Like the rest of her class, she was given G Suite for Education, brimming with a host of different applications for her to explore.[158] Her father Jeff W. had other plans. He was concerned about the sacrifice of privacy that would come at the expense of newer technology. He fought hard to negotiate for an alternative without use of the Google account, to which the district ultimately acquiesced.[159] It gave him the caveat though that next year, no exceptions would be made. The school district followed through on its word. In fourth grade, Katherine was signed up for the Chromebook program. Despite neither member of the family consenting to the program, Katherine's information was shared with Google without any notice to her parents.[160] She was effectively required to opt-in. Again, Jeff fought. He secured another alternative for the year, but was informed

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[154] *Students' Internet Access Before and During the Coronavirus Pandemic by Household Socioeconomic Status*, NCES BLOG (Sep. 20 2021), https://nces.ed.gov/blogs/nces/post/students-internet-access-before-and-during-the-coronavirus-pandemic-by-household-socioeconomic-status.
[155] *What is Hybrid Learning?*, HYBRID LEARNING @ PENN STATE (2019), https://sites.psu.edu/hybridlearning/what-is-hybrid/.
[156] Nirvi Shah, *'I Feel Half as Successful': Teachers Push to Ban Hybrid Instruction, But Districts Want to Keep It,* POLITICO (Dec. 29 2021), https://www.politico.com/news/agenda/2021/12/29/teachers-districts-hybrid-education-526214.
[157] *Id.*
[158] Alim et al., *supra* note 143.
[159] *Id.*
[160] *Id.*

that next year, no more exceptions. Jeff, realizing that individual battles with the school weren't feasible, enlisted the legal assistance of an outside nonprofit to outline the privacy concerns inherent to the Chromebooks.[161] For Jeff, the battle was never simply about the data collection; rather, it was about the impression of blindly handing over data to large companies left on students. He explained, "In the end, Google is an advertising company. They sell ads, they track information on folks. And we're not comfortable with our daughter getting forced into that at such an early age, when she doesn't know any better."[162]

Before the modern mass commercialization of technology, three major pieces of legislation sought to protect minors.[163] In 1974, Congress enacted the Family Educational Rights and Privacy Act (FERPA), designed to protect the privacy of student educational records.[164] Before its enactment, student information was in a free-form of disorder.[165] Even before the modern call for stronger data protection, FERPA addressed the particular fragility of loose management of personally identifiable information in the school invited. Any badge of governmental authority at any level was enough to obtain the personal information of students, whether it be academic, medical, or mental.[166] Parents were informed of any substantial changes in a student's education *only if* the school decided to tell them. Teachers had no obligation to communicate noticeable observations regarding students to their families.[167] The Watergate scandal proved to be the much-needed catalyst to resolve these difficulties, illuminating government abuse of personal data that fueled the passage of FERPA.[168] FERPA creates stronger rights for parents and students regarding how their education records are managed and prevents their unauthorized disclosure to third

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[161] *Id.*
[162] *Id.*
[163] Deborah Kozak, *Overview of CIPA, COPPA, and FERPA*, SAINT PAUL PUBLIC SCHOOLS, https://www.spps.org/cms/lib/MN01910242/Centricity/Domain/11270/OverviewofCIPACOPPAandFERPA12.2015.pdf.https://www.spps.org/cms/lib/MN01910242/Centricity/Domain/11270/OverviewofCIPACOPPAandFERPA12.2015.pdf (last updated Dec. 8, 2015).
[164] 34 C.F.R. § 99.2 (2011).
[165] Karen J. Stone & Robert N. Stoner II, *Revisiting the Purpose and Effect of FERPA*, (Feb. 2002), https://www.stetson.edu/law/academics/highered/home/media/2002/Revisiting_the_Purpose_of_FERPA.pdf.
[166] *Id.*
[167] *Id.*
[168] Mary M. Penrose, *In the Name of Watergate: Returning FERPA to Its Original Design*, 14 N.Y.U. J. LEGIS. & PUB. POL'Y 75, 76 (2011).

