

Maine Learning Technology Initiative 2.0 2023–24 Evaluation Report

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Executive Summary

Building on two decades of previous experience supporting one-to-one device allocation, Maine Learning Technology Initiative (MLTI) 2.0 seeks to expand access to digital devices across a broader range of grades than the previous version of the initiative, provide high-quality professional learning in support of digital learning and technology integration, and support robust school technology infrastructure in schools throughout the state. The Year 3 evaluation of MLTI 2.0 focused on providing feedback to the Maine Department of Education (Maine DOE) on implementation of the initiative's components, how teachers and students are using technology resources provided by MLTI 2.0 or otherwise, and supports or resources that would be useful for promoting technology integration. The evaluation team conducted a teacher survey in a representative sample of 28 schools, reviewed artifacts of professional learning, analyzed teacher feedback surveys administered following professional learning events, and profiled eight schools based on interviews and focus groups with administrators and teachers. This section discusses the evaluation's findings and offers recommendations based on those findings.

MLTI excelled in developing professional learning resources, with evidence that the topics of these resources matched teacher interests. Resource development has continued as in past years, with nearly 90 new resources. Most of these were self-paced learning resources, with a smaller number of resources for in-person and hybrid events. The primary focus of these resources was on technology integration, particularly on the use of specific applications and tools. A secondary focus was on active learning and student engagement. This focus of development appears to match well with teachers' reported interest in learning about new types of technology. MLTI has not yet developed many professional learning resources on artificial intelligence, which was a topic of interest expressed by teachers on the survey. It is unclear from the extant data whether MLTI provided opportunities for teachers to practice using technology, another area of interest expressed by teachers.

Professional Learning About Technology

About three quarters of the surveyed teachers reported that they had participated in some form of MLTI professional learning. About one third of the surveyed teachers indicated that they participated in hybrid events (e.g., live and recorded sessions and webinars), although fewer than half that proportion participated in self-paced learning, in-person events, and coaching. Among the few participants who completed a postsurvey, most provided high ratings for quality and usefulness. Unlike previous years, the evaluation did not have access to extant data on participation in coaching or other in-person events.

Across all eight profiled schools, staff reported informal opportunities for teachers to work together to use technology tools to meet student needs but no formal opportunities for shared

inquiry. The eight schools varied in the availability of professional learning that supported teachers' ongoing curricular needs.

- **Recommendation 1:** In response to teacher interest in artificial intelligence, consider developing professional learning resources focused on the use of artificial intelligence tools in classroom instruction.
- **Recommendation 2:** Given teacher interest in opportunities to practice using technology, along with the lack of shared inquiry, consider organizing and facilitating online communities of practice devoted to integrating technology tools into classroom instruction.
- **Recommendation 3:** To inform the continuous improvement of MLTI professional learning efforts, we recommend (a) establishing a formal process for collecting data on teacher participation in professional learning and (b) collecting data on the professional learning needs of teachers.

Infrastructure Support

The focus of MLTI infrastructure support efforts was cybersecurity. The MLTI team provided presentations and conducted a large tabletop exercise on this topic; participants typically rated the quality of this support as high. The infrastructure specialist made fewer school visits this year compared with Year 2, focusing instead on district-level presentation and conferences. MLTI also provided funds through the Cyber Performance Grants for districts to improve their cybersecurity through the acquisition of firewalls and computer monitoring systems. School staff noted that these systems alleviated concerns about students accessing inappropriate content.

- **Recommendation 4:** Given the benefits of the Cyber Performance Grants for technology integration, MLTI may consider expanding this program to additional schools.

Among the profiled schools, evidence exists of a reliable and robust technology

infrastructure. Six profiled schools had evidence of high levels of infrastructure (based on staff interviews), as indicated by dependable wireless connectivity, access to up-to-date software and digital learning tools, and efficient technical support. Two profiled schools had medium levels of infrastructure, as indicated by relatively less dependable Wi-Fi throughout the school, outdated devices and software, or technical support that was not timely. These findings are consistent with teacher survey results indicating infrequent technical difficulties that interrupt student use of technology.

- **Recommendation 5:** Given the evidence for reliable infrastructure, we recommend that the MLTI program continue its current efforts to support infrastructure for all schools and consider providing targeted support for the minority of schools in which the infrastructure is not yet as robust.

Technology for Teaching and Learning

Teachers frequently used technology for instruction and management, and a majority emphasized student use of technology. Teachers reported frequent use of technology for instruction and management, with most using technology at least weekly. About three fifths of the surveyed teachers reported that they frequently asked students to use technology for communication, collaboration, and critical thinking, and about two fifths reported frequent student use of technology for creativity. These proportions have been consistent across 3 years. Teachers reported frequent use of word processing software, learning management systems, and presentation tools. Among teachers who identified technology tools they would use if they had access to them, teachers most frequently mentioned personalized learning tools.

Teachers had positive attitudes and beliefs about technology integration. Nearly nine in 10 teachers agreed or strongly agreed that they were confident in their ability to integrate technology and that technology was useful for instruction. These beliefs were not significantly different in Year 3 relative to Year 2.

- **Recommendation 6:** Given the overall stability of these measures of technology use and beliefs for the sampled population of teachers, MLTI may consider exploring the contextual factors that influence teacher technology integration, and whether participation in technology-focused professional development is associated with changes in these teacher technology measures.

Technical difficulties were infrequent. About three quarters of the teachers reported that their students infrequently encountered technical difficulties (i.e., monthly or less frequent). However, teachers whose students frequently used technology for collaboration, communication, creativity, and critical thinking (respectively) were somewhat more likely to report frequent technical difficulties.

Leadership for Technology Integration

School-based leadership for technology integration remains limited. A majority of the profiled schools did not have a formal vision for technology use, and half of the schools' leaders described participating in professional learning opportunities related to technology. Although schools did not tend to have a formal vision for technology use, teachers did, overall, feel encouraged by their colleagues to experiment with technology. However, this encouragement was not tied to specific goals or initiatives within the schools.

- **Recommendation 7.** Given the areas for improvement in school leadership for technology, MLTI may consider offering a professional learning series focused on school leadership to school administrators. It may be worthwhile to consider a target hire among the digital ambassador team to focus on this need.

Introduction

This report presents findings from the evaluation of Year 3 of the Maine Learning Technology Initiative (MLTI) 2.0. The Maine Department of Education (Maine DOE) contracted with the American Institutes for Research® (AIR®) to evaluate the program. This report builds on the findings presented in the Year 2 evaluation report, submitted by AIR to Maine DOE in July 2023. During the 5 years of the evaluation, AIR will evaluate implementation of the major components of MLTI 2.0 and analyze the outcomes of these components with regard to schools, educators, and students.

History and Goals of the Program

Maine DOE's Office of Innovation launched MLTI 2.0 in July 2021. The program seeks to

close Maine's digital learning gap by creating, developing, and continuously improving the redesigned program's interrelated dependent components into supports, measures, services and activities that build a foundation of a State and local partnership focused on the equitable integration of technology into engaging and effective educational experiences. (MLTI Advisory Board, 2020, p. 5)

The program's components include one-to-one devices for students and educators, professional learning, and infrastructure support. MLTI 2.0 builds on the original MLTI plan developed in 2001 to deploy one-to-one devices, provide broadband services, and offer professional learning opportunities (Maine Department of Education, n.d.). Maine DOE developed an updated MLTI focused on equitable access to and use of technology to improve student-centered learning practices for critical thinking, collaboration, creativity, and communication. The goal of the program is to prepare students to be innovative leaders in a digital economy and educated and adaptable members of a global workforce (Maine Department of Education, 2020).

Summary of Major Components

MLTI 2.0 has three main components.

- **Device Access.** MLTI funded the purchase and distribution of one-to-one computing devices for students in Grades 7 and 8 in Year 1 and added one grade (either older or younger, based on the district's choice) in both Years 2 and 3. The initiative also funds the purchase of devices for educators in these schools. Recognizing that Maine already funded one-to-one computing devices in Grades 7 and 8, the funding in Year 1 allowed schools to update the devices currently available to students in those grades.
- **Professional Learning.** The initiative funds two state-level digital learning specialists to oversee five MLTI digital ambassadors, who provide high-quality professional learning in

support of digital learning and technology integration. The two digital learning specialists develop and manage execution of the statewide vision for professional learning on using technology for teaching and learning. The five digital ambassadors directly connect with educators and provide professional development.

- **Infrastructure Support.** The initiative funds a state technology infrastructure specialist to support districts in evaluating existing technology infrastructure and developing career programs for students in the technology infrastructure field. This specialist also provides guidance to districts on how to leverage different funding sources to expand their technology infrastructure.

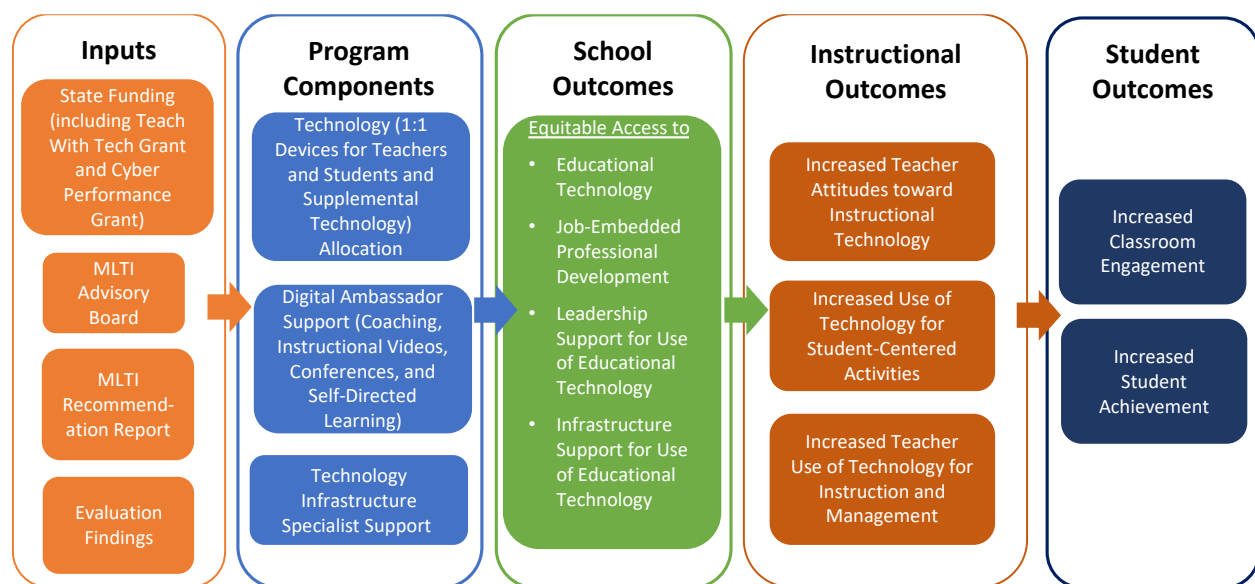
MLTI 2.0 provides grant funding to any Maine public school that agrees to participate in the initiative. Schools may use funding to provide MLTI-approved devices to students and educators. In Year 3, MLTI 2.0 expanded to one additional grade level (up to Grade 10 or down to Grade 5) beyond the Year 2 expansion, serving a potential population of 56,000 students and 5,700 educators in Grades 5–10. Three hundred one schools participated in MLTI 2.0 in Year 3 (July 2023–June 2024), representing 64% of the public schools in Maine that offer Grades 5–10 (National Center for Educational Statistics, n.d.). Maine DOE allocated 13,415 devices for students and 1,887 devices for educators in summer 2023, at an estimated cost of \$6,533,954 (or \$427 per device).¹ Schools could choose among the following devices: Apple MacBook Air, Apple iPad, CTL Convertible Chrome Laptop, Dell Chromebook, Dell Latitude, and WCA Windows HP ProBook.

In Year 3, Maine DOE launched two new grant programs to supplement the device access provided by the MLTI 2.0 initiative: the Cyber Performance Grant and the Teach With Tech Grant. The purpose of the Cyber Performance Grant was to “help districts bolster network security and safety” by investing in security measures such as firewall upgrades, transitions to cloud services, vulnerability assessments, and awareness campaigns (Maine Department of Education, 2023a). The Teach With Tech Grant’s purpose was to invest in “technology that will create transformative learning experiences for students and supplement the devices already provided [through the MLTI 2.0 program]” (Maine Department of Education, 2023b). With the Teach With Tech Grant, schools were encouraged to purchase supplemental technologies, such as 3D printers, laser cutters, robotics and coding kits, and audio or video production equipment. Sixty-one districts received the Cyber Performance Grant, and 33 schools received the Teach With Tech Grant.

¹ Total allocations were based on the number of students enrolled and the number of staff employed by a school, with a 10% buffer to account for any enrollment or staffing changes. Data source: Administrative data on device allocations provided to AIR by Maine DOE.

The MLTI 2.0 logic model summarizes the key components of the initiative and their anticipated influence on schools, teachers, and students (Exhibit 1). As depicted in the logic model, the initiative’s components will lead to three school-based outcomes: more equitable access to educational technology, more equitable participation in high-quality professional learning opportunities, and more equitable school-level support for using educational technology. Enhancing these school-based outcomes will influence teacher attitudes toward technology and promote more frequent use of technology for student-centered instruction (Argueta et al., 2011; Hur et al., 2016; Liu et al., 2017; Miranda & Russell, 2012; Moeller & Reitzes, 2011; Office of Educational Technology, 2021).

Exhibit 1. Logic Model for MLTI 2.0



Source: Author.

The logic model includes school-level factors adapted from the Future Ready Schools framework (Office of Educational Technology, 2016), which will help support the integration of technology into instruction. These factors include the following:

- **School leadership:** promoting a shared vision for teaching and learning using technology, along with a culture of trust and innovation
- **Professional learning:** encompassing job-embedded professional development and collaboration in a learning community
- **Technology infrastructure:** including wireless connectivity, network bandwidth, and technical support staff who ensure the reliable use of technology

Maine DOE anticipates that these instructional changes will provide students with increased access to technology-enhanced learning opportunities and foster greater classroom engagement.

Review of Prior Evaluation Findings

The Year 3 evaluation builds on the findings from Years 1 and 2. In Years 1 and 2, MLTI largely succeeded in its goal of providing devices to students and educators on a one-to-one basis. In Year 2, specifically, nine in 10 participating schools distributed one device per student, and seven in 10 schools distributed one device per educator. Furthermore, infrastructure support was well received among those schools that received an IT (information technology) support site visit, with school staff who participated in these visits reporting being satisfied or very satisfied with the support provided by the infrastructure specialist. The majority of surveyed teachers used technology on a daily basis for both supporting instruction and classroom management and communication. Surveyed teachers also reported that the tools they used most frequently are word processing and presentation software, course management, and communication tools. Most teachers also reported being confident in their ability to use technology for instruction and believed that technology is useful for instruction.

Based on the findings from Year 2, the evaluation team recommended some areas of growth for the professional learning and infrastructure components. With respect to professional learning opportunities, teacher survey data suggested that about half of the teachers participate in some type of MLTI-developed professional learning opportunity. AIR suggested that a major focus of MLTI be making the professional learning component stronger for teachers and administrators, either by conducting needs sensing to determine priority topics for professional learning or helping schools incorporate professional learning into existing school routines. Similarly, only a small percentage of MLTI schools received a visit from the MLTI infrastructure specialist. AIR recommended that Maine DOE consider expanding the goals for the infrastructure support component of the program to reach a larger number of MLTI schools or focus resources on those schools that need the most support. In our school profiles, we also found that schools varied considerably in the extent to which they support professional learning related to technology, and staff described either medium or low levels of leadership with respect to promoting a shared vision for technology use, promoting a culture of innovation, and participating in professional learning for technology leadership. As such, AIR recommended that Maine DOE expand the MLTI approach to professional learning, especially to include opportunities for school administrators.

