

Remote Learning

Introduction

The COVID-19 pandemic forced school closures in March 2020, affecting 1.5 billion learners across 173 countries, approximately 84.3% of all enrolled learners globally¹. Many pK-12 teachers, schools, and educational programs had to quickly adapt their regular practice and curricula to remote learning. Educators compiled synchronous and asynchronous solutions using digital tools tailored to their students' proficiencies to help ease the transition to online assessment — including short videos, music, and real-time exercises that encourage conversation²— and with this, teachers strategically designed synchronous activities to build community, amplify student voices, and encourage critical thinking. Courses were often restructured to focus on group activities, projects, and a growth mindset rather than completing a more traditional curriculum that prioritizes assessment through exams.

However, many challenges that have existed for marginalized groups (such as girls, disabled students, and students without reliable internet access) are exacerbated when students are learning from home. Nearly 11 million girls are at risk of not returning to school, especially girls aged 12-17 in lower-income countries³. Although low- and lower-middle-income countries are in need of more funding in the wake of the pandemic, two-thirds have cut their public education budgets⁴.

Challenges unique to the pandemic also made the transition to remote learning difficult. Student motivation was the hardest thing to recapture in a world of tremendous loss — loss of daily routines, loss of socialization, loss of after school activities, and most profoundly, the loss of loved ones to COVID-19. On top of this, school systems tried to replicate typical classroom practices over Zoom, many of which did not translate well over screens. For example, younger pK-12 students require direct adult supervision with internet-capable devices, which has not always been available when students' caretakers are working, or have multiple children to oversee. Even when adult guidance is available, the supplemental apps that provide curriculum sources for asynchronous content delivery have overwhelmed both students and parents alike. Increasingly constrained schedules have also prevented educators from covering their typical curriculum, yet few school districts in the United States have modified their requirements⁵.

¹ UNESCO (March 2020). "[Education: From disruption to recovery](#)"

² Brookings (March 2021). "[With digital savvy, teachers can enliven America's classrooms](#)"

³ UNESCO (March 2021). "[Girls' education and COVID-19: New factsheet shows increased inequalities for the education of adolescent girls](#)"

⁴ UNESCO (February 2021). "[COVID-19: Two-thirds of poorer countries are cutting their education budgets at a time when they can least afford to](#)"

⁵ Reich, J. (March 2021). "[J-WEL Connections: Lesson Learned from Remote Learning](#)"

Though this is not the case everywhere, as some locations across the globe have made changes as large as outright canceling traditional end-of-year exams in favor of learners' well-being.⁶

Nevertheless, when we examine the efficacy of remote learning practices of the last year, context matters. Negative language like "learning gaps," "learning loss," and "deficiencies" overlooks the fact that students have adapted to massive disruptions to their schooling, acclimated to new technologies, overcome intense socio-emotional difficulties, and still managed to learn parts of the curriculum despite all of these challenges. Focusing on the "average" learner does all learners a disservice. When educators not only meet individual learners where they are but instead ask for student input about the future of schooling, students will prove their capacity for learning is even greater than previously acknowledged.

MIT's Response

MIT was uniquely positioned to address the challenges of remote learning even prior to the pandemic. MIT has deep experience with digital tools and pedagogies for both the physical classroom and online practice, embodied through MIT's motto, "*mens et manus*" ("Mind and Hand"),. For example, J-WEL itself is housed in MIT Open Learning, home to the revolutionary MIT digital learning efforts including MIT OpenCourseWare and MITx. Across the institute, MIT's pedagogy is infused with an entrepreneurial, problem-solving mindset grounded in real-world applications. The power of the MIT community has generated transformative educational solutions that aim to resolve the inequities that existed before COVID-19 compounded those problems.

One community outreach initiative that MIT launched in March of 2020 was [Full STEAM Ahead](#) (FSA), which provides research-based hands-on learning opportunities for preK-12 students around the world. The initiative began by offering open, online access to high-quality learning materials through an online platform. This led to the creation of 10 curated learning packages based on science, technology, engineering, arts, and mathematics (STEAM) learning activities for pK-12 educators, learners, and parents in addition to the other online resources. FSA also launched online remote programs facilitated by college mentors. These programs, which benefited middle school and high school age students, have successfully demonstrated that remote learning can be a collaborative social learning experience for both students and mentors.