parties.[169] These "educational records" are, for the most part, just information gathered during a school's normal operation, such as grades, disciplinary files, and health records. While the scope of FERPA is sometimes a cause of confusion, schools have an obligation to communicate FERPA rights to families yearly, so there is general acclimation and tolerance of those educational records.[170]

While not remarkably similar to FERPA, Congress enacted another piece of legislation regarding children, schools, and technology: The Children's Internet Protection Act (CIPA). Enacted in 2000, CIPA reduces children's access to certain obscene or pornographic content over the Internet.[171] In order to receive certain discounts, schools and libraries must certify that they have implemented Internet safety policies that block access to this harmful or objectionable material. Part of their certification also requires monitoring of minors' online activities. Most of the more paternalistic tendencies of schools can find their origins in CIPA.[172] The most significant criticism the law received is aimed at the mass filtering out of what schools deem inappropriate. Alongside clear violations of the statute's guidelines, other websites, including social networking platforms and video-sharing sites, are also often netted in the process.[173] Districts err on the side of overregulation rather than allowing the occasional uninhibited YouTube video to slip through the cracks.

The last significant piece of legislation is the Children's Online Privacy and Protection Act (COPPA), enacted in 1998.[174] Unlike the other two, COPPA isn't school centric; rather, it imposes requirements on operators of websites and online services who directly or indirectly target minors under thirteen. In particular, COPPA requires parental consent, comprehensive privacy policies, and secure management of information collected from children.[175] It was updated in 2013 by the Federal Trade Commission to reflect growing developments in mobile devices and social media, expanding parental control and broadening what

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[169] 20 U.S.C. § 1232(g).
[170] *Id.*
[171] Kozak, *supra* note 163.
[172] 20 U.S.C. § 9134.
[173] *The Pros and Cons of the Children's Internet Protection Act*, TITANHQ, https://www.titanhq.com/the-pros-and-cons-of-the-childrens-internet-protection-act/ (last visited Nov. 11, 2023).
[174] Jeff Knutson, *What is COPPA?*, COMMON SENSE EDUC. (Oct. 25, 2018), https://www.commonsense.org/education/articles/what-is-coppa.onsense.org/education/articles/what-is-coppa.
[175] *Revised Children's Online Privacy Protection Rule Goes Into Effect Today*, FED. TRADE COMM'N (July 1, 2013), https://www.ftc.gov/news-events/news/press-releases/2013/07/revised-childrens-online-privacy-protection-rule-goes-effect-today.

constitutes "personal information" under the statute.[176] In a lot of ways, COPPA is the most evinced out of the three pieces of legislation to modern reform in the data privacy arena. It certainly has inspired the five states that conducted their own reform.[177] It is not without criticism despite its adaptive applications. These include its sometimes lax consent process and the murky line drawing regarding when online services are children-centered.[178] COPPA overall has served as an effective regulatory shield for minors using personal devices. However, school-issued devices sit in a different regime, continuing to evolve alongside modern technological advancements. FERPA, COPPA, and CIPA remain good law, but their central purposes were all constructed near or before the beginning of the century. School tech thus continues to face dynamic, uncharted considerations, only some of which have been resolved.

As Katherine and Jeff's situation highlights, one of the challenges plaguing school devices is the general lack of transparency regarding their usage.[179] Schools are constantly investing in newer educational technology, as reflected in their $26–41 billion spending.[180] There is no annual obligation to inform families about what is being provided to their children, nor is consent always required.[181] Whether a school or state chooses to do so is a different question, but this forthcoming attitude is not always guaranteed. In a survey conducted by the Education Frontier Foundation, parents were overwhelmingly not notified when schools implemented newer technology in the classroom.[182] Further, students and teachers alike often had accounts using their personal information created for them. Opt-in questions were not posed; instead, they received notification about the schools' actions after the fact.[183] Therefore, the investigative burden of how educational technology is used in the classroom can sometimes fall on the families, often without much assistance from the school districts. The seeds of mistrust are planted simply due to communication failures.[184] This is only exacerbated by the predatory dangers the imposed technology creates.

