Creating Conditions for Powerful Technology Use: Teachers' Technology Journey in Puerto Rico

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Abstract: This study explores the ways in which teachers in Puerto Rico are currently increasing their effective use of technology for their instructional practice through expanded access to professional learning opportunities and supports. The aim of this study was to gain insight about the effectiveness and impact of professional learning supports for technology integration and use, including competency-based micro-credentials, for educators. This report synthesizes the findings from the perspective of 14 teachers on their technology journey as well as from larger island-wide surveys and data. It sought to identify patterns and trends, as well as common structural barriers and opportunities, influencing the professional learning and development of teachers around their use of technology as part of their classroom practice.

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Introduction

Instructional technology is a critical component of teaching and learning in today's world. Technology, when aligned to research-based practices, supports teachers in delivering instruction that is adapted to meet the needs of all students. But it's not enough for teachers to simply use technology tools. Teachers need to be able to effectively use technology, including selecting appropriate tools and integrating technology into the curriculum in order to have impactful technology use. Impactful technology use is the ability of educators to use technology to develop their students' skills in six imperative categories: agency, collaboration, communication, creativity, critical thinking, and ability to select relevant technology tools. During the past decade numerous reforms and interventions have been introduced with the aim of improving technology use by teachers in classrooms across Puerto Rico. These efforts have largely been focused on two areas: 1) technology device acquisition and distribution and 2) professional development for educators on use of devices. As part of a series of projects funded by the Puerto Rico Department of Education (PRDE) starting in 2020, the Puerto Rican-based educational organization Global Education Exchange Opportunities (GEEO) partnered with Digital Promise Global (Digital Promise), a national non-profit with a mission to close the Digital Learning Gap, to lead professional development efforts aligned with the PRDE's goals for instructional technology from May 2020 through August 2021. Due to the ongoing COVID-19 pandemic, learning opportunities and engagements during the project took place virtually. Digital Promise and GEEO's efforts were grouped around three interventions: 1) virtual learning opportunities, 2) micro-credentials, and 3) coaching.

Despite the immense challenges of the pandemic that forced many aspects of the project to shift, the project represented a significant change in Puerto Rico's approach to supporting teachers with technology integration. Namely, this was the first formal introduction of competency-based professional learning through micro-credentials in Puerto Rico. To support current implementation and to provide insights to shape future implementation, Digital Promise examined teachers' experiences with technology and professional learning through a series of case studies. It was intended that the insights gained through this case study would be of value to school leaders, education agencies, and policy makers, both in Puerto Rico and beyond in their work to improve instructional technology use and integration.

Methodology

Case Study Design

The qualitative research design chosen for this study was a case study[1]. The case study allowed for an exploration of educational systems in Puerto Rico through the experiences of a focused group of educators to understand how they may reflect the experiences of teachers across Puerto Rico through multiple sources of data. From October 2020 through June 2021, survey data were collected and focus groups with teachers were conducted. The qualitative data were coded by themes to identify connections. Categories of codes included: teachers' experiences with technology and professional learning in Puerto Rico, teachers' individual perspectives of technology use, and teachers' personal development. These analysis categories provided a framework for interpreting other data points collected over the course of the project, as well.

Research Questions

This study addressed the following questions:

1. What do teachers think they need to know and do to effectively integrate technology into their practice?

2. How satisfied are teachers with professional development, micro-credentials, and coaching as mechanisms to support their use of technology in their practice?

3. What supports do teachers still need to effectively use technology?

Selection and Participation

In October 2020, Digital Promise facilitated the first in a series of kickoff workshops to introduce educators and school leaders in Puerto Rico to micro-credentials. It included information about what micro-credentials are, how the micro-credential platform works, how to set up an account in the platform, and choose the first micro-credential to earn. Before and after the workshop, the 3,803 participants who registered for the workshop were asked to complete a pre-survey. We received 2,026 responses.