MIT was also able to migrate some existing programs and resources that had remote elements to being fully online. The Beaver Works Summer Institute (BWSI) revamped remote versions for seven of their project-based, workshop-style courses for 7th and 8th grade students, rising senior students, and public schools and teachers conducting STEM courses. They served 178

⁶ Welsh Government (2020). "[Wales' approach for qualifications in 2021 confirmed by Education Minister Kirsty Williams](#)"

students across 101 schools. BWSI plans to continue integrating these new remote programs in the coming years, which would increase the program's participation substantially.

[MIT Office of Engineering Outreach Programs \(OEOP\)](#) was able to convert two of their three programs for pK-12 students into completely virtual experiences. MIT Online Science, Technology, and Engineering Community (MOSTEC) is a six-month science and engineering program for rising high school seniors from across the country. Two hundred and thirty one students completed two online courses; discussed research; completed 83 group projects for the virtual [Final Symposium](#); and attended webinars by MIT Faculty, researchers, and other STEM professionals. Saturday Engineering Enrichment and Discovery (SEED) Academy (for 7th through 10th grade students in the Greater Boston Area) surveyed students' access to technology, adapted class materials to fill three virtual enrichment sessions with both STEM content and soft skills to help students cope with the new virtual learning reality.

Similarly, MIT and the NSF Science and Technology Center on Emergent Behaviors of Integrated Cellular Systems (EBICS) created Broadening Engagement through Engineering At MIT ([BEEAM](#)) as a year-round high school science education and research intern program for rising high school juniors and seniors in the Greater Boston Area. When the [BEEAM 2020 Summer Cohort](#) kept students engaged throughout the transition to distanced learning and research conducted at home.

[Educational Studies Program \(ESP\)](#) offers academic and non-academic classes developed and taught by MIT students, alumni, and faculty to middle grade and high school students in the Boston area. Their motto "teach anything, learn anything, do anything" encourages students to engage in independent study for the subjects they are most interested in taught by teachers who are passionate about those subjects. ESP's Spark and Splash programs pivoted to virtual offerings in 2020.

Challenges of Remote Learning

Lost Routines and Classroom Culture

If "culture" is the learned habits practiced by a group of people to reflect their socially transmitted traditions, then for remote learning, students are extracted from the learned habits of classroom culture and relocated to the context of home culture, which has its own expectations and traditions. Moving students from the brick-and-mortar classroom to the virtual classroom at home removes students from their daily schooling routines and learning contexts with the expectation that students will recreate classroom culture within their existing home routines. Now more than ever, educators need to understand how the cultural and contextual differences of learners affect their ability to learn.⁷ The remote learning experience needs to be individually designed for each learner with their specific home cultural contexts in mind. A remote learning

⁷ National Academies of Sciences, Engineering, and Medicine (NASEM). (2018). How people learn II: learners, contexts, and cultures. Washington, DC: The National Academies Press.

community needs to be crafted intentionally in a way that respects the culture of home but is also conducive to learning goals.⁸

Student Motivation

With the new context of remote learning, many educators struggled to motivate their students through two layers of computer screens.⁹ As Jim Goodell (Senior Analyst, QIP) and Aaron Kessler (Senior Learning Scientist, MIT) indicate in their report “[The Science of Remote Learning](#),” before educators can engage in “higher” levels of motivation for learning, students’ “basic survival needs (e.g. not starving, feels safe) and psychological needs (e.g. belonging, esteem) must ‘more or less’ be met.” Once again, educators, schools, and administrators must consider the cultural contexts, routines, and responsibilities of learners’ home lives.

Students have other internal motivations for participation that should be encouraged. Educators can spark learners’ innate sense of curiosity if students are allowed to choose projects that are of personal interest to them. Additionally, students cited the loss of their social environment as one of the primary things they missed about school⁴. If educators facilitate group projects during synchronous learning time, students’ desire for facetime with friends can also help them further their academic pursuits.

Exacerbated Inequities

For brick and mortar schools, educators and policy makers provide access to classrooms through methods such as providing transportation or creating laws for mandatory attendance. For remote learning, the means of access look different. Students need internet-capable devices, reliable internet connectivity, regular check-ins and supplemental support, and virtual “classrooms.” Inequities in device distribution, connectivity, individual learning contexts, available learning resources, and communication channels between schools and families can further impact students’ learning abilities.¹⁰ Additionally, students might have compounded issues in a remote learning context. Learners who have limited technology access might also have parents or responsible caregivers who are essential workers, household or childcare responsibilities of their own, and/or crowded housing conditions that don’t allow for a focused learning space.⁶ As Paul Attwell reported in his article “The First and Second Digital Divides,” “low-income, nonwhite children more often used technology in math class for drill and practice, while affluent, white children were more likely to use technology for graphing, problem-solving, and other higher-order exercises.” Although his findings were published nearly 20 years ago, these same inequities still exist today.¹¹

⁸ Goodell, J. & Kessler, A. (2020). “[The Science of Remote Learning](#).”