By far, the largest issue surrounding school-issued devices is the adoption of software and hardware that monitors K-12 students

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[176] *Id.*
[177] Greenberg, *supra* note 127.
[178] Knutson, *supra* note 174.
[179] Gebhart et al., *supra* note 143, at 12.
[180] Epstein, *supra* note 150.
[181] Gebhart et al., *supra* note 143, at 8.
[182] *Id.* at 10–11.
[183] *Id.*
[184] *Id.* at 11–13.

nationwide.[185] These programs tend to fulfill various objectives at any given time. The CDT has documented the extent of this monitoring. One school administrator noted that "[students' online] traffic 24/7 is going through our web filter… There's no limitation on that. If they're on our device, it doesn't matter what time of day or what day of the week—their traffic is going through our web filter."[186] Buttressing this sentiment are 81% of teachers participating in the survey indicating that their districts issued devices hosting monitoring software. The only mitigating factor is that one of four of these teachers added that the monitoring could only occur during school hours.[187] Control often motivates the application of expensive software like Bark, Gnosis IQ, Gaggle, and Lightspeed.[188]

Sometimes, it is to recognize signs of mental health struggles, preempting any severe developments.[189] Other times, it is to flag potential academic challenges.[190] CDT's results reveal that, no matter how positive the intention, these purported safety benefits are countered by potentially harmful impacts on students' well-being.[191] Given how prevalent monitoring is, schools are without the justification for these excessive intrusions.

The effects of school-issued monitoring devices were only intensified by the COVID-19 pandemic.[192] In increasing the amount of technology delivered to students, schools had even greater reasons to increase their supervision of student activity. More technology invited more diligence required to comply with federal laws. An isolating pandemic meant a greater risk of mental struggles and stagnation of social development. Remote learning necessitated more flexibility in measuring student participation and engagement.[193] It is of no surprise then that out of the 86% of participating teachers who indicated that their

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[185] Crispin, *supra* note 152.
[186] Hankerson et al., *supra* note 153, at 8.
[187] Bridget McCrea, *Are Schools Disproportionately Surveilling Students Who Rely on School-Owned Devices?*, EDSURGE (June 15, 2022), https://www.edsurge.com/news/2022-06-15-are-schools-disproportionately-surveilling-students-who-rely-on-school-owned-devices.
[188] Crispin, *supra* note 152.
[189] *Id.*
[190] Rebecca Torchia, *What to Know About Student Privacy on School-Issued Devices*, EDTECH MAG. (Aug. 24, 2021), https://edtechmagazine.com/k12/article/2021/08/what-know-about-student-privacy-school-issued-devices.
[191] McCrea, *supra* note 187.
[192] Alyson Klein, *During Covid-19, Schools Have Made a Mad Dash to 1-to-1 Computing. What Happens Next?*, EDUCATIONWEEK (Apr. 20, 2021), https://www.edweek.org/technology/during-covid-19-schools-have-made-a-mad-dash-to-1-to-1-computing-what-happens-next/2021/04.
[193] *Id.*

schools were issuing twice the amount of school-issued devices, 80% of surveyed teachers reported that these devices included monitoring software.[194] Two chief findings arise from this mass investment in school devices. The first is that higher poverty areas are disproportionately monitored at higher rates than their peers.[195] This stems from the lack of access to personal devices at home. The use of students' personal devices leads to less reliance on school devices.[196] As a result, more disadvantaged students are at risk of pervasive monitoring, increased unwanted interaction with authority, and reach potentially malicious third-party actors.[197] The second primary concern is the deterrent effect of student expression online. The CDT survey reported this so-called "chilling effect," noting how students felt less comfortable being authentic online when they knew they were being monitored.[198] Their reluctance is not without good reason, for data collected through the software could be used out of context to discipline them or even capture sensitive information regarding sexual identity.[199] School-issued devices sit in a critical place right now. Without any recent federal legislation to address rising trials, states and the court of public opinion have been left to chart the path forward for these devices.