The pre-survey asked educators about their willingness to participate in a case study. After receiving their responses, Digital Promise randomly selected participants who expressed interest in the case study and reached out to them to confirm their participation. Digital Promise ensured that the randomized sample included participants from all seven regions in Puerto Rico. As a result of the outreach, 25 participants initially elected to participate in the case study. Digital Promise asked the selected participants to commit to the following:

- Respond to all emails in a timely manner

- Participate in two of the three focus groups (December 2020, March 2021, and June 2021).

- Earn at least three micro-credentials between November 2020 and June 2021.

- Complete a mid-year survey (February 2021).

- Complete the post-survey (June 2021).

[1] Creswell, John W. (1994). Research design : qualitative & quantitative approaches. Thousand Oaks, Calif. :Sage Publications

To compensate and thank educators for their time, Digital Promise committed to provide a $100 gift card to participants who met the criteria at the end of the case study. After the initial outreach, 14 educators participated in the case study.

The 14 participating educators had a wide range of years teaching in primary, middle, and secondary schools, and their subjects included, but were not limited to, physical education, adapted physical education (special education), Maestro Recurso Uso de la Computadora (MRUC), math, visual arts, Spanish, and English. The participants were from the following regions (see table 1). Most of the schools in these regions struggle with internet connection, especially ORE de Mayaguez and ORE de Ponce. In 2020 the Department of Education provided laptops to some students while others are still waiting to receive them this year.

Table 1. Number of case study educators by region

Region	Participants	Area
ORE de Arecibo	1	Rural
ORE de Bayamón	2	Urban
ORE de Caguas	3	Rural
ORE de Humacao	2	Rural
ORE de Mayaguez	1	Rural
ORE de Ponce	3	Rural
ORE de San Juan	2	Urban
Total	**14**	

Data Collection

Digital Promise developed a mid-survey and a post-survey for educators in Puerto Rico engaged in the GEEO project, including the case study participants. We received 14 pre-survey responses, nine mid-survey responses and five post-survey responses from the case study participants (see table 2). Digital Promise conducted three rounds of focus groups. One in December 2020, one in March 2021, and the last one in June 2021. The focus groups were conducted in virtual groups of five people or less for approximately 50 minutes and audio was recorded. We asked questions about their experience engaging with micro-credentials, coaching, and other tech-related and professional learning questions.

The surveys and the focus group protocols were designed by the Digital Promise team and shared with the GEEO team for feedback. All surveys were administered in Spanish and all focus groups were conducted in Spanish. Once the focus group audio recordings were transcribed, Digital Promise analyzed and summarized the data. Given that the post-survey had significantly fewer number of participants than the pre-survey and mid-survey, a longitudinal case study was not performed based on these results alone. Instead, this

case study presents the results from the focus group analysis and uses the aggregated data from the surveys (from all participants, not only the case study participants) for comparisons and trends. The findings presented thus represent the results of qualitative data analysis drawn from the case study focus groups and the quantitative data represent the results from the surveys administered to the larger group of educators to best provide insights and recommendations for use in the field. Findings that mention teachers in Puerto Rico refer to the case study participants unless it is specified that the finding was drawn from the larger aggregated data.

Table 2. An overview of the data collection instruments, timeline, participation, and purpose.

Data Collection Method	Date	Number of Responses from Educators	Number of Responses from Case Study Participants	Purpose
Educator Pre-Survey	October 2020	1,995	14	To gain context on the participants' experience with technology and coaching, and familiarity with micro-credentials.
Educator Focus Group 1	December 2020	N/A	14	To understand the challenges and successes in their practice, the areas for improvement, and their experience with micro-credentials and coaching.
Educator Mid-Survey	February 2021	65	9	To gather feedback on their experience with the micro-credential process, changes in their technology use, and the level of support and coaching they received from their schools.
Educator Focus Group 2	March 2021	N/A	3	To understand the challenges, successes, and progress in their practice, the areas for improvement, and their experience with micro-credentials and coaching.
Educator Post-Survey	June 2021	59	5	To gather feedback on their experience with technology, micro-credentials, and coaching, and the level of satisfaction with the project.
Educator Focus Group 3	June 2021	N/A	3	To understand the challenges and successes in their practice, the areas for improvement, and their experience with micro-credentials and coaching.