Evaluation Approach and Questions

Similar to Years 1 and 2, one of the goals for Year 3 was to provide formative feedback to Maine DOE and other stakeholders about how MLTI 2.0 components were implemented, how teachers and students used technology, and what types of supports or resources would be useful. To address these topics, the evaluation team gathered extant data on all participating schools,

administered a teacher survey to a sample of 28 schools, and conducted focus groups with teachers and interviews with school principals and technology leaders in a sample of eight schools. The Year 3 evaluation addressed the same five process evaluation questions (EQs) as did the Years 1 and 2 evaluation:

1. To what extent are the key components of MLTI 2.0 implemented as intended? What are the facilitators of and barriers to implementation?
 - a. Annual allocation of one-to-one computing devices
 - b. Opportunities for professional learning that emphasize student-centered approaches to technology integration
 - c. Support for district technology infrastructure and technology infrastructure programs
2. What are stakeholder opinions about the quality and usefulness of these components?
3. To what extent and how are schools establishing conditions that support integration of technology into instruction?
4. To what extent and how are educators using technology to support student-centered learning? What barriers and facilitators have educators encountered?
5. What are promising technology tools or models for supporting student-centered learning?

AIR used extant, statewide data to describe implementation of the program components related to device access, MLTI 2.0 professional development, and technology infrastructure support (EQ1). AIR conducted a teacher survey in a sample of 28 schools to gather feedback about the quality and usefulness of the MLTI 2.0 components (EQ2), the extent to which educators used technology to support student-centered learning (EQ4), and the technology tools that teachers used to support student-centered learning (EQ5). We conducted interviews and focus groups in eight schools to create school profiles that describe three domains of supports for technology integration: school leadership, professional learning, and technology infrastructure (EQ3).

Year 3 of the evaluation also addressed three EQs related to program outcomes:²

6. To what extent is MLTI 2.0 associated with a reduction in the digital divide as related to equitable
 - a. access to educational technology (e.g., ratio of devices to students, types of devices and software);
 - b. use of technology for student-centered learning activities;
 - c. access to high-quality professional learning opportunities; and

² In Year 4, the evaluation will examine a fourth outcome question about changes in student engagement across years.

- d. school-level support for use of educational technology?
- 7. To what extent is participation in MLTI 2.0 associated with increased teacher confidence in technology use and increased belief in the usefulness of classroom technology?
- 8. To what extent is participation in MLTI 2.0 associated with increased use of technology to support student-centered instruction?

AIR used teacher survey data to measure teachers' use of technology for student-centered learning, access to high-quality professional development, and availability of infrastructure support (EQ6) and teachers' confidence in using technology and beliefs about the usefulness of technology (EQ7). AIR examined the reduction of the digital divide by collecting extant data, such as program and administrative records, vendor documentation, and publicly available data sets (EQ6). AIR will submit findings on the digital divide in a separate memo in August 2024.

Report Organization

This report is organized as follows:

- Section 1 describes the evaluation methods, including sampling, data collection, measurement, and analysis procedures for all data sources.
- Section 2 addresses the program's component of professional learning, with respect to implementation (EQ1b) and participant reactions (EQ2).
- Section 3 addresses the program's components of technology infrastructure support, with respect to implementation (EQ1c) and participant reactions (EQ2).
- Section 4 describes teacher and student use of technology, with regard to the purpose of technology use (EQ4) and the types of tools used (EQ5). It also summarizes findings related to the teacher outcomes of MLTI 2.0—namely, whether the program is associated with changes in teacher attitudes toward technology (EQ7) and instructional practices related to technology (EQ8).³
- Section 5 describes findings related to the conditions supporting technology use (EQ3).
- Section 6 provides an overall discussion of major findings and recommendations.

Section 1. Evaluation Methods

³ AIR will submit findings on the digital divide (EQ6) in a separate memo to Maine DOE.

The evaluation consisted of descriptive and correlational analysis methods that examined several data sources across three major categories: extant program data, survey data, and qualitative interviews or focus groups.

Extant Data Sources

AIR analyzed extant data from Maine DOE to help assess program implementation statewide. The analyses described access to technology (i.e., whether schools received new devices as intended), access to professional learning opportunities, and support for district technology infrastructure.

- **Data on professional learning opportunities.** AIR obtained professional learning session materials to assess the number and types of professional learning resources produced and provided. These data included videos on the MLTI YouTube channel as well as a list of additional professional learning offerings that the MLTI team provided to educators. In addition, AIR obtained postsurveys (i.e., surveys administered by MLTI and completed by teachers after in-person and online professional learning activities) to assess teacher perceptions of the usefulness and quality of the professional learning opportunities.
- **Data on support for district technology infrastructure.** Maine DOE provided records (e.g., logs of email communications with the infrastructure specialist, event flyers, agendas) that AIR used to assess the number of infrastructure support events that occurred through MLTI in 2023–24. AIR also obtained responses from a participant satisfaction survey provided after an infrastructure support event that assessed attendees' perceptions of the quality of the event activities.

Teacher Survey

Survey Sample

For the teacher survey, AIR used a stratified systematic sampling approach to select 28 schools from among the 283 MLTI-participating schools. We used two main strata: schools that received a Teach With Tech Grant ($n = 14$) and those that did not ($n = 14$). Each strata was further subdivided by three roughly equally sized substrata: tertiles of the proportion of students eligible for free or reduced-price lunch. Based on statewide distributions, the sample was balanced to have proportional representation of schools with respect to nine superintendent-level regions, school level (elementary, middle, and high schools), and locale (rural: distant or remote, town or rural-fringe, and city or suburb), with the goal of including at least one school from each region, including schools from each school level and from urban, suburban, and rural locales. AIR sampled these schools from the population of 283 schools serving Grades 5–10 that signed the MLTI opt-in agreement. AIR collected surveys from teachers in nearly all participating schools.

Response Rate and Nonresponse Bias. Of an estimated 827 teachers, 425 teachers responded, yielding a response rate of 51%. Teachers from 25 of the 28 schools in the sample responded.

To test for systematic bias in nonresponse, AIR examined whether the proportion of teachers responding at each school varied by school-level characteristics (i.e., percentage of students eligible for free or reduced-price lunch, percentage of students with disabilities, per-pupil expenditure, number of teachers per school, or region). There were no significant correlations between school-level response rates and any of these school characteristics.

Teacher Survey

The teacher survey included 68 items (with both Likert-type rating scales and frequency scales) on the following topics:

- Time spent in professional development (three items; Margolin et al., 2019)
- Types of MLTI professional learning opportunities (four items)
- Number and types of MLTI professional learning videos watched on YouTube (two items)
- Professional learning opportunities teachers would like to access (one open-ended item)
- Frequency of technology use for instruction (10 items; National Center for Education Statistics, 2009), addressing the subtopics of instructional preparation and delivery (four items) and management and productivity (six items)
- Frequency with which teachers ask students to use technology related to the four 21st century skills (20 items), with subsets of items addressing collaboration (four items), critical thinking (four items), creativity (five items), and communication (six items; Margolin et al., 2019).
- Availability of support for technology use (five items)
- Frequency of use of specific educational software and tools (16 items), covering the following seven categories of software and tools (two or three items per category): course management, productivity, communication, programming and analysis, personalized learning, simulations and educational games, and creativity
- Educational software and tools to which teachers would like access (one open-ended item)
- Frequency of technical difficulties related to students' access to technology (one item)
- Technical difficulties related to students' access to technology (one open-ended item)
- Confidence in the ability to integrate technology (three items; Gerdeman et al., 2021)
- Value of technology for instruction (three items; Vannatta & Banister, 2009).

Composition of Survey Measures

AIR aggregated item-level survey responses into scale scores corresponding to different topics. We conducted psychometric analyses using the Rasch model to determine if these sets of items formed reliable and coherent scales. The followings sets of items on the teacher survey demonstrated evidence that they could be treated as single-factor scales:

- Frequency of technology use for instructional preparation and delivery (four items)
- Frequency of technology use for management and productivity (six items)
- Availability of support for technology use (five items)
- Confidence in ability to integrate technology (three items)
- Value of using technology for instruction (four items)

For these items, the study team used the Rasch model to predict a single scale score representing teachers' response across all items. We then transformed the score to correspond with the response category in the original response scale (i.e., strongly agree, agree, disagree, strongly disagree) in which the scale score had the highest probability of being observed (Wright & Masters, 1982).⁴

For sets of items that did not show evidence supporting scaling using the Rasch model, we categorized teachers based on whether their responses to items in the set exceeded a certain threshold. For each of the four sets of items related to the frequency of asking students to use technology in ways that develop 21st century skills, we categorized teachers as emphasizing that skill if they responded with the options of daily or almost daily, weekly, or monthly to two or more items. As described earlier, these four topics each comprised four to six items.

We used a similar approach to categorize teachers based on how frequently they used seven categories of educational software and tools. Each category had either two or three items, and we counted teachers as frequent users of that category of tool or software if their rating for at least one item in that category was monthly or more frequent.

Analytic Methods for Examining Change in MLTI 2.0 Outcomes

AIR examined change in teacher outcomes using the mean overall Rasch scale scores for the following three constructs from the teacher survey: frequency of technology use for student-centered activities, confidence in ability to integrate technology, and belief in the usefulness of technology. We analyzed teacher survey data for all sampled schools in Year 2 and Year 3, and we drew a new sample of schools in Year 3 that partially overlapped with the sample from

⁴ Additional methodological details and results from these psychometric analyses are available upon request.

Year 2. We estimated changes in scores using a linear regression analysis that compared mean scores in Year 3 with the same measures in Year 2, nested within region to account for potential similarities in teacher responses in schools in similar areas of the state. School-level covariates aggregated to the regional level also were included to control for differences associated with regional characteristics (i.e., percentage of students eligible for free or reduced-price lunch, total number of students, and rurality).⁵

For descriptive purposes, we categorized each teacher based on their typical response to the response scale across the individual items comprising the scale. We then used response frequencies to illustrate differences in the distribution of responses across years.

School Profile Data Sources and Methods

We created profiles based on interviews and focus groups with staff at eight schools. The aim was to understand how school staff perceive their schools' leadership, professional learning, and technology infrastructure as supports for integrating technology. In addition, we asked school staff exploratory questions about their experiences with the Cyber Performance Grant or the Teach With Tech Grant to provide feedback to Maine DOE about the types of technology purchased with each grant as well as benefits and challenges that the school experienced with the new technologies.

Sampling

We sampled eight schools from a list provided by Maine DOE that included all Maine public schools that (a) participated in the MLTI and (b) received either a Cyber Performance Grant or a Teach With Tech Grant. Sixty-one districts received the Cyber Performance Grant, and 33 schools received the Teach With Tech Grant. For the school profiles, we selected four schools that received the Cyber Performance Grant and four schools that received the Teach With Tech Grant. We balanced the sample to have roughly proportional representation of schools based on statewide distributions by locale and by the percentage of students from low-income families and to include schools from eight of the nine different superintendent regions. Two schools in our original Year 3 sample did not respond to our request for participation. To find two alternate schools, the MLTI team suggested we reach out to schools they had worked with in the past and would likely be willing to participate in the evaluation.

Data Collection

The research team conducted virtual video interviews with each school's principal and designated school technology leader, as well as virtual video focus groups with teachers. In

⁵ Additional methodological details and results from these analyses are available upon request.

total, AIR conducted eight principal interviews, eight technology leader interviews, and six teacher focus groups. Teachers at two schools did not participate in the teacher focus groups.

Analysis Framework

AIR developed a technology integration support framework to guide interview and focus group protocol development and qualitative data collection and analysis. This framework describes three major domains of school-level processes that prior research indicated are critical for supporting technology integration: technology infrastructure, leadership for technology integration, and professional learning for technology integration. These domains correspond to the Future Ready Schools framework (Office of Educational Technology, 2016) and reflect the MLTI 2.0 logic model. Further details about the framework and qualitative analysis are in Section 5.

Section 2. Opportunities for Professional Learning That Emphasize Student-Centered Approaches

This section presents findings about professional learning opportunities developed by MLTI; the extent of school participation in those professional learning opportunities; and teachers' feedback on the professional learning opportunities, including their satisfaction with the resources provided and preferences for future opportunities. The findings are based on an analysis of extant program data, teacher survey data, and data from school administrator interviews and teacher focus groups.

These analyses also provide information on the extent to which MLTI 2.0 reached three program implementation milestones about access to professional learning opportunities:

- MLTI digital ambassadors developed professional learning opportunity resources. The criterion for this milestone is the development of 20 resources, with at least four resources developed in the following five topic areas: technology integration, active/project-based learning and student engagement, digital citizenship, digital instructional design, and computer science.
- MLTI schools participated in online or in-person professional learning opportunities. The criterion for this milestone is the participation of 80% of schools.
- Surveyed teachers perceived MLTI professional learning opportunities as useful. The criterion for this milestone is for 80% of teachers to agree that these opportunities are useful on postsurveys.

Our findings indicate that the MLTI digital ambassadors developed 72 online professional learning resources and provided professional learning opportunities most frequently through hybrid events (in person and virtual) and self-paced learning. These newly developed professional resources mostly addressed the topics of technology integration and active learning/student engagement. Overall, most surveyed schools (88%) had at least one teacher report participation in at least one type of professional learning opportunity. Most teachers who completed postsurveys strongly agreed or agreed that the training provided through MLTI was useful to their work.

Professional Learning Resources Developed and Offered

MLTI developed and provided professional learning opportunities in four formats:

- **Self-paced learning:** opportunities to engage in self-paced online learning through asynchronous viewing of online resources (e.g., YouTube video content)
- **In-person events:** opportunities to participate in synchronous group events held in person (e.g., conferences or presentations at a school site)
- **Hybrid events:** opportunities to participate in events either synchronously or asynchronously, which were presented both virtually and in person (e.g., recorded live sessions of book clubs, live webinars that are subsequently posted online)
- **Coaching:** opportunities for teachers to engage in synchronous, one-to-one or group coaching with an MLTI digital ambassador, either in person or online

Self-Paced Professional Learning Opportunities

The self-paced learning opportunities comprised podcasts or webinars posted to the MLTI YouTube channel. As indicated by a review of extant artifacts, MLTI ambassadors organized these online professional learning resources into playlists, which the AIR team then coded into 12 topical categories (Exhibit 2).⁶ In Year 2 of the evaluation, the MLTI YouTube channel included 150 professional learning resources. In Year 3, MLTI developed 72 additional professional learning resources, bringing the total number of resources to 222 videos.⁷ Most of the 72 new videos addressed the topical category of applications and tools (56 new videos) and to a lesser extent recipes for project-based learning (nine new videos), with all remaining categories containing three or fewer new videos.⁸

⁶ To categorize the playlists of professional learning resources into topical categories, AIR conducted qualitative coding based on the names of these playlists. In some cases, AIR grouped playlists with similar themes under a single category (e.g., the Digital Citizenship 101 and News & Media Literacy playlists were grouped into the digital citizenship category). In other cases, the MLTI YouTube channel used the same category title for multiple related playlists.

⁷ Seventy-six of the 222 total videos or resources are student-created tutorials for the MLTI SLAM Show.

⁸ MLTI also created a new playlist with six videos about artificial intelligence. These videos were not included in the count of new videos because they had already appeared in other playlists.

Exhibit 2. Self-Paced Learning Resource Categories, Playlists, and Videos

Topic area	Playlist topical category	Number of playlists	Number of digital resources created in Year 3	Total number of videos or resources
Technology integration	Applications and tools	6	56	121
	Technology integration	1	0	10
Active learning and student engagement	Recipes for project-based learning	4	9	20
	Student engagement	1	0	17
	Active learning	1	0	9
Digital citizenship	Digital citizenship	4	3	22
Digital instructional design	Digital instructional design	1	0	6
	Blended learning	1	0	4
Computer science	Computer science and computer science integration	1	2	7
Other	Support for ALL: Differentiation in the classroom	1	0	4
	Teacher wellness	1	1	1
	Compilation of topics	0	1	1
	Total	22	72	222

Note: AIR determined the playlist categories based on the MLTI YouTube playlist titles or themes of the videos included in the playlist. Two resources in this table were not included in YouTube playlists but were instead other self-paced learning opportunities (i.e., Padlet of resources, digital board game).