While only a handful of states have enacted comprehensive data privacy laws, thirty-five have adopted *student* privacy laws within the last decade. These laws all share one thing in common: strong protections for personally identifiable information.[200] However, not all of them specifically address the issues stemming from school-issued devices. Minnesota's Student Data Privacy Act, enacted this year, takes a stance on the matter, banning schools and their vendors from surveilling students via school-issued devices. The bill was passed unanimously and only allows for tracking in emergency situations.[201] The law seems to be the first of its kind because none of the other states, including the five with comprehensive data privacy laws, direct their protections against this brand of conduct at the schools. Instead, third-party vendors are provided with very narrow and clear responsibilities regarding student

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[194] Crispin, *supra* note 152.
[195] *Online and Observed*, *supra* note 153 at 10.
[196] *Id.*
[197] *Id.* at 11.
[198] McCrea, *supra* note 187.
[199] *Id.*
[200] *Colorado Jumps into Student Data Privacy Protection With New Privacy Law*, THOMPSON COBURN LLP (July 21, 2016), https://www.thompsoncoburn.com/insights/blogs/regucation/post/2016-07-21/colorado-jumps-into-student-data-privacy-protection-with-new-privacy-law.
[201] H.R. 2353, 92nd Sess. (Minn. 2022).

data. Therefore, monitoring by companies often is not feasible or outright not tolerated. Until states (or the Federal Government) take a hard stance on monitoring, school districts are not subject to these same limitations.

IV. PROPOSALS TO CURB EXISTING CHALLENGES TO VIRTUAL REALITY IMPLEMENTATION

What does the future of extended reality in the classroom look like? VR/AR technology hosts a vastly different scale and scope than any tech K-12 schools have encountered before. In the wake of decentralized student privacy laws, higher opportunities for misconduct with the technology, and general confusion surrounding the capabilities of the hardware, these devices are increasingly in need of clear regulation if they are to function sustainably in schools' curricula. These regulations have to target multiple actors and address a number of problem areas. In doing so, extended reality technologies will finally have the cohesion, reliability, and efficiency the field has been noticeably lacking.

A. Recommendations for Federal Regulatory Bodies

Moving forward, Congress has to establish a regulatory framework regarding what compliance looks like for VR/AR developers. States and foreign entities have invested substantially into propagating some of the strongest comprehensive data privacy protections that exist—federal silence has been noticeable as a result.[202] The greater the number of domestic territories establishing their own guidelines, the greater the regulatory uncertainty for companies, who have to balance numerous expectations with the potential for a national retooling of these rules. The legislature needs to leverage its preemptive capabilities to set the tone moving forward, in the process encouraging responsible innovation by companies and safer experiences for consumers.

In unifying existing laws around data privacy, the legislature should provide clarification on how existing legal structures like FERPA, COPPA, and CIPA will treat immersive technology moving forward. The three laws have not been strangers to revisions that account for the ever-evolving technological landscape and would benefit from another observance. COPPA, for example, both in its potential within the classroom and by minors purchasing the devices for other purposes, will certainly have a larger portion of its audience below the age of thirteen.

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[202] Holland, *supra* note 119.

Accordingly, both traditional COPPA-covered personal information like audio and visual recordings and geolocation data and more unique sensitive information like biometric data would all require some form of parental consent before they could be obtained.[203] Guidance on whether the collection of some personal information essential to the operation of the hardware may be appropriate without parental involvement would heavily benefit the technology. To the extent that any collected data by VR/AR hardware qualifies as personal information or any other listed data, it constitutes an educational record under the coverage of FERPA.[204] Therefore, parental consent again would be necessary before this data is given to third parties. Even so, Katherine and Jeff W.'s situation illustrates that schools will sometimes avoid this aspect and authorize the outflow of collected data.[205] Congress can take a stance on the matter in a revision to FERPA that resolves what parents should expect in regard to VR/AR in the classroom.

The comprehensive federal data privacy legislation should also address the seemingly worsening environment of misconduct blooming in virtual spaces. While there is a tactic that schools themself can adopt that will limit instances of students being subjected to harassment, cyberbullying extends past the walls of the school, so Congress should finally provide clear guidance to VR developers. At the moment, enforcement sits chiefly with these companies unless the cyberbullying rises to the extent of triggering state law.[206] Paradoxically, outside of the sheer lack of infrastructure to police the Metaverse, the largest concern these companies host is a lack of regulatory uniformity Innovation in VR/AR technology currently conflicts with rigid, consumer-focused protections that, when extended to emerging technology, frustrate the experiences it can provide. Clarity on the sensations developers can replicate might dilute some of the more distinctive misconduct available through applications. The introduction of alternative methods of remedy for harassed consumers, meanwhile, may encourage more companies to invest in effective enforcement vehicles. These approaches can resolve potentially conflicting compliance requirements and set clear standards for user protection for both existing and emerging practices in VR/AR.