The following section provides a summary of the findings. Since this is a case study report, the findings do not represent the results from the entire population of educators in Puerto Rico. The findings note where further research is necessary and recommended to examine specific areas.

Findings and Analysis

Technology and Remote Learning

Teachers in Puerto Rico were facing the unprecedented challenges of the COVID-19 pandemic throughout the study. Teachers' technology use significantly increased in comparison to pre-COVID school years, and they needed to find new tools and resources that would help them reach their students. When asked about their ability to effectively integrate technology into their practice, teachers expressed that it was difficult to transition to teaching with technology, citing current electrical and broadband infrastructure, exacerbated by recent hurricanes and earthquakes, as key barriers. Teachers feel that the lack of technology resources for teachers and students, paired with slow internet connection, do not motivate them to use technology in their practice. During the first focus groups in, two participants also shared that they were unable to effectively integrate technology into their classroom due to a lack of devices and had to obtain laptops through donations.

These concerns were largely connected to overall feelings about the lack of support for teachers in their use of technology from the Department of Education. When asked about their satisfaction with current professional development opportunities to support their use of technology, most educators expressed their dissatisfaction with their professional development experiences and the level of financial support for professional development opportunities that the PRDE provides to schools. Teachers stated that there was not enough targeted training, especially on technology tools.

Findings revealed that teachers currently receive very little support for their use of technology beyond what they learn from other teachers, and were largely in want of more. Teachers want more workshops and learning opportunities from the Department of Education and their schools that are tailored to their needs, subject areas, and level of knowledge. For example, teachers noted that the resources needed in one specific subject area, such as math, was not the same as those needed by instructors in another subject area, such as special education. Similarly, there is a feeling that workshops are helpful to a certain extent, but they often provide too much information at once or are overlapped in their calendars. This added to teachers feeling overwhelmed, as they receive so many invitations to attend mandatory workshops from the PRDE, and they do not feel empowered to make their own decisions regarding their professional learning. Teachers shared that they sometimes have to attend 2–3 workshops simultaneously from their laptops and phones. Also, when asked about satisfaction with professional development for their use of technology, teachers shared that the majority of workshops that educators engaged with this year were not designed to ensure that participants were engaged, nor did they provide enough time for teachers to explore new tools or practice applying new skills.

During the initial focus group discussions, some educators noted the lack of technology skills that students had for learning purposes. There was a consistent sense that students had a strong knowledge of technology used for entertainment, but very little understanding of technology use in a learning environment. This presented a challenge for educators who were already struggling with access to and use of technology. In addition to teaching their content area, teachers needed to help students do effective online searching, send email attachments, and manage remote learning tools. Earlier in the school year, the combination of teachers feeling that they did not have the skills necessary to effectively use technology and students' lack of familiarity with technology tools for learning contributed to teachers' feelings of being overwhelmed. In

later focus group discussions, educators expressed that students' knowledge of the purpose of technology for learning had increased, as well as their receptiveness and willingness to use technology in a learning environment.

The shift in attitude toward technology extended to parents as well. Several educators shared that some parents were at first reluctant to allow their children to connect to remote classes. They thought that their children were not capable of engaging in remote learning. Educators noticed a change in this mindset from October to June. This shift was particularly important for students with disabilities. Educators in the physical education or the adaptive physical education space had particularly not been enthusiastic about remote learning, mainly because of the nature of adaptive work for students with disabilities and autism. When asked about support needed to effectively use technology in their practice, teachers credited parent engagement as a huge factor in the success of students with disabilities and autism.

Teachers also hoped that teaching remotely had illustrated for school leaders the need to invest in holistic support for educators. In responses to questions about support for their technology use, teachers expressed that their schools had a strong focus on training teachers on technology use but there was not a focus on emotional support. Teachers feel that emotional support provided by the school was limited to students rather than extending it to educators as well.