In-Person and Hybrid Professional Learning Resources

In Year 3, MLTI ambassadors also facilitated in-person events and hybrid events. In-person events were held at district offices, schools, or conferences and predominantly covered the two topic areas of “technology integration” and “active learning and student engagement.” Hybrid professional learning first occurred as a live webinar, with the slides posted for future viewing on the MLTI YouTube channel. The topics presented during hybrid events included digital citizenship, technology integration, and active or project-based learning and student engagement. Exhibit 3 presents the number of professional learning opportunities developed or delivered by MLTI in Year 3, organized by topic area and format. Based on these findings, MLTI greatly exceeded part of the stated implementation criterion of creating at least 20 professional learning resources with at least four resources in each of the five topic areas (as listed in Exhibit 2). However, MLTI developed four or more professional learning resources in three of the five areas: technology integration (64 resources), active/project-based learning (17 resources), and digital citizenship

(four resources). MLTI developed fewer than four resources for the topics of digital instructional design (none) and computer science (two resources).

Exhibit 3. Formats and Topics of Professional Learning Opportunities Developed in Year 3

Topic area	Self-paced learning	In-person events	Hybrid events	Coaching	Total resources developed in Year 3
Technology integration	56	5	3	0	64
Active learning and student engagement	9	6	2	0	17
Digital citizenship	3	0	1	0	4
Digital instructional design	0	0	0	0	0
Computer science	2	0	0	0	2
Other	2	0	0	0	2
Total	72	11	6	0	89

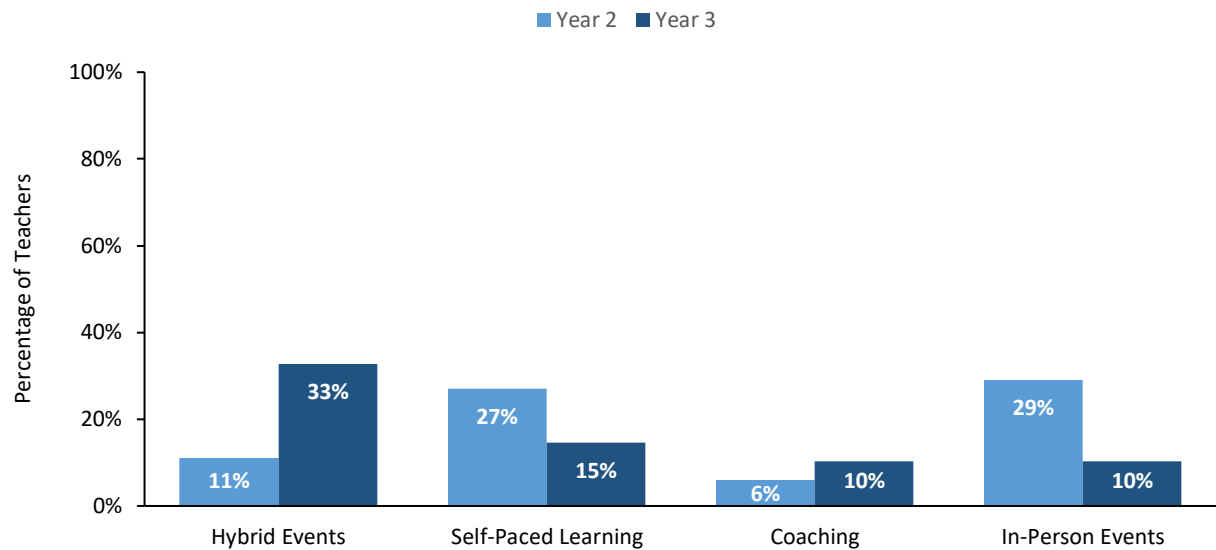
Extent of Participation in Professional Learning Opportunities

We examined the extent of teacher participation in all four formats of MLTI-provided professional learning opportunities (in-person, hybrid, coaching, and self-paced learning), based on responses to the teacher survey. Overall, 160 surveyed teachers (53%) reported participating in at least one professional learning opportunity, with hybrid events having the highest level of teacher participation.

We used the teacher survey data to describe the overall percentage of teachers who participated in each type of MLTI professional learning opportunity. Overall, hybrid events had the highest reported self-level of teacher participation among MLTI professional learning opportunities. More than one third (33%) of the surveyed teachers participated in these hybrid events (Exhibit 4). Relatively few teachers indicated participating in self-paced learning (15%), coaching (10%), in-person events (10%), or other learning opportunities (11%).

We compared the proportions of teachers who reported participating in MLTI professional learning opportunities to last year's survey and found an increase of 22 percentage points in the proportion of teachers participating in hybrid opportunities, with decreases of 19 percentage points and 12 percentage points (respectively) in the proportion of teachers attending in-person events and participating in self-paced learning (Exhibit 4).

Exhibit 4. Percentage of Teacher Survey Respondents Participating in Each Type of MLTI Professional Development, by Program Year



Note. $N = 302$ for the Year 3 survey and 186 for the Year 2 survey. Survey items: In-person events = “In-person group offering (e.g., conference presentation)”; Self-paced learning = “MLTI Videos on YouTube”; Coaching = “1-on-1 coaching (virtual or in person) with an MLTI Ambassador”; and Hybrid events = “Online hybrid offering (e.g., book studies).” One percent of the respondents indicated “Other.” Data sourced from the teacher survey.

Number and Type of MLTI Professional Learning Videos Viewed

One item on the teacher survey asked teachers to indicate the number of MLTI self-paced learning videos that they watched in the past year. Overall, the 23 teachers who reported watching any MLTI videos reported watching approximately five videos on average ($M = 5.4$, $SD = 3.8$), with a range between one and 15 videos.

These 23 teachers also responded to an item on the survey asking which type of MLTI professional learning video they had watched. Overall, videos in two topic areas—digital citizenship and active/project-based learning and student engagement—were the most watched. Nearly three quarters of the teachers (72%) responded that they watched videos about digital citizenship, and about two thirds of the teachers (63%) said that they watched videos about active/project-based learning and student engagement. About one third of the teachers (31%) reported watching videos about digital instructional design, and a quarter of the teachers (25%) reported watching videos on technology integration (25%). Relatively few teachers reported watching videos about computer science (16%).

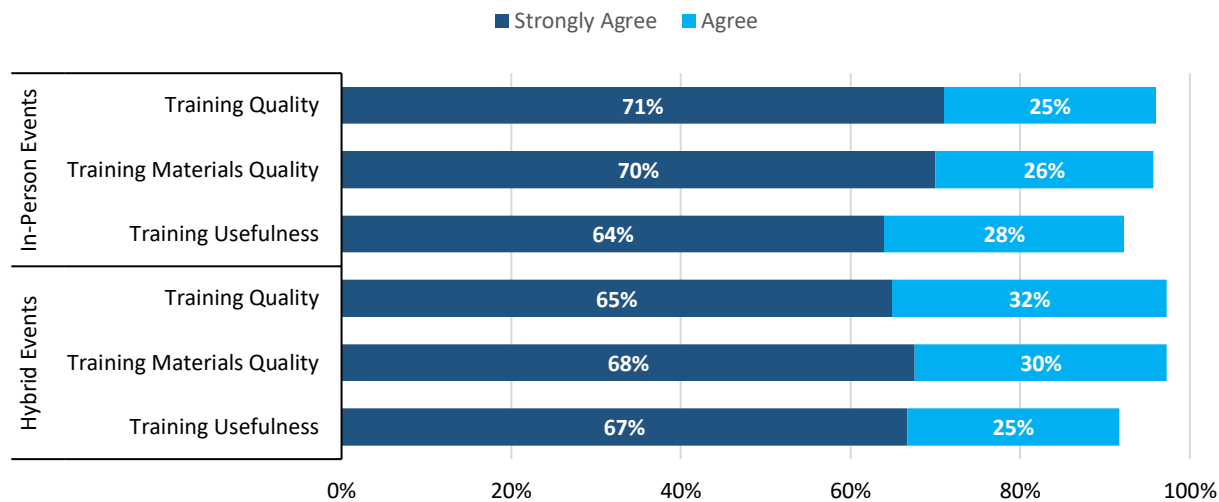
Participant Feedback on Professional Learning Opportunities

Teachers provided feedback on the quality and usefulness of the professional learning opportunities via postsurveys administered by the MLTI team. Through the teacher survey and during school interviews, teachers and staff also provided feedback on additional technology-focused professional learning they would find useful. Overall, nearly all teachers who responded to these surveys indicated that they agreed or strongly agreed that the training and materials provided in the professional learning opportunities were useful and of high quality.

Quality and Usefulness of MLTI Professional Learning Opportunities

Postsurveys administered after participation in self-paced learning and in-person events presented teachers with three items about their satisfaction with the training’s overall quality, the material quality, and its usefulness. Overall, nearly all teachers (at least nine of 10) agreed or strongly agreed that the training and the materials were of high quality, and the trainings were useful (Exhibit 5). These Year 3 results are comparable to the results from Year 2, in which most teachers (at least eight of 10) agreed or strongly agreed with these items.

Exhibit 5. Satisfaction With MLTI Professional Learning Opportunities



Note. N = 322–324 for in-person events (i.e., in-person and synchronous). N = 23–24 for hybrid events (i.e., virtual and synchronous or in-person and asynchronous). Survey items asked respondents to rate their agreement with the following statements: “Training was of high quality,” “Training materials were high quality,” and “Training was useful to my work.” Response options of strongly agree or agree are shown; other options (not shown) were partially agree, partially disagree, disagree, and strongly disagree. Responses about self-paced learning (i.e., virtual and asynchronous) and coaching were not shown given the low response (N = 2 and N = 0, respectively). Data sourced from the postsurveys of teachers.

Additional Professional Learning Opportunities Requested by Teachers

The survey presented teachers with an open-ended question about any additional professional learning opportunities focused on educational technology that they would find useful. Teachers and school technology coordinators at six profiled schools also described additional professional learning opportunities they believed would be useful. Of the 466 teachers who completed the teacher survey, 128 teachers (27%) identified at least one additional professional learning opportunity they would find useful. Here we present the most frequent types of professional learning they requested. When applicable, we also note findings from the profiled schools that participated in interviews and focus groups.

- How to use a specific instructional tool, such as Google Suite and digital media editing tools (32 surveyed teachers)
- Practicing with technology or learning about new types of technology (32 surveyed teachers; teachers and technology coordinators at five profiled schools)
- How artificial intelligence tools can be used in educational settings (29 surveyed teachers; teachers at one profiled school)
- Instructional tools for specific content areas, such as mathematics, computer science, or visual arts (18 surveyed teachers)
- Software for classroom management, such as screen sharing tools, learning management systems, or grading tools (10 surveyed teachers)
- Professional development that went beyond learning how to use instructional tools and was more focused on integrating the technology into their instruction (10 surveyed teachers)
- How to use technology for different pedagogies, such as blended learning, language learning, differentiated instruction (nine surveyed teachers).

Summary

The MLTI team developed dozens of professional learning resources and provided professional learning opportunities in four different formats: in-person events, self-paced learning opportunities, hybrid events, and coaching. For the most part, these resources addressed the topic area of technology integration (and, to a lesser extent, active learning and student engagement). Most of these resources were in the self-paced learning format, with some as in-person and hybrid formats.

More than three quarters of the surveyed teachers (78%) reported that they had participated in some form of MLTI professional learning, with most participating schools (88%) having at least one teacher participate in some form of MLTI professional learning. Hybrid events (e.g., live and recorded sessions and webinars) had highest self-reported level of teacher participation, which

increased from Year 2. Participation in self-paced learning and in-person events appeared to decrease in Year 3.

Teachers reported positive opinions about the quality and usefulness of MLTI professional learning opportunities. Most teachers (at least nine in 10) agreed or strongly agreed that the training and training materials were of high quality and useful for their work.

In terms of additional professional development, teachers most frequently noted that they would like training on how to use a specific instructional tool (e.g., Google Suite), opportunities to practice using technology or learn about new types of technology, or information on how to use artificial intelligence in educational settings.

Based on these findings, MLTI met or partially met the three milestones related to the program component of providing access to professional learning opportunities (Exhibit 6).

Exhibit 6. Completion of the Access to Professional Learning Opportunities Milestones

Milestone	Actual	Criterion reached?
Develop 20 total resources, with at least four resources across five topic areas.	Eighty-nine resources developed, with at least four resources developed in three of the five topic areas.	Partial
Eighty percent of MLTI schools participate in professional learning opportunities.	Eighty-eight percent of surveyed schools participated in MLTI professional learning opportunities.	Yes
Eighty percent of teachers at MLTI schools agree or strongly agree that the MLTI professional development is useful.	Between 92% and 93% of educators strongly agreed or agreed that the training was useful for their work.	Yes

Section 3. Support for District Technology Infrastructure and Technological Infrastructure Programs

This section describes the infrastructure support services provided by Maine DOE. MLTI provides funding for Maine DOE technology infrastructure specialist staff to work with schools and districts to develop additional programs for students in the technological infrastructure field (Maine DOE, n.d.), as well as a Cyber Performance Grant focusing on enhanced cybersecurity. This section describes these activities during 2023–24 using infrastructure specialist reports and conference participant satisfaction data from surveys provided by the MLTI team. This section also reports on three program milestones related to access to infrastructure (see Appendix A for a summary of the program milestones):

- The state infrastructure specialist delivers technology infrastructure presentations (**criterion:** four presentations).
- The state infrastructure specialist conducts site visits with districts (**criterion:** 14 schools).
- IT staff who receive IT support report satisfaction with the support received (**criterion:** 80% of staff).

Our findings indicate that MLTI provided four presentations on technology infrastructure support to two districts and two state associations, and conducted a statewide tabletop exercise on cybersecurity. Overall, participants in the tabletop exercise were satisfied with the quality of that event.

Provision of Technology Infrastructure Support

The technology infrastructure specialist assisted schools through three different categories of technology infrastructure support:

- **District site visits.** The technology infrastructure specialist conducted site visits to check in with IT staff and address particular areas of concern for that district.
- **Practitioner-focused conferences on technology infrastructure.** The technology infrastructure specialist attended and presented information to district staff at state conferences.
- **Presentations.** The technology infrastructure specialist developed and delivered presentations, either remotely as a virtual webinar or in person at conferences, on different topics of interest (e.g., cybersecurity).