⁹ Reich, J. et al. (2020). “[What’s Lost, What’s Left, What’s Next: Lessons Learned from the Lived Experiences of Teachers during the 2020 Novel Coronavirus Pandemic](#)”

¹⁰ Goodell, J. & Kessler, A. (2020). “[The Science of Remote Learning](#)”

¹¹ Attwell, Paul. 2001. “Comment: The First and Second Digital Divides.” *Sociology of Education* 74(3): 252–259.

Internet Connection

While many schools were forced to pivot to remote learning in 2020, the majority of remote learning solutions (over 75%) available in the United States during the height of the pandemic relied on online platforms, despite nearly 47% of primary and secondary school-aged learners (roughly 465 million children) not having internet connections at home. That lack of access applies to roughly half of all people on a global scale as well (approximately three billion people).¹² That inequity prevents learners from successfully transitioning to a solely-online learning experience. Unreliable access is also a barrier. Poor internet or audio connections can lead to students tuning out of synchronous video lessons, or even dropping out of remote learning entirely.¹³

Student Supplemental Support

Learners' supplemental support needs for remote learning might differ from their in person learning. Some students who thrived in physical schools might struggle with remote learning. Additionally, the existing supplemental support for students from the physical classroom will need to be adapted to the remote learning context. Educators will need to assess the new needs for every learner, and develop new teaching strategies and staffing plans.⁶

Home Environment

There are other factors in the home environment besides internet connectivity that contribute to the success of remote learning. Many students are unable to take responsibility and ownership of their own learning. What happens if parents or caregivers are unable to provide supervision to accessing synchronous videos and other digital tools? For asynchronous activities, would they be able to provide academic support if they don't speak English? Are there other distractions and responsibilities that students have at home that would prevent them from focusing on their learning (i.e. other people at home, no isolated/dedicated space for learning, looking after siblings or grandparents while their parent is working an essential job, etc.)?

Teacher Burnout

Additionally, policy makers must also consider the social-emotional well-being of educators. Teachers also have their own COVID-related stressors, including concerns over health and safety, job security, and competing priorities at home. Some teachers experienced a sense of professional loss when adapting their pedagogies online, feeling they had been rendered a novice again. The pandemic accelerated pK-12 education's already high rates of burnout and turnover.

As we discussed in our report on Mental Health and Social-Emotional Learning, the researchers Oberle and Schonert-Reichl found that higher levels of teacher burnout correlated with higher

¹²UNESCO. "[Connectivity: Making universal connectivity a reality](#)"

¹³ Hawthorne, S. (2020). "[Impact of Internet Connection on Gifted Students' Perceptions of Course Quality at an Online High School](#)"

stress levels in students. Based on that study, Oberle and Schonert-Reichl recommended increasing support, resources, and professional development opportunities to prevent burnout and foster well-being among teachers.