Data from the case study participants aligned with key findings from the wider survey data.[2] Educators were asked to rate their perception on their general technology skills (sending emails, attaching documents, or using the internet), using technology to inform their teaching approach, and using technology to design instruction. Educators from Bayamón largely had higher self assessment ratings than those in ORE de Humacao, ORE de Caguas, ORE de San Juan, and ORE de Arecibo across dimensions of technology use including for communication, designing instruction, and informing teaching approach. Broadly, educators with more than 15 years of experience rated themselves higher than educators with fewer years of experience.

Consistently across the survey responses from the pre-, mid-, and post-survey, the large majority of educators have indicated that they use technology every day to teach. Additionally, when educators were asked to rate their general technology skills, ability to select and use technology to inform their teaching, and ability to select and use technology to design their instruction, we noticed a shift in responses. Most of the educators rated their skills as "neither weak nor strong" in the pre-survey. In the mid- and post-survey, the answers gradually change into the "neither weak nor strong" and "strong" categories.

Coaching

Research shows that coaches have a significant impact on teacher practice. During the 2020–2021 school year in the pandemic, coaching was a key factor in supporting teachers as they navigated new, remote, and hybrid learning environments. While some coaching systems existed in the past, the PRDE currently does not support schools with general funds, policies, guidelines, or resources to establish and maintain a coaching model. Coaching is only offered in a limited capacity in school improvement plans. Even though most teachers across Puerto Rico do not currently have a coach supporting their technology use, the study set out to learn more about teachers past experiences with coaching and the impact of the current absence in coaching supports.

[2] The survey data represents the results from all participants (not only focus group participants) and are shared here for comparison and trends purposes only.

When asked about their experiences with coaching to support their use of technology, there was consensus that coaching could be improved. In their previous experiences, coaches were not prepared for the role and lacked the knowledge and teaching experiences necessary to understand classroom dynamics and technology challenges. Teachers view coaches as using old teaching methods that are no longer relevant to instructional practices today. This creates some reluctance among educators to engage in coaching, and may contribute to the current absence of coaching support offered by the PRDE or schools across the island.

Throughout the focus group discussions, educators reported that they either coach themselves and/or rely on their colleagues for coaching. Without relevant professional development from the PRDE or their schools, and without access to instructional coaches with the knowledge and skills to support their technology use, there has been increasing collaboration between teachers to support each other during this difficult school year. While this collaboration has strengthened relationships amongst teachers, the burden is great given other demands of a classroom teacher. Case study participants offered insight into how they would like to engage with coaching to support their use of technology. Teachers shared that they would like a voice in selecting their coaches or a formal system in which to provide feedback on their coaching experience. According to the educators, an ideal coaching experience would include a coach who is patient, available, prepared, spends enough time with the educator, is punctual, observes their classes, reviews their plans, provides step-by-step guidance, shares feedback, communicates consistently, and uses current research-based teaching methods. An ideal coach would work together with the teacher using strategies personalized to each situation to reach more impactful solutions.

Data from the case study participants aligned with key findings from the wider survey data.[3] Consistently across the survey responses from the pre-, mid-, and post-survey, the large majority of educators reported that their colleagues support them in their technology use while a very small percentage reported that coaches do. In the post-survey, the majority of the group didn't participate in coaching experiences or engaged with coaching 1–3 times per month. In the pre-survey, we asked educators to identify who supports their technology use in the classroom. More than half of educators indicated that they receive support from fellow teachers. A smaller percent indicated that they receive other support, including from librarian colleagues, independent research (such as finding video tutorials), and workshops (such as from the Department of Education or DE INNOVA). Of note for the Department of Education and schools is that more than a third of teachers in the post-survey still indicated that they do not receive any support in technology use in the classroom. The teachers from ORE de Bayamón and ORE de San Juan reported the highest levels of lack of support while the teachers from ORE de Ponce reported the lowest levels of lack of support. Educators from all other regions reported equal levels of lack of support under this category. From the educators who indicated that they do not receive any support in technology use in the classroom, the majority had more than 15 years of teaching experience. More data needs to be gathered on the types of support needed for experienced educators, particularly as technology use and technology tools continue to evolve.