The last clear thing Congress should prioritize is a general understanding of what extended reality technologies are. Implicitly, a level of understanding is necessary to legislate the required laws for the

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[203] Knutson, *supra* note 174.
[204] 20 U.S.C. § 1232(g); 34 C.F.R. § 99.3 (2011).
[205] Gebhart, *supra* note 143.
[206] *What is Cyberbullying?*, *supra* note 100.

technology to succeed, so this will prove to be a critical undertaking for the House and Senate. The two chambers have shown in recent years that they are not equipped to take on regulation of "Big Tech" as it stands,[207] from Senator Blumenthal's viral misunderstanding of how Instagram operates to Congressman Steube's interrogation of the Google CEO over the nature of spam folders. Competent and effective legislation requires some level of technological literacy, and given the complex, evolving nature of VR/AR, it would be optimistic to assume that things would be different this time. Even the California Privacy Rights Act started off and was, in substance, an initiative of *Californians for Consumer Privacy*, a private organization.[208] After the organization's ballot proposition passed, state legislators negotiated less restrictive regulations before enacting it.[209] For a federal regulatory environment, not only would there not be outsourcing of the hard work and research, but there would also be an expectation for the law to discuss virtual reality, something neither California nor the GDPR spoke to. Therefore, patience and diligence will be essential for the nation's lawmakers.

B. Recommendations for States

States will benefit significantly from the presence of a federal regulatory environment addressing AR/VR technology, given their authority over education. They have their own part to play, though, in creating a clearer understanding of how the hardware can be utilized in classrooms. Because of the current fragmented nature of data privacy, states have vastly different standards for compliance drafted with technology other than extended reality hardware in mind. To function effectively, extended reality hardware collects and operationalizes certain personal information to create the various virtual worlds and images at the heart of the technology. Compliance then with more strict state data privacy laws like California and Connecticut would all but

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[207] Brad Polumbo, *Senators Don't Understand Technology. How Can They Regulate It?*, WASH. EXAMINER (Oct. 02, 2021, 07:00 AM), https://www.washingtonexaminer.com/opinion/senators-dont-understand-technology-how-can-they-regulate-it.

[208] Daisuke Wakabayashi, *Silicon Valley Faces Regulatory Fight on Its Home Turf*, N.Y. TIMES (May 13, 2018), https://www.nytimes.com/2018/05/13/business/california-data-privacy-ballot-measure.html.

[209] Scott Lashway, *The California Privacy Rights Act has Passed: What's In It?*, JD SUPRA (Nov. 18, 2020), https://www.jdsupra.com/legalnews/the-california-privacy-rights-act-has-49371/.

make this immersion impossible. States should review certain standards imposed upon data collection processes that attach to AR/VR out of generality and explore potential carve-outs. This intentionality would expand rather than hinder the host of benefits offered by the technology in the classroom and would maintain cohesion with federal expectations.

Given that states have been active in implementing cyberbullying laws, most of the difficulty in this area has already been addressed. Instead, revisions to cyberbullying statutes similar to the FTC's updates of COPPA would prove valuable. With greater Federal guidance on VR/AR, states can reflect new understandings in their conceptualizations of harassment and unwelcome conduct. These new laws should then shape how schools navigate virtual conduct in the classroom.

C. Recommendations for Schools & School Districts

Schools and school districts will play pivotal roles in determining the sustainability of immersive learning. Federal and state continuity will pave the way for more access to extended reality technology within the classroom. It will be the decision of educational stakeholders to decide whether schools invest in the hardware. Given the often-higher price figures attached to the tech, it is not a decision that can be made half-heartedly. Schools will have to take a chance on the benefits immersion provides in a classroom. It is also not a decision that stakeholders, like the Legislature, can make without understanding what immersive tech is, how it can be implemented in the classroom, and the reported benefits attached to its use. VR, in particular, is fighting an uphill battle at the moment due to the general misunderstanding of how it actually functions, on top of the general unknowns surrounding its long-term impacts. Stakeholders will have to decide where they fall on the issue in order to cover any real ground. They should do so intentionally and with outside expertise if necessary. Pursuing inadequate or unproven virtual reality hardware will only harm schools. Districts should question every aspect of agreements with their vendors, from data management storage to cybersecurity procedures. Part of the investment is ensuring its worth.