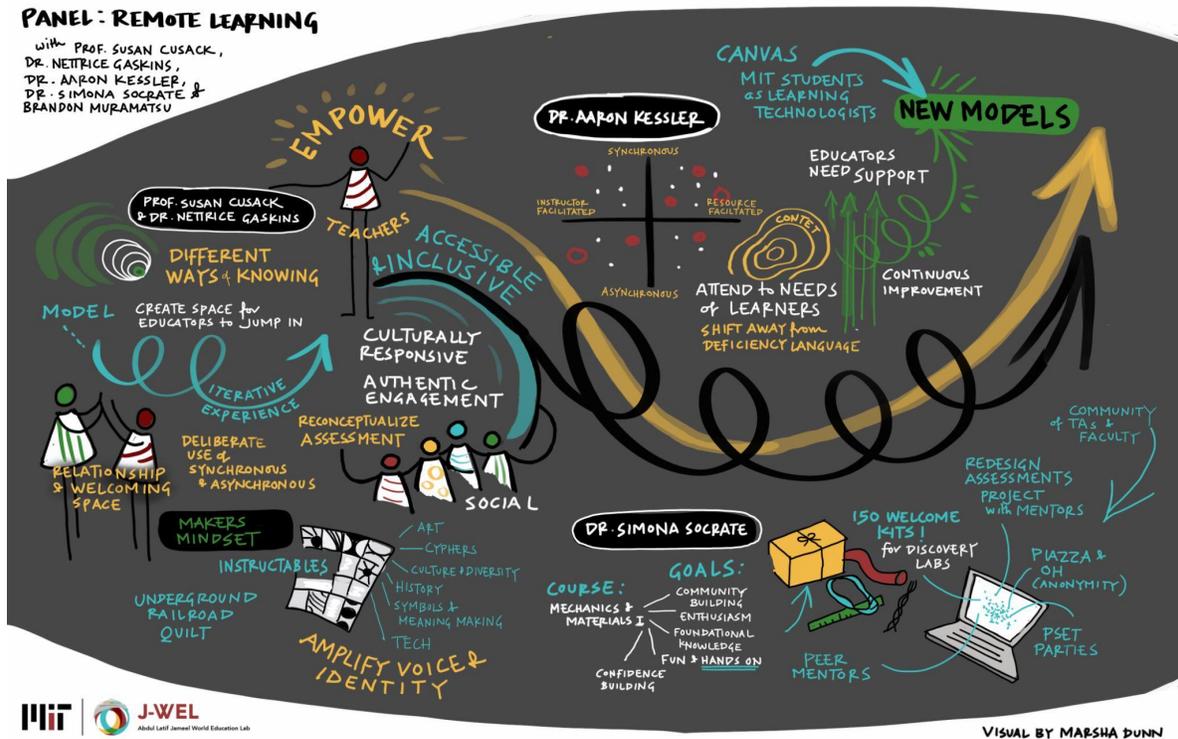


Figure 1: Graphic record from the Remote Learning panel With Prof. Susan Cusack, Lesley University, Dr. Nettrice Gaskins, Lesley University, Dr. Aaron Kessler, MIT, and Dr. Simona Socrate. MIT at the J-WEL Connections event in March 2021

Potential Solutions for Remote Learning

Design Process for School Planning

In a series of charrettes with a variety of school stakeholders (students, teachers, principals, district leaders, parents, consultants, state officials, and more), Reich and Mehta identified seven themes of the design process for school planning:

1. Building strong relationships are the key to success across an educational enterprise, from students, to teachers, to administrators.
2. In addition to building stronger relationships between learners and educators, schools need to build stronger partnerships with families and communities. Students' learning environments away from school need to encourage them to complete the lessons.
3. Equity must extend beyond its traditional focus of elevating academic achievement for underserved students. School systems must examine their structures, processes,

pedagogies, and culture, and establish new learning experiences that are relevant, purposeful, and meaningful for all learners.

4. Amplify students' agency in the classroom and during school design processes.
5. Since schools have lost classroom time during the school year, schools will need ways to prioritize the curriculum and discard what is not essential.
6. Optimize how to use limited in-person time, versus which learning activities can be completed successfully at home.
7. Adaptation is key. During a time that has upended daily educational practices, designing new processes for school planning should provide time, space, mechanisms, and flexibility, in order to facilitate continuous learning and improvement.

Supporting Social-Emotional Learning

Before addressing content learning, educators must prioritize students' social-emotional learning (SEL) and mental health. Students participating in SEL programs can improve their academic performance in core competencies, their classroom behavior, their increased ability to manage stress and depression, and their attitudes towards themselves, their peers, and their school.¹⁴ Education during the pandemic has placed a greater emphasis on building trusting relationships and fostering safe and welcoming spaces for students. Unfortunately, the pandemic has placed a strain on existing mental health resources, while also worsening some of the mental health challenges already affecting students. Policy makers need to expand more comprehensive social welfare systems for children and families.

Possible interventions include integrating well-studied SEL programs and mindfulness practices into students' school day, as well as exploring resilience-building frameworks like systems thinking and growth mindsets. These are evidence-based interventions that have been successfully adopted by school boards in cities like British Columbia, Canada and into teacher education programs, which are more and more recognizing the important role of the education community in supporting students' mental well-being. Recent research in neuroscience demonstrates that children's brains are able to adapt, change, and rewire in response to new information and experiences, suggesting that such interventions can be implemented at any point in students' learning. In the past year, teachers have also developed new and adapted methods for screening and preventing mental health concerns, including finding ways to prioritize opportunities for social connection in remote learning environments.