Micro-credentials

The focus of the overall GEEO and Digital Promise project was professional development to support the effective use of technology by educators in Puerto Rico. Micro-credentials were chosen as an intervention

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tool for the project because they provided an opportunity for personalized professional learning, which was critical for addressing the wide range of needs of educators. Micro-credentials are digital certifications that verify an individual's competence in a skill or set of skills. Micro-credentials are competency-based, research-backed, personalized, on-demand, and shareable.

Teachers earned micro-credentials by submitting required evidence, which may include video/audio recordings of classroom instruction, annotated lesson plans, mini lessons, and other artifacts, on the Digital Promise Micro-credential Platform. Teachers were able to choose from a curated list of 22 Spanish language micro-credentials (see Table 3). These micro-credentials were Spanish-language versions of previously existing English-language micro-credentials developed by Digital Promise as part of a Journey Map, which was a visual representation of teachers' adoption and use of technology in their practice (see Figure 1). Teachers across Puerto Rico took an initial assessment, the Technology Uses and Perception Survey (TUPS) from the University of South Florida, which became part of an educator's Plan Individual Tecno-pedagógico (PIT). The TUPS assessment provided educators with two information points: 1) insight on where they were on the Journey Map and 2) a TUPS level. Both data points suggested micro-credentials based on what an educator needed at that stage in their technology integration journey. Teachers were provided feedback on their micro-credential application, which supported them in their professional development and helped them reflect and resubmit to earn a micro-credential if they were not successful with previous applications. By the end of the case study, educators in Puerto Rico had earned 376 micro-credentials.

Table 3. A list of 22 micro-credentials and their corresponding categories

Stage	Micro-credentials			
Ready to Learn	Technology as a tool for Professional Learning		Why Use Tech in the Classroom?	
Ready to Implement	Behavior Management in a Digital Classroom	Creating Digital Citizens	Directing Digital Media	Introducing Digital Literacy Tools
	Technology Management - Planning for Success	Designing Physical Environments with Purpose	Transformative Collaboration	Empowering Parents through Technology
Ready to Empower	Managing Technology-Rich Classrooms	Engaging in Continuous Learning about Technology Coaching	Promoting Digital Citizenship	Providing Technology Resources
	Reflection on Practice	Technology for Assessment I	Technology for Assessment II	Technology for Differentiation
	Visionary Leadership for Technology	Technology-Rich Professional Learning	Technology for Rigorous, Relevant, and Engaging Learning I	Technology for Rigorous, Relevant, and Engaging Learning II

Figure 1. The Journey Map

Micro-credentials also proved to be promising professional learning options during the COVID-19 pandemic and remote learning. Micro-credentials provided on-demand access to professional learning resources and tools, most of the micro-credentials could either be earned outside the classroom or in a remote learning environment, and the micro-credentials represented relevant competencies that teachers needed to develop to be successful at integrating technology to their classroom practice. The artifacts captured within micro-credential applications also provided valuable insight into common challenges teachers were addressing across the island, as well as common technology tools used to address those challenges.

Common classroom challenges related to technology included:

- Limited time with students as a result of connectivity issues faced by both students and teachers.

- Falling into a routine that was not engaging to students.

- Differences in device access for students, such as a cell phone versus a computer.

Some goals that educators were striving to achieve through engagement with selected micro-credentials include:

- Developing more interesting and dynamic lessons to keep students engaged.

- Finding ways to communicate relevant and important information to parents.

- Better understanding where parents and learners need support related to remote learning.

- Aiming to increase use of technology tools to allow for student and teacher collaboration.

Examination of awarded micro-credential applications highlighted the following tools and resources as helpful for a wide range of teachers:

- Online training such as workshops and webinars to learn specific tools and skills.

- Platforms for communication with parents, e.g. Facebook and Whatsapp.

- Platforms for designing more engaging and collaborative classes, e.g. Microsoft Office Suite tools (Powerpoint), Kahoot, or GeoGebra.