If administrators do decide immersive learning is worth the investment, they should be careful to avoid the pitfalls that have surrounded the modern implementation of school-issued devices. As a preliminary matter, parental involvement will be fundamental to successful implementation. Many parents have voiced data privacy concerns vis-a-vis the issuance of laptops and tablets to their students without their knowledge. What is the likelihood that technology that

harbors those same causes for concern, on top of having a stigma as unsafe and unproven, will not raise red flags for parents? To circumvent this, schools should be upfront with desires about their ambitions to bring VR into the classroom. Hosting community meetings and other opportunities for families to learn more about how and why immersive learning is a worthy addition to the classroom. Ask them questions. Display a receptive candor to questions asked. Be transparent about funding pathways, as well as indicating which technologies are being pursued. This gives parents a chance to do their own research and make informed decisions about the future of their children's learning. Consent should be collected clearly and annually. This not only guarantees compliance with the major federal student data laws, but also provides families with the opportunity to respond to growing developments in VR/AR, whether positive or negative. And if they decide to opt-out, provide them with meaningful capacities to do so while guaranteeing a learning experience that won't penalize their students as a result. This can even be accomplished with incremental opt-out scenarios where it is how the personal data is managed, not the usage of the hardware itself, that is subject to choice. Together, these efforts will empower parents as stakeholders in their children's education, preventing unnecessary or otherwise encumbering challenges at the community level.

With the proper groundwork set, administrators should also pay careful attention to cybersecurity. Most data will likely be collected and stored by third-party vendors, but under the three pieces of federal legislation, the acts (or failures) of the vendors will be imputed upon the schools.[210] Therefore, routine assurance and review of the best practices of technology vendors will prevent widespread harm and liability of a potential breach. A lot of work can be alleviated on the part of school officials if they, if cost-allowable, hire a technology specialist within the school. The specialist can serve many purposes, fronting the intake efforts for new technology, fielding concerns from parents, helping equip teachers to handle immersive technology, and, relevant here, handling expectations and communications for third-party vendors. Collectively, an expert in the building or district will contribute to a secure educational technology environment, which benefits immersive learning at large.

The last major policy school administrators can implement is definitively establishing that school-issued devices, to the extent that they are VR/AR tech, do not leave the school. Normalization of the new technology might suggest similar treatment to laptops and tablets; in

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[210] Kozak, *supra* note 163.

fact, VR's opportunity for distance learning and its corresponding benefits are well documented.[211] However, the current terrain of virtual social environments is still too far from a respectful and minor-friendly culture to expose students to those risks. Harassment in apps like VRChat has already become popularized; parents, if they undertake even minute research, will uncover the susceptibility of the apps to inappropriate conduct. While much of this content would be filtered out regardless because of CIPA, schools, in an effort of transparency, should assure parents that the hardware will remain exclusively in the classroom and only involve educational programming or other school-appropriate material at all times. This will again lessen the anxieties parents might have for their children to be in uncomfortable situations similar to what Kelly Guillory experienced. It also addresses the monitoring culture growing across the nation. If the only access students have to VR technology is guided use in the classroom, harms stemming from monitoring are significantly decreased, as students will not have much opportunity for personal use of the devices.

D. Recommendations for Teachers

Teachers will play the role of primary intermediary between students and technology, meaning that the success of immersive learning will depend entirely on how they shape their implementation. Like governments and school administrators, they should make conscious efforts to understand the hardware coming into their classrooms. Their duty extends a bit further, though. Teachers should also be observing success stories like Mr. Huang's third-grade social studies classroom. Doing so allows them to pinpoint what creates successful instruction, as well as exposing them to tried-and-tested safeguards to protect students. Teachers should include students in their digital literacy efforts. The first wave of school-issued device implementation has not been accompanied by strong efforts to bolster student privacy and security techniques. Guidance in handling apps and other software, as well as maintenance of password-protected information, will prove invaluable to the proficiency and technology literacy of those most affected by immersive learning.