The technology infrastructure specialist developed and delivered the following four presentations this year:

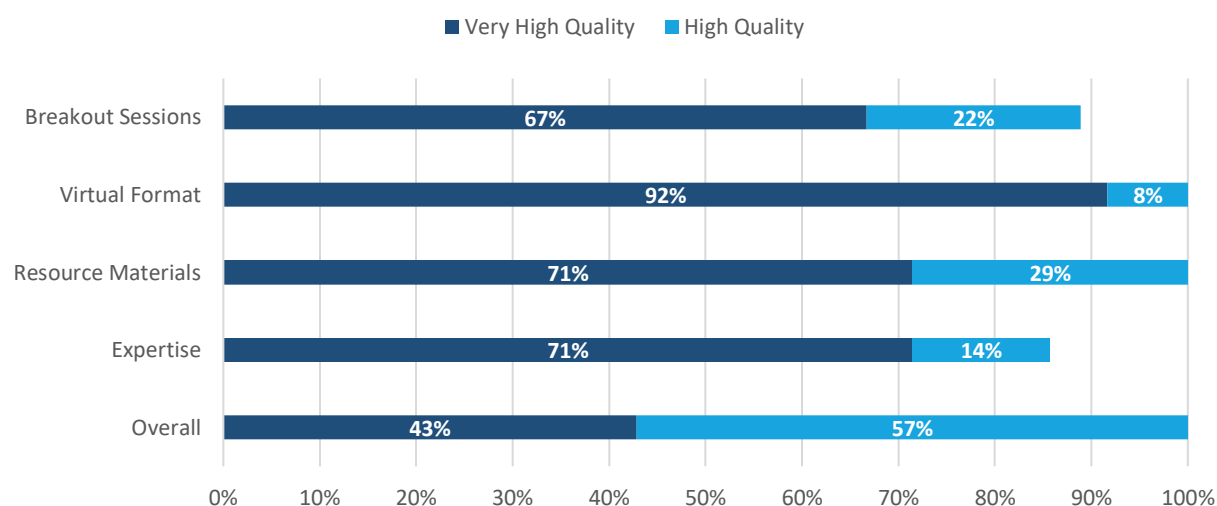
- **K12 Cyber Storm.** This presentation to the Association of Computer Technology Educators of Maine reviewed and reflected on Maine’s first ever cybersecurity tabletop exercise, including a discussion of the planning, detailed scenarios of the event, and lessons learned.
- **BangorSafe and SacoSafe.** These two presentations provided information about cybersecurity specific to the Bangor and Saco school districts, including district policy, state law regarding student data privacy, and student technology use.
- **Shields Up Maine.** This presentation to the Maine School Management Association discussed the highlights and key learnings from nine working group sessions of IT directors from 10 school administrative units (SAUs) participating in Shields Up Maine (an ongoing working group of 10 SAUs organized by MLTI 2.0).

These presentations were delivered both virtually and in person to district staff either on-site at the district schools or at two in-person conferences: the Association of Computer Technology Educators of Maine and the Maine School Management Association. The two district site visits reached a potential audience of administrators at 15 participating MLTI 2.0 schools (approximately 5% of the schools).

- **Statewide Cybersecurity Tabletop Exercise.**⁹ This year, in collaboration with the Maine Educational Technology Directors Association and the Cybersecurity and Infrastructure Security Agency, the infrastructure specialist also organized an online cybersecurity tabletop exercise. This event was a three-session, eight-hour event with statewide participation, consisting of two preparation sessions and a discussion-based cybersecurity response simulation in which district staff were able to conduct a walkthrough of a cybersecurity event. There were representatives from 115 schools in attendance (approximately 38% of the participating MLTI schools).

MLTI collected satisfaction surveys on the quality of the tabletop exercise. IT staff members at 12 of the 115 schools who attended the tabletop exercise completed a satisfaction survey (yielding a 10% response rate). Overall, feedback was positive. All respondents reported that the virtual format, resource materials, and the tabletop exercise were of high quality or very high quality. Eight in 10 respondents reported that the breakout sessions and expertise were of high quality or very high quality (Exhibit 7).

Exhibit 7. Satisfaction With Tabletop Exercise



⁹ A tabletop exercise is a facilitator-guided session where participants meet to discuss roles and responses to one or more emergency scenarios.

Note. *N* = 11. Response options of very satisfied and satisfied are shown; other options (not shown) were dissatisfied and very dissatisfied. Data sourced from the satisfaction surveys for the tabletop exercise collected by MLTI.

Cyber Performance Grant

Of the eight profiled schools, three received the Cyber Performance Grant through MLTI. These schools primarily used these funds to purchase enhanced security for student devices, such as firewalls and computer monitoring systems. Staff at these schools reported that the enhanced security measure makes it easier to monitor student devices to ensure that students are accessing only school-appropriate websites. Similarly, staff at these schools reported that improved firewall systems let teachers “continue teaching . . . without the concern” of students accessing inappropriate content. School staff did not report any challenges or restrictions regarding the new cyber performance infrastructure. However, one technology coordinator reported that the grant funds were not received before the start of the school year, leaving the director to purchase the software with their own money and receive reimbursement retroactively by reapplying for the grant.

Summary

The focus of the majority of the MLTI team infrastructure support efforts were on cybersecurity. The MLTI team provided four presentations and conducted a large tabletop exercise on this topic, as well as facilitated a grant program that supported schools in improving their cybersecurity via the purchase of firewalls and monitoring systems. Staff at schools participating in the grant noted that these measures alleviate concerns about students accessing inappropriate content. The infrastructure specialist made fewer schools visits this year compared with Year 2, focusing instead on district-level presentations and conferences.

Based on the findings reported in this section, MLTI achieved two of three milestones for access to infrastructure (Exhibit 8; see Appendix A for a summary of all program milestones).

Exhibit 8. Summary of Successful Completion of the Access to Infrastructure Milestones

Milestone	Actual	Criterion reached?
The state infrastructure specialist conducts four presentations.	The infrastructure specialist created three presentations on infrastructure support that were presented to district staff at four events.	Yes
The state infrastructure specialist conducts 14 site visits.	The infrastructure specialist visited two districts, with a potential audience of 15 school sites.	Yes

Eighty percent of IT staff who receive IT support are satisfied or very satisfied that the infrastructure support is useful.	—	Insufficient data
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Section 4. Teacher and Student Use of Technology

This section presents findings on the extent to which teachers used technology to support their instruction and productivity and to promote student-centered learning. As specified in the MLTI 2.0 Guiding Principles (Maine DOE, 2020), teachers are expected to use technology to afford students opportunities for student-centered learning that involve collaboration, communication, creativity, and critical thinking. For the first time, we examined the use of technology for these purposes at the elementary level, as we expanded our sample to elementary schools (including all teachers in each school in the survey sample).

This section also presents findings about tools and technologies for supporting student-centered learning. It describes how frequently teachers use different types of technology tools with their students, as well as types of additional tools teachers would like to access.

Finally, this section summarizes teacher ratings of their confidence in using technology and their beliefs about its usefulness for teaching and learning. We examined change in these responses across time.

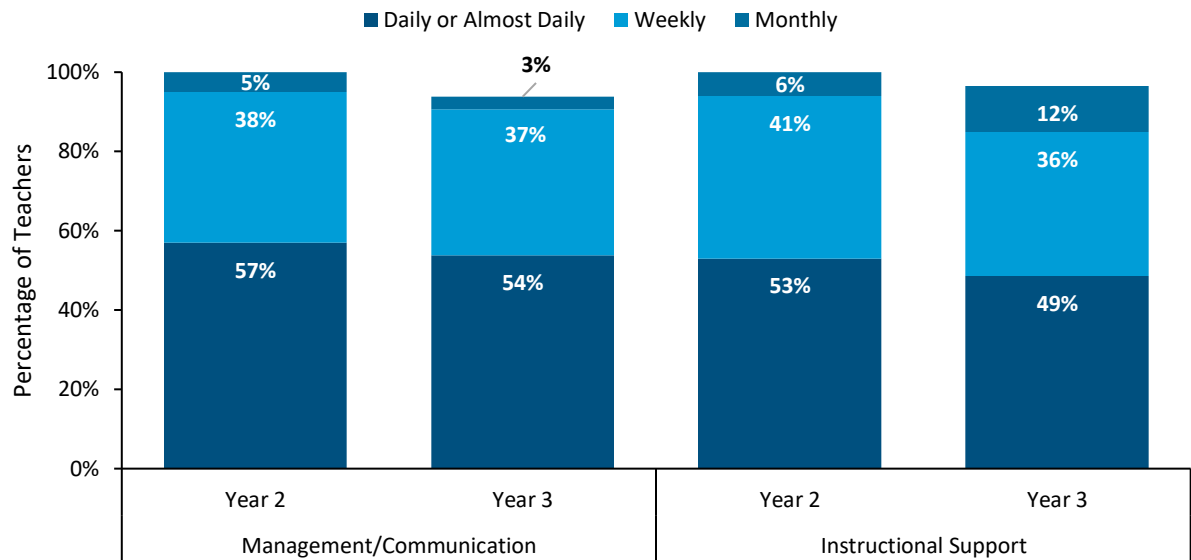
Several of the major findings were unchanged from previous years. We found that most teachers use technology to support instruction and classroom management. About three fifths of the teachers ask students to use technology for communication, critical thinking, and collaboration at least monthly.

Teacher Use of Technology to Support Instruction and Management

This section examines teacher reports of how frequently they used technology to support classroom instruction, or for classroom management and communication. As described in Section 1, we combined teacher survey responses to compose scale scores for two constructs: use of technology to support classroom instruction and use of technology for classroom management and communication (see Appendix B for the items).

Nearly all surveyed teachers (at least nine in 10) reported that they used technology for management and communication daily or almost daily (54%) or weekly (37%). Nearly nine in 10 teachers (85%) stated that they used technology to support instruction daily or almost daily (49%) or weekly (36%). These findings were similar to but slightly less frequent from Year 2 (Exhibit 9).

Exhibit 9. Teacher Use of Technology for Instructional Support and for Management and Communication, by Year



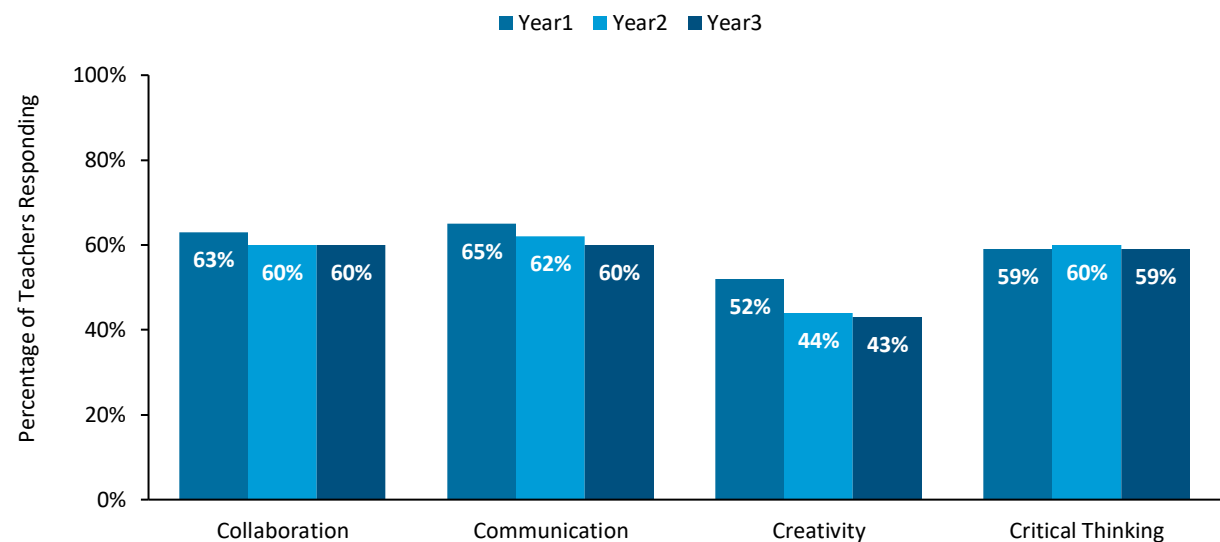
Note. *N* = 290 surveyed teachers. This sample is limited to teachers who completed these items in the MLTI teacher survey. The percentage of teachers in each response category is based on the response category in which teachers’ scale scores were most likely to be observed. Data sourced from the teacher survey.

Student Use of Technology for Collaboration, Communication, Creativity, and Critical Thinking

The MLTI 2.0 program sought to address the goal of improving student-centered learning practices for critical thinking, collaboration, creativity, and communication. To evaluate progress toward this goal, the teacher survey asked teachers to report the frequency with which they asked their students to use technology in ways that promoted the 21st century skills of collaboration, communication, creativity, and critical thinking. For all four categories, teachers described how frequently students engaged in four to six activities related to each skill (see Teacher Survey Item 11, Appendix B). Based on these responses, the evaluation team identified teachers who emphasized student technology use for each skill, which we defined as asking students to engage in two or more activities related to a particular skill at least monthly (see Methods for more details).

Overall, the proportion of surveyed teachers who emphasized student technology use for these four skills differed across skills. In Year 3, about three in five teachers emphasized student technology use for collaboration (60%), communication (60%), and critical thinking (59%), whereas about two in five teachers emphasized use of technology for creativity (43%; Exhibit 10).

Exhibit 10. Percentage of Surveyed Teachers Emphasizing Student Use of Technology for Collaboration, Communication, Creativity and Critical Thinking, by Program Year



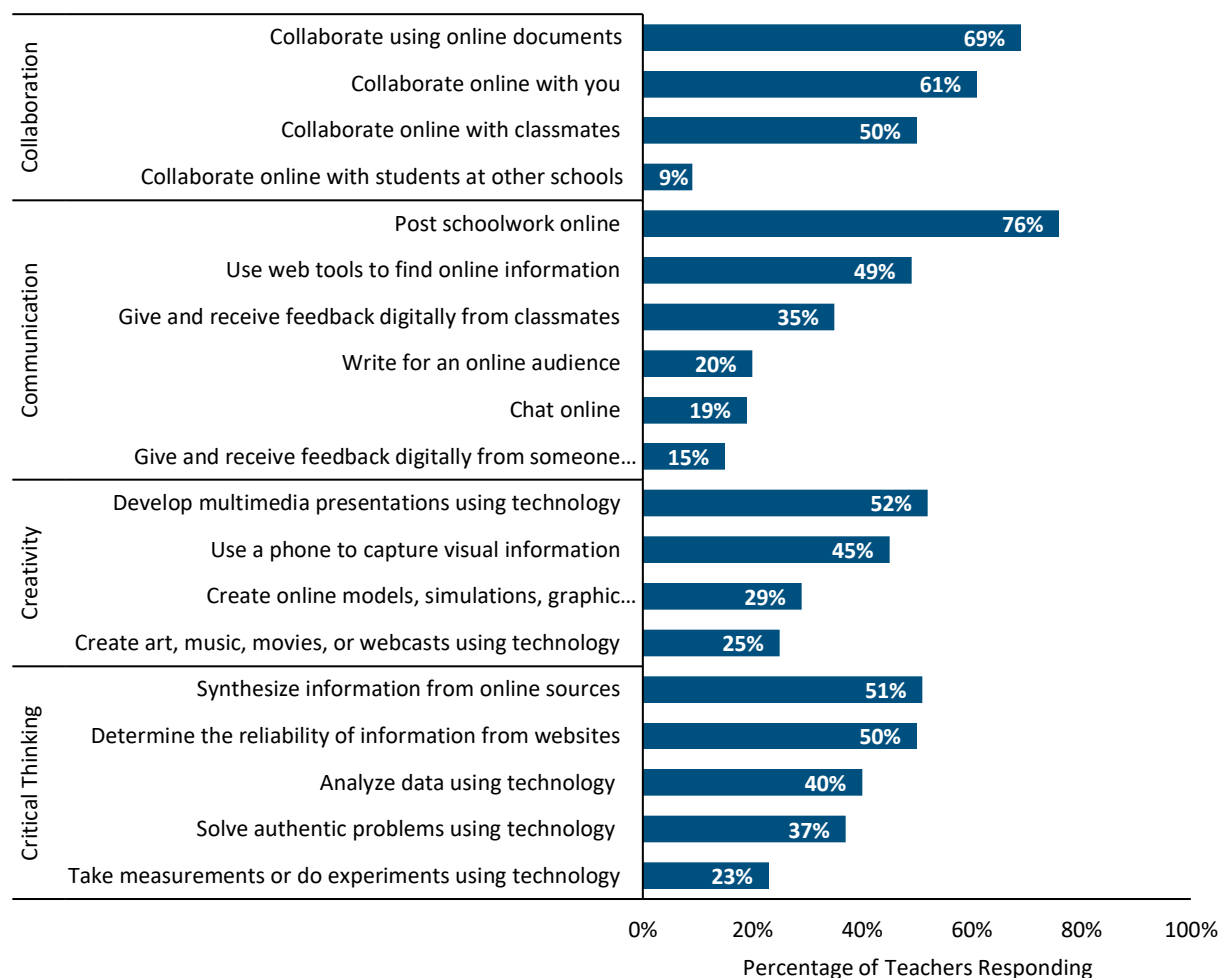
Note. *N* = 187 for Year 1 survey, 181 for Year 2 survey, and 290 for Year 3 survey. Percentages refer to the percentages of surveyed teachers who reported that they asked students to use classroom technology at least monthly for at least two activities in all four categories (collaboration, communication, creativity, and critical thinking). Data sourced from the teacher survey.