The majority of educators in Puerto Rico were not familiar with micro-credentials prior to the project. Case study participants were engaged with micro-credentials after the first kickoff workshop. The participants in the group had different levels of understanding of micro-credentials. Some participants were still confused about the requirements by the end of the case study, while others had already earned them and were comfortable with the process. Participants who were still confused cited a lack of time investment or understanding of why micro-credentials were valuable for them to earn. More studies need to be conducted to understand the roots of the discrepancy in teachers' understanding and comfort levels with micro-credentials and what supports are needed for all teachers to have the option to engage with micro-credentials as part of their professional development on the use of technology.

Of note for the Department of Education and school leaders is that when asked about micro-credentials as a mechanism for supporting their use of technology, teachers expressed that they enjoyed exploring the micro-credential resources, receiving feedback from assessors, and getting quick responses whenever they had questions. Additionally, the participants who did not earn micro-credentials this school year were interested in earning them in the future. The participants who earned the most micro-credentials in the group shared that their biggest motivation was the possibility of a salary increase. While some teachers were concerned about compiling and submitting students' work as evidence, overall, the main reason why some participants did not earn micro-credentials was due to time limitations. Educators expressed that for micro-credentials to be successful, they need to understand how they can have a positive impact on their practice, particularly because of teachers' many competing priorities.

Data from the case study participants aligned with key findings from the wider survey data.[4] When educators were asked about their level of familiarity with micro-credentials, most of the educators said they were somewhat familiar with the concept. A smaller percentage was consistently reported under the "very familiar" and "extremely familiar" category. Educators also consistently reported to be "a little" or "moderately'' enthusiastic about micro-credentials, which reflects a lack of clarity on what micro-credentials are and how they can benefit their teaching practice. On the other hand, the educators who earned micro-credentials reported higher levels of enthusiasm about micro-credentials than the ones who didn't earn them. This is a good indication that educators who engage with micro-credentials find them useful in their technology use journey. In the post-survey, the large majority of educators indicated that it's either somewhat likely, likely, or very likely that they'll continue earning micro-credentials as part of their professional learning.

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Discussion and Conclusion

As technology becomes more critical to classroom instruction, it is important that Puerto Rico develops a blueprint for technology integration. Readiness to effectively use technology and transition to remote learning was the difference between schools that were able to provide a consistent learning experience for their students on par to pre-COVID times and schools that struggled to meet the needs of their students, teachers, and school community. This divide can only be bridged through a concerted effort from the Department of Education and schools in Puerto Rico. Efforts need to be sustained, funded, and provide the support necessary for all teachers to continuously move forward along their technology integration journey. The findings from this study provide valuable insights into how teachers would like to be supported along this journey.

In hopes that these findings can help shape current and future technology integration programs, we suggest that education decision-makers in Puerto Rico focus efforts on the following key recommendations:

1. **Improve pre-service teacher training on technology use**
   From the moment educators begin teaching, they have a need to use technology in their instruction. But many teachers across Puerto Rico do not feel prepared to select technology tools and effectively use them in their classroom practice to support student learning. Pre-service teacher training programs, such as those primarily run by colleges and universities, are critical intervention opportunities. These programs should work with organizations such as the PRDE and GEEO to align the technology instruction in teacher training programs to the needs of schools in Puerto Rico. Micro-credentials can be integrated into teacher training programs to ensure that pre-service teachers are able to demonstrate research-backed skills related to the powerful use of technology.

2. **Personalize professional learning**
   Professional learning should not be one size fits all. Over the last decade, education has made strides in personalizing learning for students, and the same must be done for adult learners. Personalized professional learning allows teachers to identify the challenges they face in their practice, seek learning opportunities to develop new skills to address those challenges, try things out in their classroom, and reflect on the impact. This autonomy helps motivate teachers to explore new tools and develop new skills.