Establishing the curriculum (and VR/AR's role in it) will be the most pressing task for any teacher in this new regulated environment. While they will have guidance from every major stakeholder, it will be

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[211] Kavanagh et al., *supra* note 26, at 93–94.

their decision what aspects of a lesson to emphasize via digital immersion, how to best facilitate explorations into virtual worlds, and how much exposure students should have to the technology. One method to accomplish this might be reflecting not on what hasn't worked in the past but on what has. A misconception teachers are sure to have about the hardware is that these tools are designed to replace more traditional instructional methods. That is far from the truth and, if indulged, could create self-destructive conflict with its implementation. The hardware is truly supplemental, accentuating certain aspects of education. For instance, if an elementary social studies teacher is generally successful with teaching geography at a cartographical level, instead of replacing that lesson plan with a virtual one, they could create a digital incentive structure for students. If a state is accurately identified, that student is taken on a quick high-level tour of the state. Combating this mischaracterization of the hardware might lead to more organic reliance on it as an instructional tool.

If families opt out of an immersive curriculum, no matter the reason, part of the teachers' challenge will be designing a plan that respects this decision without ostracizing the students from engaging in lessons. This will be determinative of whether parental consent to VR/AR is meaningful or arbitrary. Streamlining achievement will require plenty of trial and error on the part of teachers; pedagogical differences in learning already exist without the presence of wholly unfamiliar technology. Assuming teachers make an effort to substantively engage with the mechanics of VR, that allows them to better prepare and respond to disparities in experience across classes. They are likely to find the most success in narrowing the availability of hardware to a handful, if not just one student, at a time. Such an approach necessitates exploring opportunities like projecting what a student with a headset sees onto a larger screen for the class to follow along with. In a setting like this, opt-out students are not being deprived of the core of the learning experience. It also tempers student exposure to the technology. Health impacts, while not necessarily inclined towards negativity, are unknown: stakeholders all around may feel more secure in limited but powerful chances to broaden class material at no expense to students.

Finally, teachers should be continuously showcasing the tangible benefits of immersive learning to parents and school administrators. When embarking on a journey into the unknown, reserving broadcasting of positive developments until too late could derail the momentum of the investment. Ms. Dopker, a science and technology teacher, incorporated

VR/AR for her eighth graders, emphasizing digital storytelling.[212] Integrating a lesson in video production into other topics like reading and history, Ms. Dopker tasked her students with creating their own stories utilizing different extended reality software. Students, as a base, crafted their own graphic novels about various historical events and then added accessory VR/AR components to enthrall users with the landscape.[213] Ms. Dopker accomplished this with access to a limited number of headsets and substantial preparation. She then had the students share these immersive graphic novels at a school book club event for families. Parents themself had the opportunity to use the headsets to experience their children's creations.[214] Ms. Dopker's unique presentation serves as an example of the community benchmarking needed for holistic buy-in to immersive education. By highlighting the particular advantages the new addition to instruction could offer and presenting it directly to the most concerned, she has presented teachers with a blueprint for how to leverage technology in the best way possible.

CONCLUSION

Ultimately, the path to sustainable implementation of immersive technology in K-12 schools moving forward will depend upon the cohesion of various stakeholders. The emerging hardware has garnered mild success permeating a handful of school districts around the nation, but many obstacles are to be overcome before it is widely embraced by educational officials. School-issued devices have already invited challenges from families; the uncharted nature of extended reality will only aggravate these concerns. Meaningful access and application are unlikely to occur unless the Federal Government provides some level of guidance going forward. A regulatory framework and a patient, diligent understanding of the hardware will establish the necessary guidance companies need to help the technology succeed in the classroom. Until then, companies, states, and school districts alike will chart fragmented courses, and students will miss out on the novel experiences only extended reality can provide.

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[212] Sobel & Jhee, *supra* note 1.
[213] *Id.*
[214] *Id.*