The following sections describe the rated frequency of student technology use for specific activities within each 21st century skill category.

Technology for Collaboration

Across three of the four activities that composed the category of technology for collaboration, at least half of the surveyed teachers reported frequent student use (Exhibit 11).

Exhibit 11. Percentage of Surveyed Teachers Asking Students at Least Monthly to Use Technology in Various Ways



Note. $N = 290$ for Year 3 survey. Percentages refer to the percentages of surveyed teachers who reported that teachers asked students daily, weekly, or monthly to use technology for various activities. The teacher survey item stem asked, “How frequently do you ask a majority of your students to . . .?” Data sourced from the teacher survey.

- More than two thirds of the teachers (69%) asked students to use technology to collaborate using online documents at least monthly.
- Sixty-one percent of the teachers asked students to collaborate online with teachers at least monthly, and 50% of the teachers asked students to collaborate online with classmates at least monthly.
- Very few teachers (9%) asked students to collaborate online with students at other schools at least monthly.

Technology for Communication

For five of the six activities that used technology for communication, a majority of surveyed teachers reported frequent classroom technology use (see Exhibit 11).

- Most teachers (76%) emphasized students' use of technology to post schoolwork online.
- Nearly half of the teachers (49%) reported asking students to use web tools to find online information, and about one third of the teachers (35%) reported asking students to give and receive feedback digitally from classmates.
- Relatively few teachers (15%–20%) asked students to use technology at least monthly for the following purposes:
 - To give and receive feedback digitally from someone outside the school (15%)
 - To chat online (19%)
 - To write for an online audience (20%)

Technology for Creativity

Across three of the four activities that composed the category of technology for creativity, fewer than half of the surveyed teachers reported frequent student use (see Exhibit 11).

- A majority of teachers (52%) reported asking students to develop multimedia presentations using technology at least monthly, and nearly half (45%) asked them to use a smartphone to capture visual information.
- Fewer than 30% of the teachers asked students to use technology at least monthly for the following purposes: to create art, music, movies, or webcasts using technology (25%) or to create online models, simulations, graphic representations, or animations (29%).

Technology for Critical Thinking

Among the activities related to critical thinking, about half of the teachers asked students to use technology at least monthly to synthesize information from online sources (51%) or to determine the reliability of information from websites (50%).

Relatively fewer teachers asked students to engage in the other critical thinking activities. Roughly two fifths of the teachers reported asking students to use technology to analyze data (40%) and or solve authentic problems (37%) at least monthly, and about one quarter of the teachers (23%) asked students to use technology to take measurements or do experiments.

Use of Technology Tools

The evaluation team examined promising tools and technologies that teachers use to support student-centered learning—both tools teachers already use during instruction and additional tools teachers would like to access. For clarity, we organized the findings about technology tools into the following seven categories:

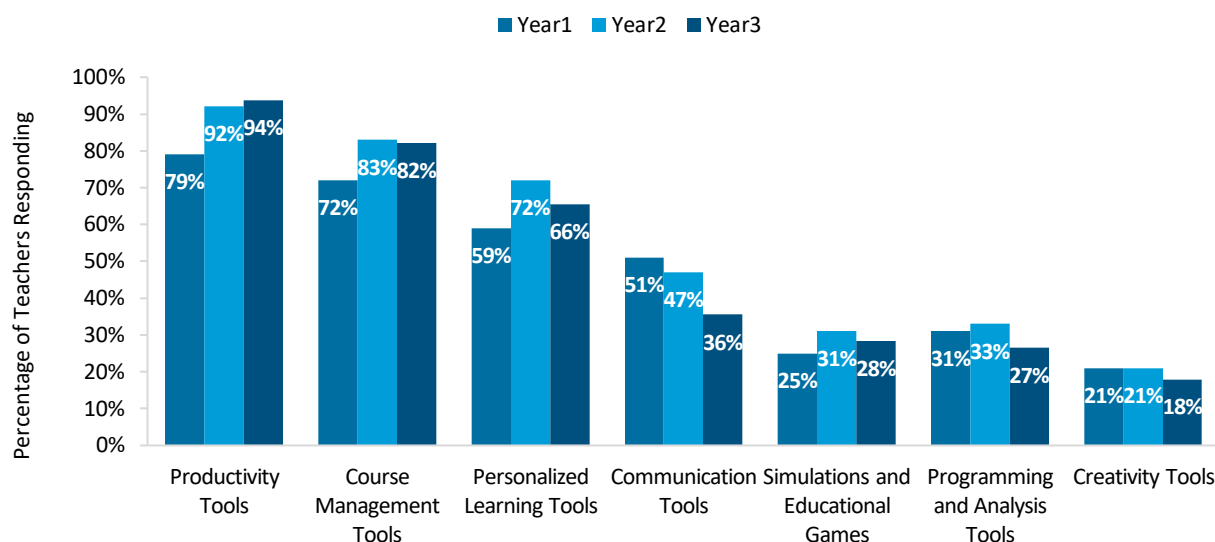
- **Productivity tools** (word processing, presentation, and spreadsheets)¹⁰
- **Course management tools** (learning management software and behavior management systems)
- **Personalized learning tools** (interactive assessment software, online lessons for the “flipped classroom” approach, and software to support personalized and self-paced learning)
- **Communication tools** (virtual communication tools and online discussion forums)
- **Programming and analysis tools** (geography or mapping software and computer programming software)
- **Simulations and educational games** (simulation software and game-based software)
- **Creativity tools** (software for video or photograph editing and music production or editing)

Frequency of Technology Tool Use

We categorized teachers as frequently using each category of technology tool if they reported using at least one tool in their classroom monthly or more frequently. Across the seven categories of technology tools that teachers used in their classrooms, the proportion of surveyed teachers reporting frequent use varied substantially, from 18% to 94% (Exhibit 12). There was an overall trend for lower percentages of teachers reporting frequent use of tools in each category compared with Year 2, with the largest drop in the category of communication tools (from 47% to 36%). The following is a brief summary of the most and least used categories of technology tools.

¹⁰ These three are grouped together because they are standard workplace software.

Exhibit 12. Percentage of Surveyed Teachers Who Reported Using at Least One Tool at Least Monthly in Seven Categories, by Program Year



Note. $N = 290$. Percentages indicate the percentages of teachers who reported using at least one tool at least monthly in each category. The survey item stem asked, “Please indicate about how often you use the following software with your students.” Response options included daily or almost daily, weekly, monthly, less than monthly, and don’t use. Data sourced from the teacher survey.

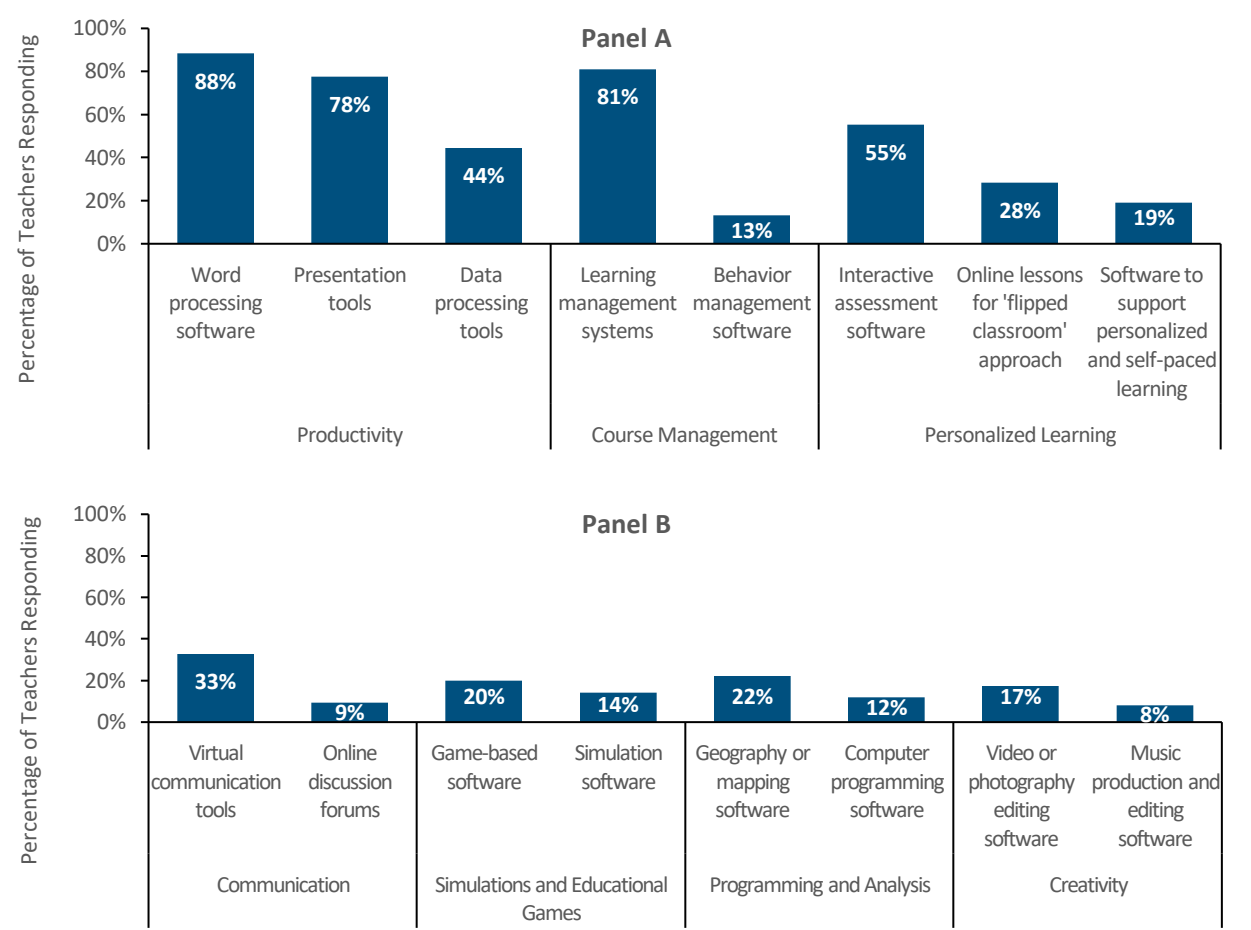
- Most surveyed teachers used at least one tool from the productivity tool category (94%), the course management tool category (82%), and the personalized learning tool category (66%) at least monthly.
- More than one third of the surveyed teachers used at least one tool from the communication tool category (36%) at least monthly. More than one quarter of the surveyed teachers used at least one tool from the simulations and educational games category (28%) and the programming and analysis tool category (27%) at least monthly.
- The creativity tool category had the lowest proportion of teachers reporting at least monthly use. About one fifth of the surveyed teachers used at least one tool from the creativity tool category at least monthly (18%).

In Exhibit 13, Panel A presents the proportion of surveyed teachers who reported frequent use of specific tools in the three categories with the highest proportion of teachers indicating frequent use: productivity tools, course management tools, and personalized learning tools. Most surveyed teachers reported using word processing software (88%), learning management systems (81%), and presentation tools (78%) at least monthly. Approximately one quarter to one half of the teachers reported using interactive assessment software (55%), data processing

tools (44%), or online tools for a flipped classroom approach (28%). About one fifth of the teachers reported using software to support self-paced learning (19%), and fewer teachers reported using behavior management software (13%).

Panel B in Exhibit 13 presents the proportion of surveyed teachers using specific tools in the remaining categories. About one third of the surveyed teachers reported using tools for virtual communication (33%). Fewer than one quarter (8% to 22%) reported frequently using tools for online discussion forums, or in any of the other categories: programming and analysis tools, simulations and educational games, and creativity tools. It may be that the tools in these four categories tend to be more specialized for content areas than tools in the more frequently used categories. For instance, computer programming software has more specialized uses than word processing software.

Exhibit 13. Percentage of Surveyed Teachers Who Reported Using Specific Tools at Least Monthly



Note. *N* = 290. Percentages indicate the percentages of teachers who reported using each technology tool at least monthly. The survey item stem asked, “Please indicate about how often you use the following software with your students.” Response options included daily or almost daily, weekly, monthly, less than monthly, and don’t use. Data sourced from the teacher survey.

Most Requested Apps

Of the 290 teachers who completed this section of the survey, 75 teachers (16%) responded to an open-ended item that asked what other software and tools they would like to access. Forty-five teachers (10% of those surveyed) identified at least one additional tool they would like to access, including the following:

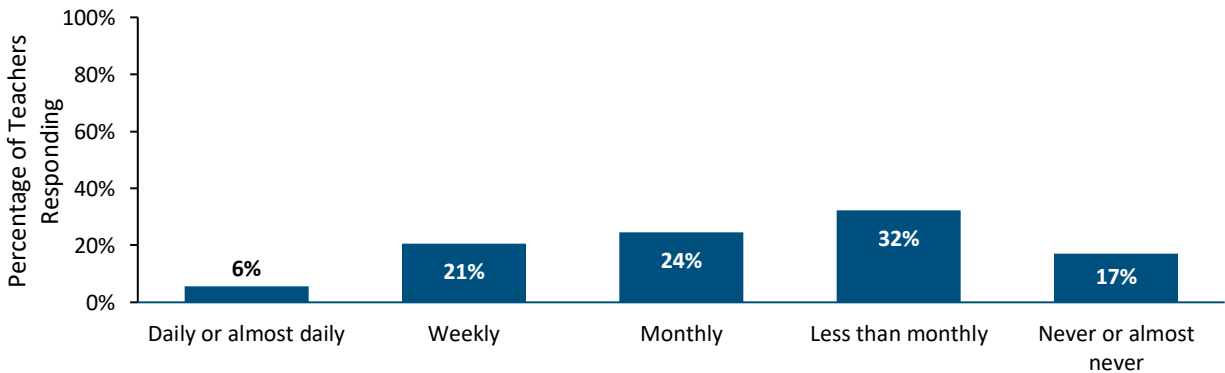
- Ten teachers identified personalized learning tools, such as IXL.
- Six teachers identified simulations and educational games, such as Minecraft and Gimkit.
- Six teachers identified course management tools, such as Apple Classroom and behavior management software.
- Five teachers identified creativity tools for video editing or music production, such as Adobe.

Other tools that the teacher respondents identified included productivity tools such as Slido and Notability, programming and analysis tools such as Python, and tools for language learning. In their responses, five teachers also discussed hardware constraints that would prevent their use of technology, such as having slow laptops or the inability to download software. These findings stand in contrast to Year 2, when 15 teachers requested creativity tools for video editing or music production, seven teachers requested creativity tools for drawing and art, and few teachers requested personalized learning tools.

Technology Difficulties

Teacher survey respondents reported how frequently their students encountered difficulties with classroom technology. Nearly three quarters of the teachers (73 percent) reported that their students encountered technical difficulties monthly (24%), less than monthly (32%), or never/almost never (17%). Roughly a quarter of the teachers (27%) reported their students experiencing technical difficulties on a weekly (21%) or daily (6%) basis (Exhibit 14).

Exhibit 14. Reported Frequency of Students Encountering Technical Difficulties



Note. N = 282. Survey item asked, “This school year, how frequently have your students encountered technical difficulties with classroom technology?” Data sourced from the teacher survey.