Engaging Individual Student Motivations

Pedagogies that work in the physical classroom might not transfer to the virtual classroom. As a result, remote learning can be an opportunity to engage students in other creative ways. Extrinsically-motivated learning methods (i.e. grades and attendance) are less effective than fostering intrinsically-motivated learning methods (i.e. student-centered, engaged learning, etc.). Motivations can derive from a variety of sources: meaning, accomplishment, ownership, scarcity, avoidance, unpredictability, social influence, and empowerment.⁶ Educators can utilize

¹⁴ Collaborative for Academic, Social, and Emotional Learning (CASEL). (2020). ["Benefits of SEL"](#)

some of the positive categories of motivation in remote learning if students are empowered to select projects and activities are personally meaningful to them that will give them a sense of accomplishment.

To engage individual student motivations intrinsically, the nonprofit education research and development organization [CAST](#)'s "Universal Design for Learning Guidelines" recommends providing multiple means of engagement, multiple means of representation, and multiple means of action and expression.¹⁵ Highlighting the relevance in a learner's life by optimizing autonomy in their own learning might help self-regulate distractions. Providing different options for the way information is displayed, whether visually or auditorily, offers a chance to meet learners where they are. This is also an opportunity to frame failure as "what they do not know" rather than a measure of self-worth, and how they can change their learning strategies to better understand the material next time.¹⁶

Agile Curriculums and Modalities

Designing new learning strategies and staffing plans is essential in the pivot to remote learning. Many educators relied on virtual modalities during the pandemic, but reliable internet connection is not guaranteed for all students. Facilitating a learning experience that includes a variety of hands-on learning methods, tools, and communication styles will increase the chance of finding the optimal student motivation.¹⁰ Some non-internet-based approaches to remote learning include: printed material pick-ups/drop-offs with phone call check-ins from teachers and distribution of materials via radio or television. Some internet-based approaches include synchronous video conferencing, social media, gaming platforms, and asynchronous video sharing on platforms like [FlipGrid](#) and [VoiceThread](#).

Furthermore, many of the discussions surrounding schools reopening focus on the logistics of safely returning to the physical classroom, rather than optimal learning environments. Many of the remote learning solutions were adopted hastily in reaction to the sudden needs during the pandemic. But if schools can evaluate best practices from the last year and look forward to intentionally design agile curriculums, educators and learners alike will be able to adapt amidst future uncertain situations. Reich, J. & Mehta J. (2020) "[Imagining September: Principles and Design Elements for Ambitious Schools during COVID-19](#)" found that if schools aim to develop a strong educational foundation, they should develop a set of shared values, a few simple common structures, and many local experiments (conducted with room for reflection, learning, and improvement).

Resources for Agile Curriculums and Modalities

¹⁵ CAST (2020). "[Universal Design for Learning Guidelines](#)"

¹⁶ Rowland, C.A. (2014). The effect of testing versus restudy on retention: a meta-analytic review of the testing effect. *Psychological Bulletin*, 140(6), 1432-1463.

UNESCO has compiled a repository of globally-sourced resources for educators and school administrators to adapt their curriculums for remote learning.¹⁷ They supply multiple systems within the categories of: psychosocial support; digital learning management systems; basic mobile phone systems; mobile reading applications; strong offline systems; Massive Open Online Course (MOOC) Platforms; self-directed learning content; collaborative platforms that support live-video communication; tools to help teachers create digital learning content; and other external repositories of distance learning solutions.



Figure 1: Graphic record from Prof. Justin Reich's keynote session at the J-WEL Connections event in March 2021

Connectivity

If creating an internet-based plan, schools and school systems must first provide internet-capable devices to every student, not just one device per family. The administration should consider re-allocating physical facility funds (e.g. heating and cooling buildings) in order to procure and distribute additional devices. To ensure internet connectivity once students have access to devices, school systems with WiFi-enabled buses could park strategically around the district, or administrators could work with local internet providers and external funders to offer free or low cost hotspots to those in need.⁶

¹⁷ UNESCO (2020). "[Distance learning solutions](#)"

UNESCO's Global Education Coalition's goals to address the issue of connectivity target five action items¹⁸:

1. Improve the availability and affordability of connectivity through partnerships with telecoms and other internet service providers.
2. Develop greater digital skills and capacity for teachers, learners and policy makers.
3. Establish a "right to connectivity" to update the modern understanding of the right to education
4. Leverage UNESCO's knowledge base to share resources about previous responses to school closures and education systems.
5. Research the specific impact of different remote learning responses during the COVID-19 pandemic.