   Teachers in Puerto Rico want to attend workshops and other learning opportunities that relate directly to the needs of their classroom as well as ones that allow them to try out and apply new skills in their classroom. As teachers took assessments and reflected on the Journey Map (see Fig. 1), it helped guide them toward resources that were appropriate for where they were in their technology integration journey. The Department of Education should coordinate with schools to design learning opportunities that support teachers at every stage of the technology integration journey and provide reflection tools and support for teachers to assess where they are on that journey. Additionally, these learning opportunities should balance quantity and quality and allow educators choice in which opportunities they pursue.

3. **Support ongoing micro-credential rollout and implementation**
   Micro-credentials present an opportunity to personalize professional learning and allow teachers to pursue working on a skill that they would like to grow in and then earn the micro-credential to then demonstrate that skill. Teachers expressed that they found the micro-credentials contained useful resources and provided them with relevant and specific feedback for their effective use of technology. As this study examined an initial introduction to micro-credentials and there is a learning curve to engaging in competency-based professional learning, more pilots and studies of micro-credentials are needed to fully understand all the supports necessary for educators to engage with micro-credentials. The PRDE should continue to support ongoing micro-credential rollouts and implementations such as those that began in the De-Innova Project.

   Rolling out micro-credentials must be a purposeful and structured process. There must be a clear 'why' communicated by the Department of Education and other education service providers about why educators should earn micro-credentials. Rollouts themselves are a learning opportunity for the service providers. Three key areas for rollout are: 1) communication about the opportunity 2) onboarding to competency-based professional learning through micro-credentials, and 3) ongoing support for teachers engaging in micro-credentials, including professional learning communities. Each of these areas should allow for multiple points of entry for educators, as well as communicate multiple reasons why educators may want to earn micro-credentials. Storytelling will be a key piece of ongoing micro-credential implementation. Teachers were eager to learn from other teachers who had earned micro-credentials during GEEO's learning opportunities, and teachers were willing to share about their experiences with micro-credentials for blog posts and other mediums.

4. **Develop recognition and incentive systems for micro-credentials**
   Teachers across Puerto Rico are doing tremendous work to meet the needs of students and families even in the face of a global pandemic. They are also engaging in informal and formal learning to increase their ability to use technology in powerful ways in their classrooms. To encourage continuous growth, particularly for those teachers who may still be hesitant or not confident in their use of technology, it is important to provide clear and meaningful recognition and incentives for developing and demonstrating new skills in the area of technology integration. Micro-credentials can be shared as digital badges and create an opportunity for the PRDE and schools to recognize and incentivize educators who are developing critical skills that positively impact student learning. When micro-credentials are aligned to the Open Badge standard (as are all Digital Promise micro-credentials) they provide a greater level of trustworthiness. When compared to alternative forms of credentialing, Open Badges offer more robust and reliable capabilities for the Department of Education and schools to easily verify the authenticity of the micro-credentials educators earn to signal new and refined skills.

   Recognition can look like more acknowledgement of the work that teachers undertake to further their teaching practice, as well as growing awareness in school leaders of what is involved in different opportunities teachers are taking advantage of, such as micro-credentials. Incentives for micro-credentials may come in the form of stipends, career pathways such as a pathway from classroom leader to coach, and base salary increases. Incentives should match the time that educators are engaging with developing new skills and which skills are of particular importance to Puerto Rican

school communities. Early efforts in states across the country highlight the important role of the state education agency in developing policies and guidelines for micro-credential recognition and incentives. More targeted micro-credential pilots and further research into current efforts are needed to determine incentive systems.

5. **Provide more opportunities for educator collaboration and connection**
Teachers repeatedly noted how they support one another in their teaching practice. School decision-makers should provide more opportunities for collaboration and connection amongst teachers. This should not feel like an additional requirement for teachers, but rather providing more time and resources during the school day (e.g. longer and synchronous planning periods across grade bands) for these connections, and elevating the collective impact of teachers. Workshops and other professional development trainings are ideal times to provide opportunities for teachers to collaborate and connect, while making them feel more meaningful and a good use of teachers' time.