Of the 290 teachers who completed this section of the survey, 105 teachers responded to an open-ended item asking what technical difficulties their students encountered. 76 teachers reported their students encountered at least one of the following technical difficulty:

- 30 teachers reported their students encountered hardware issues, e.g. “screens turning black, chargers that don’t work”.
- 25 teachers reported their students encountered connectivity difficulty, e.g. “Apple TV connection problems”.
- 25 teachers reported their students encountered issues with credentials/access problems, e.g. “unable to access websites, log into accounts”.
- 13 teachers reported their students encountered other technical difficulties, e.g. “printing problems”.

Additional types of technical difficulties encountered included software/applications, network speed, and student responsibility for equipment. 11 teachers reported their students encountered software/applications difficulties, 10 teachers described the technical difficulties as student responsibilities for equipment, and 8 teachers reported their students encountered network speed difficulties.

We examined the association of the frequency of student technical difficulties with the frequency with which teachers asked students to use technology in ways that supported communication, collaboration, creativity, and critical thinking. Teachers who emphasized student use of technology for these four purposes (respectively) tended to report more frequent student technical difficulties.¹¹

Teach With Tech Grant

Of the eight profiled schools, five received the Teach with Tech Grant through MLTI. Through the grant, staff at these schools reported purchasing supplemental technology, such as 3D printers, podcasting equipment, microscopes, Smart Podiums, and large televisions. Staff reported that the new technology enhanced teaching and learning by making lessons more engaging for students, which allowed teachers to project lessons and student assignments easily and promoted more creativity. Staff also shared that the program increased access to technology. Some challenges that staff mentioned included new technologies not being compatible with existing technology, expensive repairs, and not enough time in teachers’ schedules to learn how to effectively implement the new technology. In addition, a technology

¹¹ Across all four technology uses, roughly 40% of the teachers who emphasized the use of technology rated the frequency as less than monthly or never/almost never, compared with 60% of the teachers who did not emphasize the technology. For communication, collaboration, and critical thinking, the χ^2 ($df = 4$) values ranged from 9.8 to 15.7, with all p values $< .05$. For creativity, we observed the same pattern, with χ^2 (4) = 9.0, $p < .1$.

coordinator from one school reported that the software they originally requested in the grant application was denied with little explanation, and the coordinator felt that it took too much time applying for the grant given the amount of money that the school received.

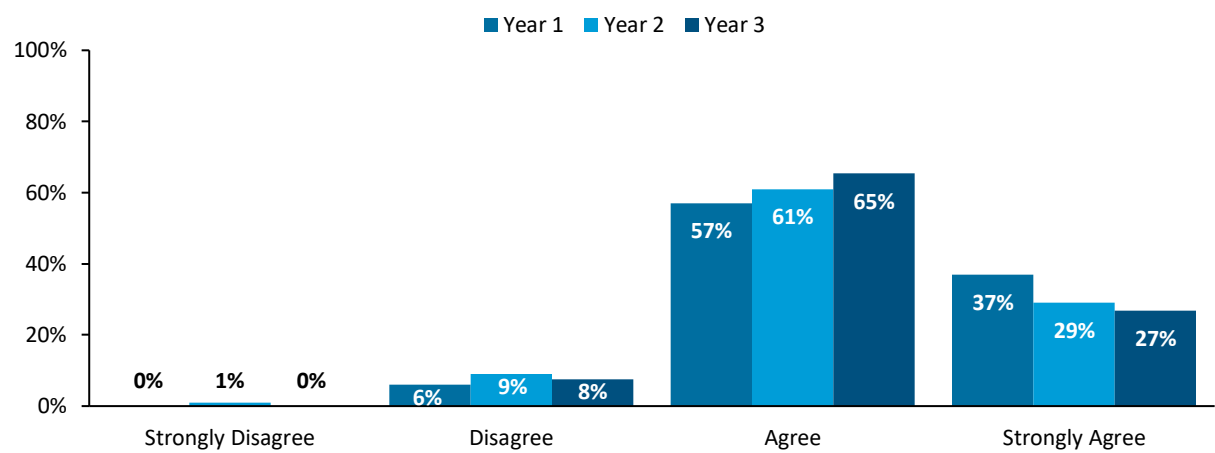
Teacher Beliefs and Attitudes Regarding Technology

The goal of MLTI 2.0 is to help teachers use technology to support student-centered learning, which includes fostering greater teacher confidence in their ability to use technology in instruction and more positive beliefs among teachers about the usefulness of technology integration. The teacher survey measured teacher attitudes on both topics, enabling the evaluation team to examine how attitudes and beliefs changed from Year 2 to Year 3.

Confidence in Using Technology

As indicated by their Year 3 scale score for confidence in using technology, most teachers (92%) agreed (65%) or strongly agreed (27%) that they were confident in their ability to use technology, which is similar to the results in Year 2. There was no significant change in teachers’ level of confidence compared with Year 2 ($b = -0.20, p = .575$), when 91% of teachers agreed (61%) or strongly agreed (29%). Exhibit 15 depicts the proportions of teachers typically selecting each response option for the confidence in using technology scale.

Exhibit 15. Proportions of Surveyed Teachers Categorized by Typical Responses to Confidence in Using Technology Items, by Program Year

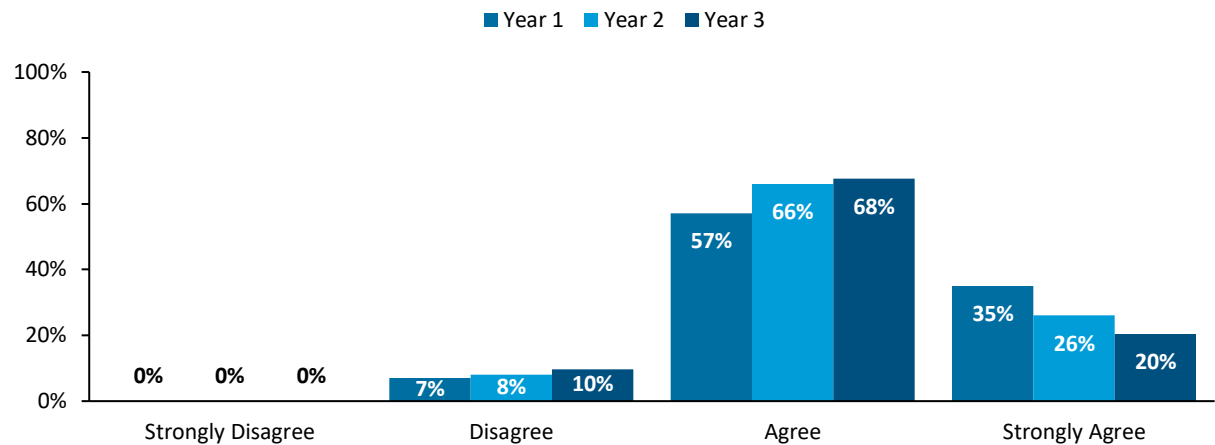


Usefulness of Technology

We also examined changes in teacher beliefs about the usefulness of technology for instruction. As for confidence in using technology, nearly all teachers (88%) agreed (68%) or strongly agreed (20%) that technology was useful for instruction. Although there was no statistically significant change in the strength of this belief compared with Year 2 ($b = 0.46, p = .084$), the proportion of

teachers strongly agreeing to items about usefulness appears to have decreased steadily since Year 1 (Exhibit 16).

Exhibit 16. Proportions of Surveyed Teachers Categorized by Typical Responses to Usefulness of Technology for Instruction Items, by Program Year



Summary

Year 3 showed similar but slightly less frequent use of technology to support instruction and to support communication and management at least weekly, compared with Year 2. Nearly all surveyed teachers (more than nine in 10) emphasized frequent (at least monthly) use of technology to support classroom instruction and to support management and communication. About half of the surveyed teachers used these tools on a daily or almost daily basis to support instruction and classroom management and communication.

Among surveyed teachers, approximately three fifths reported that they frequently asked students to use technology for communication, collaboration, and critical thinking; these proportions have remained similar across Years 1–3. Slightly less than half of the teachers (43%) reported that they frequently asked students to use technology for creativity, a proportion similar to Year 2 (44%) but less than Year 1 (52%). Specific technology uses reported most frequently by teachers included posting schoolwork online, collaborating using online documents, collaborating online with their teacher, and developing multimedia presentations using technology.

As in Year 1 and Year 2, surveyed teachers reported that the tools they used most frequently were in the categories of productivity tools, course management tools, personalized learning tools, and communication tools. Teachers reported frequent use of word processing software, learning management systems, and presentation tools. Thirty percent or fewer of the surveyed

teachers reported frequent use of tools in the following categories: programming and analysis tools, simulations and educational games, and creativity tools.

Teachers indicated which software or technology tools they would use if they had access to them. Of the 45 individuals who identified a tool, personalized learning tools were the most frequently cited. These findings differ from Year 2, when teachers most frequently requested creativity tools. Most teachers reported that their students infrequently encountered technical difficulties (i.e., monthly or less frequent).

Teachers had positive attitudes and beliefs about technology integration. Nearly nine in 10 teachers agreed or strongly agreed that they were confident in their ability to integrate technology, and technology was useful for instruction. These beliefs were not significantly different in Year 3 relative to Year 2.

Section 5. Conditions Supporting Technology Integration

This section describes the different levels of school support for technology integration at Maine MLTI schools, primarily through profiles of eight schools. The purpose of these profiles is to understand three domains of school supports: technology infrastructure, leadership for technology integration, and professional learning for technology integration. Each domain comprises two or three dimensions, as depicted in Exhibit 17. Appendix C provides a detailed description of the school profile methodology, definitions of framework dimensions, and domain scores for each school.

Exhibit 17. Framework of School Supports for Technology Integration

Domain	Dimension
Technology infrastructure	Connectivity and capacity
	Digital tools for teaching and learning
	Access to effective and efficient technical support
Leadership for technology integration	Shared vision
	Culture of innovation
	Professional learning for school leaders
Professional learning for technology integration	Job-embedded professional development for teachers
	Collaboration and community

Based on the qualitative data, AIR analysts assigned each school to a level from 0 to 2 (low to high) for each dimension in a domain. After assigning dimension levels, we summed the dimension levels to reach a domain score. For the technology infrastructure and leadership domains (which each having three dimensions), possible domain scores ranged from 0 to 6. For the professional learning domain (which has two dimensions), possible domain scores ranged from 0 to 4.

For each domain, we then categorized schools into groups that exhibited low, medium, or high levels of a domain. Schools were categorized at a low level of a domain if they received a domain score between 0 and 2 for technology infrastructure or leadership or between 0 and 1 for professional learning. Schools were categorized at a medium level of a domain if they received a domain score between 3 and 4 for technology infrastructure or leadership or a 2 for professional learning. Schools were categorized at a high level of a domain if they received a domain score between 5 and 6 for technology infrastructure or leadership or between 3 and 4 for professional learning.

Technology Infrastructure

The technology infrastructure domain contains the dimensions of connectivity and capacity, digital tools for teaching and learning, and technical support. This domain focuses on schools providing dependable Wi-Fi connectivity, up-to-date software for teachers and students, and efficient and effective technical support (see Box 1). Based on their domain-level scores, six profiled schools had high levels of technology infrastructure (scores of 5 or 6 out of 6) and the remaining two had medium levels (3 or 4 out of 6). When compared with the results from Year 2, schools profiled in Year 3 tended to have slightly higher technology infrastructure domain scores than schools in Year 2. Exhibit 18 provides the eight schools’ dimension and domain levels for technology infrastructure.

BOX 1. DIMENSIONS WITHIN THE TECHNOLOGY INFRASTRUCTURE DOMAIN

Dimension	Definition
Connectivity and capacity	The network provides dependable connectivity for all students and staff to access varied digital learning tools and online resources at the same time. Student safety and privacy are protected, while still allowing students and teachers to explore online environments and digital tools without unwarranted restrictions.
Digital tools for teaching and learning	Teachers and students have up-to-date hardware and software for teaching and learning (e.g., learning management system, e-portfolio system, assessment system, portal learning object repository, collaborative tools). Teachers and administrators participate in decision making about software purchases. Teachers can request purchase and installation of software as needed.
Technical support	The school has access to a staff member with dedicated time to address technical issues encountered by staff and students. Technical support is timely, effective, and efficient.

Exhibit 18. Domain and Dimension Levels for the Technology Infrastructure Domain

School	Rating for connectivity and capacity	Rating for digital tools for teaching and learning	Rating for technical support	Domain level for technology infrastructure
Schools with high domain scores				
School B	2	2	2	6
School C	2	2	1	5
School D	2	2	2	6
School E	2	2	2	6
School F	2	1	2	5
School G	2	2	2	6
Schools with medium domain scores				
School A	1	2	1	4
School H	2	0	2	4

Note. Dimension levels ranged from 0 to 2. Domain levels ranged from 0 to 6.

The following summarizes schools' experiences in each dimension of the technology infrastructure.

- **Connectivity and capacity.** Seven profiled schools had high scores for connectivity and capacity. Staff at these schools described dependable Wi-Fi in all classrooms. For example, the technology coordinator from School C stated that they have not heard of any connectivity issues this school year and described the school's Wi-Fi strength as "100%." Staff at one school reported disruptions in connectivity. The principal at School A said,

I feel like our system crashes, not crashes, but is down more than it should be. And it's hard to get it consistently on. And we're like, oh, did you lose the Internet? . . . It's a couple of times a month at least, you know. Sometimes it's, like I said, weather related, but sometimes it's just down, for whatever reason.

All eight schools used online tools and apps to protect student safety and privacy while online, such as web filters that monitor for dangerous words or illicit activities.

- **Digital tools for teaching and learning.** Six profiled schools had high scores for digital tools for teaching and learning. Staff at these schools indicated that they have the appropriate software and systems needed to deliver instruction, and the process for requesting new software is easy. For instance, the technology coordinator at School E reported that their software and systems for teaching and learning are "cutting edge." Staff at that school

reported that acquiring new software is relatively easy and requires listing the software in their annual budget request, which is approved by the school and the district. Staff at two schools reported issues with their software. For example, the technology coordinator and teachers at School H indicated that they do not have completely up-to-date software for teaching and learning. Teachers said they generally cannot download Chrome apps or extensions and consider their devices to be “glorified browsers” because there is little installed besides Outlook, Paint, and Photos. One teacher mentioned not receiving approval for new software requests, and another said,

Kids are not allowed to stream videos. If we’re like, hey, kids, watch a video, we can’t give it to them. We’re told it’s too much bandwidth. So, there’s a lot of things that we try to do that we don’t have access to.

- **Access to effective and efficient technical support.** Six profiled schools had high scores for access to effective and efficient technical support. Staff at these schools described a process for addressing technical issues that is straightforward and indicated that they have access to a staff member with dedicated time to address technical issues promptly and effectively. For example, the technology coordinator from School B stated that he handles everything from apps to computer technology, including glitches in software updates with cloud-based systems. Still, staff from two of these six schools mentioned that adding more IT staff would improve their ability to provide effective and efficient technical support. Two profiled schools reported issues accessing effective and efficient technical support. Staff from these schools shared that technical support staff were not located at their schools, which caused delays and left teachers and students without immediate access to technical support when needed. For instance, the technology coordinator at School C shared that the technical support staff member is a district-level employee who splits their time between various schools. This leads to issues if teachers need technical assistance when the technical support staff member is not at School C. Teachers reported similar difficulties, stating, “If [technical support staff] is not here, then you are kind of out of luck.” Staff from both schools mentioned that adding more IT staff would improve their ability to provide effective and efficient technical support.

Leadership for Technology Integration

The leadership for technology integration domain (henceforth, leadership domain) comprises the following dimensions: a shared vision, a culture of innovation, and professional learning for school leaders (see Box 2). To evaluate these dimensions, we asked school staff to describe the extent to which school leaders developed and shared a formal vision or plan for technology use, encouraged teachers to experiment with technology, and participated in professional learning focused on leading technology initiatives. Five schools had medium levels of leadership for

technology integration (a score of 3 or 4 out of 6), and the remaining three schools had low levels of leadership (scores of 0–2 out of 6). When compared with the results for Year 2 schools, schools profiled in Year 3 had higher leadership domain scores than schools in Year 2. Within the shared vision dimension and professional learning for school leaders dimension, there was a range of ratings (high, medium, and low) across schools. Within the culture of innovation dimension, all schools received medium ratings. Exhibit 18 presents the eight dimension and domain ratings for leadership.