Tutoring and Mentorship

In 2020, the United States invested approximately \$42 billion in high-impact tutoring and saw "substantial" effects in schools. Tutoring provides an average of 4 months additional learning in elementary literacy and almost 10 months additional learning in high school math.¹⁹

MIT J-PAL conducted an evidence review of "[The Transformative Potential of Tutoring for preK-12 Learning Outcomes](#)," and found across all of studies in their analysis, tutoring programs consistently lead to improvements in learning, which overall, elevates students from the 50th percentile to nearly the 66th percentile. They also found that tutoring programs led by educators or paraprofessional tutors are generally more effective than programs that use volunteer or parent tutors. Although the effects of tutoring programs tend to be more effective for students in earlier grades, some programs at the secondary level were also found to be effective. (Specifically, reading tutoring tends to be more effective for students in preschool through first grade, while math tutoring tends to be more effective for students in second through fifth grade.)

The National Student Support Accelerator's pilot program (introduced through 10 local education agencies across seven states) found that in order to ensure quality, the implementation policy required each participating tutoring program to have either independent, experimental evidence of effectiveness at improving student learning, or these five features:

1. Tutoring is embedded in existing schools either during the school day, immediately before the school day, or immediately after the school day (whereas J-PAL found it more effective to embed within the school day)
2. A minimum of three sessions per week
3. A consistent tutor who is supported by ongoing oversight and coaching, which by J-PAL's recommendations, should be a teacher or a paraprofessional

¹⁸ UNESCO. "[Connectivity: Making universal connectivity a reality](#)"

¹⁹ Loeb, S. & National Student Support Accelerator (2020). "[Addressing Learning Gaps with High-Dosage Tutoring Interventions](#)"

4. Tutoring sessions informed by data
5. Materials aligned with research and state standards

Another study carried out in Italy by Michela Carlana of the Harvard Kennedy School and Eliana La Ferrara of Bocconi University, "[Apart but Connected: Online Tutoring and Student Outcomes during the COVID-19 Pandemic](#)," found similar benefits when evaluating the impact of individual tutoring with disadvantaged students over even a short five-week period. Volunteer university students who worked with middle school age students for at least 3 hours per week led to increased academic performance, improved social-emotional skills, and psychological well-being. Their findings also suggested that these effects were even more prevalent with both families having lower socioeconomic status and populations of immigrant children.

Research indicates the effectiveness of tutoring programs with “dosage” requirements, structured sessions, tutor coordination with schools, and experienced tutors had positive effects on student learning.²⁰ Tutors did not necessarily have to be teachers, but they had to be socially, culturally, and instructionally competent, and prioritize student equity, safety, and cohesion. Examples of paraprofessional tutors could include school staff members, undergraduate students in education, and service fellows. Tutoring allows educators to identify and address individual student needs, and build trusted relationships while students are isolated with remote learning.

Additionally, there is an inherent benefit for students who receive any type of mentorship. For example in [MIT Full STEAM Ahead’s Fall 2020 program](#), participants learned interdisciplinary STEAM content that challenged them to construct projects, create visuals and videos to communicate their ideas, and collaborate as teams with individuals they had never met in person. The key factor for success was having a strong cohort of university student mentors who not only facilitated the educational activities but primarily served as mentors who were able to create welcoming, stable communities for K-12 students who often were dealing with feelings of isolation and anxiety as a result of sheltering-in-place advisories. More research is pending. However, preliminary data suggests that individualized and group attention generally reaps greater positive outcomes for learners, even in remote settings.

Conclusion

While some are clamoring for a “return to normal” for life before the pandemic, many educators do not want to return to old pedagogical practices because the prior status quo left many students from the most vulnerable populations underserved. The lessons learned from trying to reach disadvantaged students with remote learning should be carried forward even as we return to the physical classroom. Practices such as expanded social welfare systems, individualized modalities that meet learners where they are, and consistent tutoring will address student needs whether they’re learning from home or from their school classroom. Additionally with the boom

²⁰ Heinrich et al. (2014). “Improving the Implementation and Effectiveness of Out-of-School-Time Tutoring”

in research surrounding best remote learning practices, educators and policy makers should take heed to implement the learning science findings from resources such as Kessler's "[Science of Remote Learning](#)" as the globe reflects on this continued adoption of remote learning to design more effective blended learning opportunities for students around the world.