6. **Formalize coaching models and structures**
A lack of a formalized system for instructional coaching means that there will be inequities in which teachers receive coaching support in Puerto Rico and which teachers do not. The PRDE can play a critical role for schools by providing guidance on what types of research-based coaching models schools should pilot and pursue (e.g. part-time versus full-time coaching models). The Department of Education can also create policies that allow current technology resources teachers, such as MRUCs (Maestros Recurso Uso de la Computadora), flexibility in their class load and schedule to take on the work of a school-based coach. Other models such as region or district-based coaching and virtual coaching communities may also prove valuable to explore. Decision-makers are encouraged to learn about the impact of different coaching models and structures by compiling feedback from coaches, teachers, and school leaders early on and monitor implementation and progress in different contexts. Recent findings from the Digital Promise and GEEO Challenge-based Coaching Model pilot may serve as a starting point to explore the impact of coaching in schools in Puerto Rico.

7. **Invest in teachers' social and emotional health**
Teaching and learning took on new challenges during the COVID-19 pandemic in ways that the education system had never seen. This takes a toll on the social and emotional health of all involved. School leaders must not only think about the well-being of students, but also the well-being of teachers. While providing various opportunities for teachers to grow professionally is important, communication should be streamlined so educators have specific channels to access the information that they need and there should be a limited number of required events. Synchronous learning opportunities should be balanced throughout the year, and be shorter and more targeted in scope. Asynchronous learning opportunities should be provided to allow for flexibility in schedules and personal life demands. Schools and the PRDE should also provide support systems for teachers whether through partnerships with local agencies or through Department of Education based professionals. Our research on adult learners shows that when adults do not feel they have social and emotional support, it can create barriers to learning. Supporting teachers' emotional health is not only important in caring for teachers as individuals, but also critical to provide them a safe and healthy environment for continuing their professional growth on the use of technology. Our adult learner model offers strategies for providing social support, including mindfulness activities, mentoring, regular check-ins, and communities of practice.

8. **Cultivate a culture of student and family engagement**

Families should continue to be valued as partners toward student growth and learning. Strong family relationships provide partnerships for teachers in meeting the needs of all students, particularly during remote learning. The PRDE and schools should also provide [support for students and families to learn more about technology tools](). In our data, teachers shared that an assumption is often made that students are more up to date with technology given their age and prevalence of technology in their life, but that was not true for the types of technology tools they were being asked to use in the classroom. Both teachers and students will benefit If students have more opportunities for exposure to various classroom technology tools.

The COVID-19 pandemic illuminated existing inequities in education and has forced the Puerto Rican education system to face its technology challenges. The findings in this report, while limited in scope, are key initial findings around questions of what teachers need to know and do to effectively integrate technology, how satisfied they are with specific mechanisms for support of technology use, and what supports they still need to effectively use technology in their teaching practice. The key takeaways from this study are relevant beyond the context of Puerto Rico as well. Teachers need to have a stable environment — broadband and device access — to effectively use technology in their classroom practice. They want more agency over their professional learning, including deciding which workshops and trainings to attend, and they want their professional development to be relevant to the challenges they face in their classrooms, with practical applications to their instruction. Teachers are also willing and open to new tools to support their technology use, but they want support in onboarding to and exploring these tools, and clear communication around the value of engaging with these tools, such as the impact of earning micro-credentials. The recommendations provided in this report will help decision-makers in education address these needs.

Overall, despite the hardships, teachers are using technology more confidently and more frequently, and are eager to have more opportunities to grow their skills. Educators expressed that they now have a solid foundation for using technology and digital tools for teaching that they didn't have before the pandemic. They envision using these skills and technologies even if they return to in-person instruction next school year. Even though educators did not achieve the academic level they wanted during the school year due to remote learning limitations, they feel that students gained another set of skills that will be useful for their professional lives, such as using technology and digital tools to interact with the world around them. There is a consensus that there is still a long way to go when it comes to technology use, and more studies are needed to dig deeper into this initial data, but the progress that teachers and students have made is still recognized. Overall, and despite the challenges, educators in Puerto Rico are willing and eager to continue to integrate technology in their teaching practices.