BOX 2. DIMENSIONS WITHIN THE LEADERSHIP FOR TECHNOLOGY INTEGRATION DOMAIN

Dimension	Definition
Shared vision	The school has a formal, up-to-date vision and a set of expectations for using technology in teaching and learning. Teachers, students, and parents know about the vision, so there is a schoolwide understanding of it.
Culture of innovation	School leaders encourage a culture among teachers of experimenting with technology in their instruction. School staff engage in technology-related initiatives and share ideas about how to incorporate technology into learning, teaching, and school administration and operations.
Professional learning for school leaders	School leaders participate in professional learning that focuses on integrating technology into instruction. School leaders participate in professional learning about how to lead the development, implementation, and evaluation of schoolwide technology plans.

Exhibit 19. Domain and Dimension Levels for the Leadership Domain

School	Rating for shared vision	Rating for culture of innovation	Rating for leader professional development	Domain level for leadership
Schools with medium domain score				
School B	1	1	2	4
School E	0	1	2	3
School F	2	1	1	4
School G	0	1	2	3
School H	0	1	2	3
Schools with low domain scores				
School A	0	1	1	2
School C	0	1	1	2
School D	0	1	0	1

Note. Dimension levels ranged from 0 to 2. Domain levels ranged from 0 to 6.

The following summarizes schools' experiences in each dimension of leadership for technology integration.

- **Shared vision.** One profiled school had a high score for shared vision. Staff at this school described having an updated technology plan that includes vision and goal statements with supporting steps and action plans. One school received a medium score for shared vision. Leadership at this school described having a formal written vision, but it was unclear whether this vision is effectively communicated to teachers. The technology coordinator stated that “the vision is that they use it to increase learning in ways that are not possible without it and also to learn new technology because they are ever-changing.” The remaining six profiled schools had low scores for shared vision. School leaders and teachers at these schools reported that no formal, written technology plan exists for technology use for teaching and learning at their school. For example, staff at School H reported that “it’s really up to the classroom teachers to determine expectations” for technology use.
- **Culture of innovation.** All profiled schools had medium scores for culture of innovation. Staff at these schools generally felt that school leaders encourage teachers to experiment with new technologies. For example, staff at School C described school leaders working with teachers on a “person-by-person” basis to encourage exploration and use of new technology. Similarly, staff at School B described encouragement from school leaders by creating a new “maker space” that allows teachers and students to learn about and use new technologies for teaching and learning.
- **Professional learning for school leaders.** Four profiled schools had high scores for professional learning for school leaders. Principals and technology leaders at these schools reported attending professional development opportunities to learn about technology integration and the development of technology plans. For example, the technology coordinator at School B reported attending district-mandated training for software and equipment. School leaders at School H also reported attending in-person and online trainings to learn about integrating technology into classrooms. Three profiled schools had medium scores for professional learning for school leaders. Principals and technology leaders at these schools reported attending some professional development, but these opportunities did not always focus on the integration of new technologies. For example, school leaders at School A reported learning about technology primarily through their own staff, relying less on professional learning opportunities. One school had a low score in this dimension. Principals and other school leaders at this school reported little to no professional learning for school leaders.

Professional Learning for Technology Integration

The professional learning domain comprises the dimensions of job-embedded professional development and collaboration and community (Box 3). To evaluate these dimensions, we asked school staff to describe the extent to which technology-focused professional learning aligned with their day-to-day instructional tasks and curricular goals and whether teachers engaged in formal collaboration and inquiry activities. Of the schools profiled, four scored in the high range and four scored in the medium range. Compared with the results from Year 2, schools profiled in Year 3 had higher professional learning domain scores than schools in Year 2. All schools had staff who described medium levels of collaboration and community. Staff described medium and high levels of job-embedded professional development. Exhibit 20 provides the eight schools’ dimension and domain levels for professional learning for technology integration.

BOX 3. DIMENSIONS WITHIN THE PROFESSIONAL LEARNING DOMAIN

Dimension	Definition
Job-embedded professional development	Teachers participate in professional learning about technology that is ongoing throughout the year and during the school day (leveraging existing school routines) and focuses on the curricular needs of teachers. Teachers can select opportunities that align with their day-to-day, ongoing needs. Just-in-time learning resources are available to address emergent needs.
Collaboration and community	Local teams of teachers collaborate on using technology and conduct shared inquiries into student learning to identify effective uses of technology and to identify or develop digital learning resources.

Exhibit 20. Domain and Dimension Levels for the Professional Learning Domain

School	Rating for job-embedded professional development	Rating for collaboration and community	Domain level for professional learning
Schools with high domain scores			
School D	2	1	3
School E	2	1	3
School F	2	1	3
School G	2	1	3

School	Rating for job-embedded professional development	Rating for collaboration and community	Domain level for professional learning
Schools with medium domain scores			
School A	1	1	2
School B	1	1	2
School C	1	1	2
School H	1	1	2

Note. Dimension levels ranged from 0 to 2. Domain levels ranged from 0 to 4.

The following summarizes schools' experiences in each dimension of professional learning.

- Job-embedded professional development.** Four profiled schools had high scores for job-embedded professional development. Staff at these schools reported several opportunities to learn about technology for teaching and learning and noted that professional learning aligns with their needs. Staff at School E stated that the technology director hosts training sessions on various new software and applications. Similarly, the technology coordinator from School F described hosting professional development days and sessions on different technology topics, such as stop-motion videos, virtual field trips, and NearPod; staff reported that these opportunities frequently align with their goals. Four schools had medium scores for job-embedded professional development. Staff at these schools described some professional development opportunities, although they did not always align to their goals. For example, staff at School C reported having one professional development day per month, but there was no given number of the days dedicated to technology. Staff at School H shared that the school “could probably do better with personalizing the professional development dependent on the skill level of the staff.”
- Collaboration and community.** All profiled schools had medium scores for collaboration and community. Staff at these schools described mostly informal opportunities to collaborate about technology for teaching and learning. Staff at School H said, “I don’t know if I would say that there’s a lot of formal collaboration with just strictly technology.” Similarly, staff at School D described informal collaboration, reporting that they will “chat . . . and generally help” one another when it comes to implementing technology. The technology coordinator from School F stated that teachers “share [things] with their peers in the hallways,” highlighting the informal collaboration that takes place.

Summary

In the technology infrastructure domain, six schools had staff who described high levels of infrastructure, and two schools had staff who described medium levels of infrastructure. The six schools in the high range had staff who described having dependable wireless connectivity, access to up-to-date software and digital learning tools, and efficient technical support. The two schools in the medium range for this domain had staff who described less dependable Wi-Fi throughout the school, outdated devices and software (with complicated processes for requesting updates), or technical support that was not timely. Scores across all three dimensions were relatively similar, and all schools tended to have consistent scores across dimensions. Given that the majority of schools were in the high range for this domain, technology infrastructure appears to be the strongest of the three domains of school supports.

School staff described a range of low and medium levels of leadership for technology integration. Staff at three schools described low levels of leadership, and staff at five schools described medium levels of leadership. A majority of the schools did not have a formal vision for technology use, and only half of the schools' leaders described participating in professional learning opportunities related to technology. Staff at all eight schools described medium levels of leadership with regard to a culture of innovation. Although schools did not tend to have a formal vision for technology use, teachers did, overall, feel encouraged by their colleagues to experiment with technology. However, this encouragement did not tie into specific goals or initiatives within the schools.

Staff at four schools described high levels of professional learning for technology integration, whereas staff at the remaining four schools described medium levels. Schools with high levels provided more professional learning opportunities that were sometimes related to teachers' ongoing curricular needs. Schools with medium levels had fewer opportunities for professional learning focused on teachers' needs. Schools in both the high and medium ranges reported medium levels of collaboration and community, demonstrating that schools were providing opportunities (although they were mostly informal) for teachers to work together to use technology tools to meet student needs. This result highlights a need for schools to provide more opportunities for teachers to formally conduct shared inquiries into effective uses of technology for teaching and learning.

Our findings suggest that the profiled schools have supports in place across all three domains. Summing across the domains, the eight schools were clustered in the middle of the range, with overall scores of 8–12 (Exhibit 21). Comparing across domains, the profiled schools mostly had high levels of technology infrastructure, medium to high levels of professional learning, and low to medium levels of leadership for technology integration. These findings indicate that (a) technology infrastructure is typically strong (and is not weak in any school); (b) schools are

providing some support for professional learning for technology integration but have room for improvement; and (c) most schools are not yet providing strong leadership for technology integration. Compared with the results from Year 2, schools in Year 3 had slightly higher domain scores for technology infrastructure, leadership, and professional learning.

Exhibit 21. Domain and Overall Scores for Technology Integration Supports by School

School	Technology infrastructure (range: 0–6)	Leadership for technology integration (range: 0–6)	Professional learning for technology integration (range: 0–4)	Overall (range: 0–16)
School A	4	2	2	8
School B	6	4	2	12
School C	5	2	2	9
School D	6	1	3	10
School E	6	3	3	12
School F	5	4	3	12
School G	6	3	3	12
School H	4	3	2	9

Section 6. Discussion and Recommendations

Building on two decades of previous experience supporting one-to-one device allocation, MLTI 2.0 seeks to expand access to digital devices across a broader range of grades than the previous version of the initiative, provide high-quality professional learning in support of digital learning and technology integration, and support robust school technology infrastructure in schools throughout the state. The Year 3 evaluation of MLTI 2.0 focused on providing feedback to Maine DOE on implementation of the initiative’s components, how teachers and students are using technology resources provided by MLTI 2.0 or otherwise, and supports or resources that would be useful for promoting technology integration. The evaluation team conducted a teacher survey in a representative sample of 28 schools, reviewed artifacts of professional learning, analyzed teacher feedback surveys administered following professional learning events, and profiled 8 schools based on interviews and focus groups with administrators and teachers. This section discusses the evaluation’s findings and offers recommendations based on those findings.

Professional Learning

MLTI excelled in developing professional learning resources, with evidence that the topics of these resources matched teacher interests. Resource development has continued as in years

past, with nearly 90 new resources. Most of these resources were self-paced learning resources, with a smaller number of resources for in-person and hybrid events. The primary focus of these resources was on technology integration, particularly on using specific applications and tools. A secondary focus was on active learning and student engagement. This focus of development appears to match well with teachers' reported interest in learning about new types of technology. MLTI has not yet developed many professional learning resources on artificial intelligence, which surveyed teachers expressed as a topic of interest. It is unclear from the extant data whether MLTI provided opportunities for teachers to practice using technology, another area of interest expressed by teachers.

About three quarters of the surveyed teachers reported that they had participated in some form of MLTI professional learning. About one third of the surveyed teachers indicated that they participated in hybrid events (e.g., live and recorded sessions and webinars), although fewer than half that proportion participated in self-paced learning, in-person events, and coaching. Among the few participants who completed a postsurvey, most provided high ratings for quality and usefulness. Unlike previous years, the evaluation did not have access to extant data on participation in coaching or other in-person events.

At four profiled schools, we found evidence of high levels of professional learning for technology integration, as indicated by professional learning opportunities that related to teachers' ongoing curricular needs. At four schools with medium levels, teachers had fewer opportunities for professional learning focused on their curricular needs. Across all schools, staff reported informal opportunities for teachers to work together to use technology tools to meet student needs, but no formal opportunities for shared inquiry.

Recommendation 1: In response to teacher interest in artificial intelligence, consider developing professional learning resources focused on the use of artificial intelligence tools in classroom instruction.

Recommendation 2: Given teacher interest in opportunities to practice using technology, along with the lack of shared inquiry, consider organizing and facilitating online communities of practice devoted to integrating technology tools into classroom instruction.

Recommendation 3: To inform the continuous improvement of MLTI professional learning efforts, we recommend (a) establishing a formal process for collecting data on teacher participation in professional learning and (b) collecting data on the professional learning needs of teachers.

Infrastructure Support

The focus of MLTI infrastructure support efforts was cybersecurity. The MLTI team provided presentations and conducted a large tabletop exercise on this topic; participants typically rated the quality of this support as high. The infrastructure specialist made fewer school visits this year compared with Year 2, focusing instead on district-level presentation and conferences. MLTI also provided funds through the Cyber Performance Grants for districts to improve their cybersecurity through the acquisition of firewalls and computer monitoring systems. School staff noted that these systems alleviated concerns about students accessing inappropriate content.

Recommendation 4: Given the benefits of the Cyber Performance Grants for technology integration, MLTI may consider expanding this program to additional schools.

Among the profiled schools, evidence exists of a reliable and robust technology infrastructure. Six profiled schools had staff who described high levels of infrastructure, as indicated by dependable wireless connectivity, access to up-to-date software and digital learning tools, and efficient technical support. Staff in two schools described medium levels of infrastructure, as indicated by relatively less dependable Wi-Fi throughout the school, outdated devices and software (with complicated processes for requesting updates), or technical support that was not timely. Technology infrastructure appears to be the strongest of the three domains of school supports that the evaluation assessed through school profiles. Relative to findings from a different sample of eight schools last year, the current sample has somewhat stronger infrastructure. These findings are consistent with teacher survey results indicating infrequent technical difficulties that interrupt student use of technology.

Recommendation 5: Given the evidence for reliable infrastructure, we recommend that the MLTI program continue its current efforts to support infrastructure for all schools and consider providing targeted support for the minority of schools in which the infrastructure is not yet as robust.

Technology for Teaching and Learning

Teachers continued to use technology for instruction and management—and continued to ask students to use technology—at levels observed in previous years of the program.

Teachers reported frequent use of technology tools for instruction and management, with most using technology at least weekly and about half using them daily. About three fifths of the surveyed teachers reported that they frequently asked students to use technology for communication, collaboration, and critical thinking, and about two fifths reported frequent student use of technology for creativity. Teachers report that students frequently post schoolwork online, collaborate online, and develop multimedia presentations. Teachers

reported frequent use of word processing software, learning management systems, and presentation tools. Teachers reported that creativity tools were the least frequently used. Among teachers who identified technology tools they would use if they had access to them, teachers most frequently mentioned personalized learning tools.

Technical difficulties were infrequent. About three quarters of the teachers reported that their students infrequently encountered technical difficulties (i.e., monthly or less frequent). However, teachers whose students frequently used technology for collaboration, communication, creativity, and critical thinking (respectively) were somewhat more likely to report frequent technical difficulties. It is unsurprising that more frequent technology use would result in more frequent technical difficulties.

Teachers had positive attitudes and beliefs about technology integration. Nearly nine in 10 teachers agreed or strongly agreed that they were confident in their ability to integrate technology, with technology being useful for instruction. These beliefs were not significantly different in Year 3 relative to Year 2.

Recommendation 6: Given the overall stability of these measures of technology use and beliefs for the sampled population of teachers, MLTI may consider exploring the contextual factors that influence teacher technology integration and whether participation in technology-focused professional development is associated with changes in these teacher technology measures.

Leadership for Technology Integration

In the profiled schools, staff described a range of low and medium levels of leadership for technology integration. A majority of the schools did not have a formal vision for technology use, and half of the schools' leaders described participating in professional learning opportunities related to technology. Although schools did not tend to have a formal vision for technology use, teachers did, overall, feel encouraged by their colleagues to experiment with technology. However, this encouragement did not tie into specific goals or initiatives within the schools. School leadership for technology has been the weakest of the school supports evaluated by the school profiles in the past 3 years.

Recommendation 7. Given the areas for improvement in school leadership for technology, MLTI may consider offering a professional learning series focused on school leadership to school administrators. It may be worthwhile to consider a target hire among the digital ambassador team to focus on this need.

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Appendix A. Summary of Milestones

Exhibit A1. Maine Learning Technology Initiative (MLTI) Milestones and Completion Status

Program component	Milestone	Actual	Criteria reached?
Access to technology	Ninety-five percent of MLTI schools receive one-to-one devices for students and educators (based on allocation and current enrollment).	Ninety-four percent of MLTI schools received one-to-one devices for students, and 72% of MLTI schools received one-to-one devices for educators (based on allocation and current enrollment).	Not addressed in this report
	Ninety-five percent of MLTI schools distribute one-to-one devices to students and educators (based on allocation and current enrollment).	Ninety-three percent of MLTI schools distributed one-to-one devices to students, and 84% of MLTI schools distributed one-to-one devices to educators (based on allocation and current enrollment).	
	Ninety percent of MLTI schools distribute 100% of their student and educator devices by October 1.	Eighty-seven percent of MLTI schools distributed 100% of their student devices by October 1, and 75% of MLTI schools distributed 100% of their educator devices by October 1.	
Access to professional learning opportunities	Develop at least four resources across five topic areas (20 total).	Eighty-nine resources developed, with at least four resources developed in three of the five topic areas.	Partial
	Eighty percent of MLTI schools participate in professional learning opportunities.	Eighty-eight percent of surveyed schools participated in MLTI professional learning opportunities.	Yes
	Eighty percent of teachers at MLTI schools agree or strongly agree that the MLTI professional development is useful.	Between 92% and 93% of educators strongly agreed or agreed that the training was useful for their work.	Yes
Access to infrastructure	The state infrastructure specialist conducts four presentations.	The infrastructure specialist created three presentations on infrastructure support that were presented to district staff at four events.	Yes
	The state infrastructure specialist conducts 14 site visits.	The infrastructure specialist visited two districts, with a potential audience of 15 school sites.	Yes
	Eighty percent of IT staff who receive IT support are satisfied or very satisfied with the support received.	—	Insufficient data

Appendix B. Teacher Survey Protocol

Introduction

1. Which school do you currently work at?

*[Required. Single select; response options: Drop down menu of MLTI schools and “*Other school not on list”]*

2. What grade(s) do you currently teach?

[Required. Multi-select; response options: Kindergarten, 1st grade, 2nd grade, 3rd grade, 4th grade, 5th grade, 6th grade, 7th grade, 8th grade]

3. Which of the following best describes your teaching role this year?

- a. I teach a specific subject area to multiple classes of students
- b. I teach multiple subjects to one class of students
- c. I do not have a teaching role

[If a is selected, skip next item. If c is selected, skip to end.]

4. Which subjects do you teach? (Select all that apply)

- a. Arts
- b. Career and technical education
- c. English language arts
- d. Math
- e. Physical education
- f. Science
- g. Social studies
- h. World languages
- i. Other

Professional development

The next four items ask about professional development you have received from *any* source.

5. How many total hours have you spent participating in *each* of the following professional development activities *focused on educational technology* during the past 12 months?

[Response option: Drop-down list of hours from 0 – 40 for each item]

- a. Formal, whole-group professional development (e.g., in-service days, professional development workshops, book study)

- b. Formal, individualized or 1-on-1 professional development (e.g., mentoring, coaching, self-paced online courses)
- c. Informal, self-organized professional development (e.g., podcasts, tutorial videos, communities of practice, blogs, social media)

This item asks specifically about professional development provided by the Maine DOE/MLTI team.

6. The Maine Learning Technology Initiative 2.0 (MLTI 2.0) provides several types of **professional learning opportunities**. In which of the following MLTI 2.0 professional learning opportunities have you participated over the past year? Select all that apply:
[Response option: Select all that apply]
 - a. 1-on-1 coaching (virtual or in person) with an MLTI Ambassador
 - b. MLTI videos on YouTube
 - c. In-person group offering (e.g., conference presentation)
 - d. Online hybrid offering (e.g., book studies)
 - e. Other (please specify)
7. *[Show if option “b” above is checked]* Approximately how many MLTI videos did you watch over the past year?
8. *[Show if option “b” above is checked]* Which of the following types of MLTI professional learning videos did you view this past year?
 - a. Digital Citizenship (e.g., internet safety, digital identity, cyber bullying, etc.)
 - b. Technology Integration (e.g., 3D printing, drones, AR/VR, etc.)
 - c. Active/Project-Based Learning and Student Engagement (e.g., game based learning, SEL, students as creators, etc.)
 - d. Digital Instructional Design (e.g., remote learning, asynchronous design, blended learning, etc.)
 - e. Computer Science (e.g., robotics, coding/programming, computational thinking, cyber security, AI, etc.)
9. What additional professional development focused on educational technology would you find most useful?
[Response option: Open response]

Use of technology in the classroom

10. How often do you use technology to do the following?

[Response options: Daily or almost daily, Weekly, Monthly, Less than monthly, Never]

- a. Creating handouts or instructional materials for students
- b. Developing lesson plans
- c. Administering assessments
- d. Delivering a presentation or direct instruction to the class
- e. Entering or viewing grades
- f. Entering or viewing results of student assessments
- g. Entering or viewing attendance records
- h. Communicate with students (e.g., email, instant messaging, etc.)
- i. Sharing class announcements or assignments (e.g., with Google Classroom)
- j. Communicate with parents (e.g., email, instant messaging, etc.)

11. How frequently do you ask a *majority* of your students to do the following?

[Response options: Daily or almost daily, Weekly, Monthly, Less than monthly, Never]

- a. Collaborate using online documents (e.g., Dropbox, Google Docs)
- b. Collaborate online with classmates (e.g., group projects)
- c. Collaborate online with students at other schools (e.g., service projects, science fairs)
- d. Collaborate online with you (e.g., provide formative feedback)
- e. Post schoolwork online (e.g., use Google Classroom or Padlet)
- f. Use web tools to find online information (e.g., Twitter, news feeds)
- g. Write for an online audience (e.g., reviews, blog posts, comments)
- h. Give and receive feedback digitally from classmates
- i. Give and receive feedback digitally from someone outside the school (e.g., an outside expert, a student in another class or school)
- j. Chat online (e.g., Skype, Google Hangout, FaceTime)
- k. Use a phone to capture visual information (e.g., a picture or a movie)
- l. Develop multimedia presentations using technology
- m. Create art, music, movies, or webcasts using technology
- n. Create online models, simulations, graphic representations, or animations
- o. Determine the reliability of information from websites
- p. Synthesize information from online sources

- q. Take measurements or do experiments using technology
- r. Solve authentic problems using technology
- s. Analyze data using technology

Supports for the use of technology in the classroom

12. Is your school able to provide you with the following support for technology use:

[Response options: 1 Almost always, 2 Usually, 3 Sometimes, 4 Rarely, 5 Not applicable]

- a. Access to high-speed internet
- b. Consistent access to wi-fi
- c. Prompt assistance with technology problems that disrupt instruction
- d. Support for computer device operation (e.g., desktops, laptops, or tablets)
- e. Access to instructional software and tools

13. Please indicate about how often you use the following software or applications with your students. *[Response options: Daily or almost daily; Weekly; Monthly; Less than monthly; Don't use]*

- a. Video or photography editing software (e.g., iMovie)
- b. Music production and editing software (e.g., GarageBand, Anchor.fm)
- c. Word processing software (e.g., Word, Google Docs)
- d. Presentation tools (e.g., PowerPoint)
- e. Data processing tools (e.g., Excel)
- f. Virtual communication tools (e.g., Zoom)
- g. Online discussion forums (e.g., Flipgrid, iNaturalist)
- h. Behavior management software (e.g., ClassDojo)
- i. Geography or mapping software (e.g., Google Maps)
- j. Learning management systems (e.g., Google Classroom)
- k. Online lessons for “flipped classroom” approach (e.g., Khan Academy)
- l. Computer programming software (e.g., Scratch)
- m. Interactive assessment software (e.g., Poll Everywhere, Kahoot!)
- n. Software to support personalized and self-paced learning (e.g., Zearn, ASSISTments)
- o. Simulation software (e.g., Gizmos, PhET)
- p. Game-based software (e.g., Minecraft Education)
- q. Other (write in)

14. Are there any computer applications you would like to use if you had access to them? If so, please list them here.

15. This school year, how frequently have your students encountered technical difficulties with classroom technology?

[Response options: 1 Several times per week, 2 About once per week, 3 a Once or twice per week, 4 Once or twice per month 5 A few times, but less than once per month 6 Students did not encounter technical difficulties with classroom technology]

16. Please describe the technical difficulties your students encountered. *[Open Response]*

The use of technology in the classroom

17. To what extent do you agree or disagree with the following statements?

[Response options: 1 Strongly agree, 2 Agree, 3 Disagree, 4 Strongly disagree]

- a. I can motivate students to use technology in a positive way.
- b. I can provide students with technology-based activities to exercise their knowledge and skills.
- c. I can provide students with technology-based activities related to my content area.
- d. Technology use in the classroom enhances student learning.
- e. I think that learning is more engaging when using technology.
- f. I want to learn more about effective technology use for teaching.

Appendix C. School Profile Methodology and Findings

We created profiles of eight schools—based on interviews and focus groups with staff—to understand how school staff perceive their schools’ leadership, professional learning, and technology infrastructure as supports for integrating technology. We created a detailed school technology integration support framework to describe schools’ level of support for technology integration in the domains of leadership, professional learning, and technology infrastructure.

School Sample

In Year 3, we sampled eight schools from a list provided by Maine DOE that included all Maine public schools that (a) participated in the MLTI and (b) received either a Cyber Performance Grant or Teach With Tech Grant. Based on statewide distributions, we selected a sample that had nearly equal representation of schools from the three tertiles of the distribution of students eligible for free or reduced-price lunch; a roughly proportional distribution of MLTI schools at the elementary (two schools), middle (four schools), and high school (two schools) levels; and which represented eight unique regions (of nine total). Two schools in this original sample did not respond to our request for participation. Both of these schools had received the Cyber Performance Grant. To find two alternate schools, the MLTI team suggested we reach out to schools they had worked with in the past and would likely be willing to participate in the evaluation. Of the two alternate schools that agreed to participate, one school received the Cyber Performance Grant and one school received the Teach With Tech Grant. Exhibit C2 provides more information about the region, school level, and tertile of the distribution of students eligible for free or reduced-price lunch for each school in the sample.

Data Collection and Analysis

The research team conducted virtual video interviews (approximately 20 minutes each) with each school’s principal, virtual video interviews (approximately 45 minutes each) with each school’s designated school technology leader, and virtual video focus groups (approximately 45 minutes each) with teachers. Principal and technology leader interviews and teacher focus groups focused on topics related to school leadership, professional learning, technology infrastructure, and use of technology. We also asked principals and technology leaders about the technologies or infrastructure support they purchased with the Cyber Performance Grant or Teach With Tech Grant as well as benefits or challenges the school experienced with the grant. In total, AIR conducted eight principal interviews, eight technology leader interviews, and six teacher focus groups. We did not conduct a teacher focus group at two schools.

The AIR research team analyzed the qualitative data and identified common themes related to the three domains of the school technology integration support framework. Analysts then used these findings to determine each school’s level for each domain of the school technology integration support framework.

School Technology Integration Support Framework

AIR developed a school technology integration support framework to guide interview and focus group protocol development and qualitative data collection and analysis. This framework describes three major domains (and their associated dimensions) of school-level processes that prior research indicated are critical for supporting technology integration. AIR used the Future Ready Schools framework to guide the school profiles because the framework focuses on school conditions for supporting technology (Office of Educational Technology, 2016). In consultation with Maine DOE, we decided to focus on the subset of Future Ready Schools framework dimensions that aligned most closely with MLTI. Exhibit C1 depicts the domains and dimensions of the school technology integration support framework.

Exhibit C1. Domains and Dimensions of the School Technology Integration Support Framework

Domain	Dimension	Definition
Technology leadership for technology integration	Shared vision	The school has a formal, up-to-date vision and a set of expectations for using technology in teaching and learning. Teachers, students, and parents know the vision, so there is a schoolwide understanding of it.
	Culture of innovation	School leaders encourage a culture among teachers of experimenting with technology in their instruction. School staff engage in technology-related initiatives and share ideas about how to incorporate technology into learning, teaching, and school administration and operations.
	Professional learning for school leaders	School leaders participate in professional learning focused on integrating technology into instruction. School leaders participate in professional learning about how to lead the development, implementation, and evaluation of schoolwide technology plans and initiatives.
Professional learning for technology integration	Job-embedded professional development for teachers	Teachers participate in ongoing professional learning about technology throughout the year and during the school day (leveraging existing school routines) and focused on the curricular needs of teachers. Teachers can select opportunities that align with their day-to-day, ongoing needs. Just-in-time learning resources are available to address emergent needs.
	Collaboration and community	Local teams of teachers (sometimes called professional learning communities) conduct shared inquiries into student learning to identify effective uses of technology and to identify or develop digital learning resources.
Technology infrastructure	Connectivity and capacity	The network provides dependable connectivity for all students and staff to access varied digital learning tools and online resources at the same time. Student safety and privacy are protected, while still allowing

Domain	Dimension	Definition
		students and teachers to explore online environments and digital tools without unwarranted restrictions.
	Digital tools for teaching and learning	Teachers and students have up-to-date hardware and software for teaching and learning (e.g., learning management system, e-portfolio system, assessment system, portal, learning object repository, collaborative tools). Teachers and administrators participate in decision making about software purchases. Teachers can request purchase and installation of software as needed.
	Access to effective and efficient technical support	The school has access to a staff member with dedicated time to address technical issues encountered by staff and students. Technical support is timely, effective, and efficient.

Based on the qualitative data, AIR analysts assigned each school to a level from 0 to 2 (low to high) for each dimension in a domain. The levels reflect each school’s level of technology integration support:

- **A level of 0** indicates that interview and focus group participants provided little or no evidence of a dimension in their responses. Participants may not have agreed about the presence of the dimension at their school.
- **A level of 1** indicates that participants provided some evidence of a dimension in their responses. Participants may or may not have agreed about the presence of the dimension at their school.
- **A level of 2** indicates that participants provided extensive evidence of a dimension in their responses. Participants generally agreed about the presence of the dimension at their school.

After assigning dimension levels, we summed the dimension levels to reach a domain level. We weighted each dimension and domain equally in determining the levels because (a) prior research indicated similar importance in technology integration, and (b) MLTI 2.0 weights these domains equally (Office of Educational Technology, 2016). For the technology infrastructure and leadership domains (each having three dimensions), possible domain scores ranged from 0 to 6. For the professional learning domain (with two dimensions), possible domain scores ranged from 0 to 4.

For each domain, we then categorized schools into groups that exhibited low, medium, or high levels of a domain. Schools were categorized at a low level of a domain if they received a domain score between 0 and 2 for technology infrastructure or leadership or between 0 and 1 for professional learning. Schools were categorized at a medium level of a domain if they received a domain score between 3 and 4 for technology infrastructure or leadership or a 2 for professional learning. Schools were categorized at a high level of a domain if they received a

domain score between 5 and 6 for technology infrastructure or leadership or between 3 and 4 for professional learning.

Exhibit C2 shows each school’s score for each domain of the school technology integration support framework. Each school has been deidentified to protect the identities of interview and focus group participants.

Exhibit C2. Domain Scores for Technology Integration Supports by School

School	Region	School level	Tertile of FRPL eligibility	Technology infrastructure	Leadership	Professional learning
School A	Cumberland	7 th -8 th	1	4	2	2
School B	Hancock	5 th -8 th	1	6	4	2
School C	Aroostook	6 th	2	5	2	2
School D	Washington	5 th -8 th	3	6	1	3
School E	Cumberland	6 th -8 th	1	6	3	3
School F	Mid-Coast	9 th	1	5	4	3
School G	Western ME	5 th -8 th	1	6	3	3
School H	Kennebec	5 th -6 th	3	4	3	2

Note. FRPL is free or reduced-price lunch program.

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