
# Evaluation of the 21st Century Learning Spaces Initiative in MCPS

## Office of Shared Accountability

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# Executive Summary

## Background

The Office of Shared Accountability (OSA) in partnership with the Office of the Chief Technology Officer (OCTO) is conducting a study of the 21st Century Learning Spaces Initiative in Montgomery County Public Schools (MCPS). The multiyear effort aims to provide greater access to the school system's expanding digital curriculum and allow instructional staff to create 21st Century learning spaces in all schools, supporting the overarching goal that "[a]ll learners will participate in technology-enriched learning communities that inspire intellectual curiosity and prepare them with the knowledge and skills to excel in college and chosen careers in an evolving digital age" (MCPS, 2014). During the 2014–2015 school year, approximately 30,000 Chromebooks were deployed in all Grades 3, 5, and 6 classrooms throughout MCPS, enough for every student in every class. In high schools, approximately 10,000 devices were introduced in Social Studies classes. In addition to the Chromebooks, the Google Apps for Education platform was introduced. Dovetailed with the introduction of these technologies was the installation and improvement of the wireless network infrastructure across MCPS. The following year, in 2015–2016, approximately 12,000 Chromebook devices were deployed to all Grade 4 classrooms, and to about 150 Grade 7 classrooms throughout the district. Coupled with the device deployments, a comprehensive plan for professional development was implemented.

The evaluation of the 21st Century Learning Spaces Initiative is being conducted in two stages. The first stage, reported here, examined the implementation of the technology initiative, including the professional learning opportunities that were provided alongside the deployment of the new technology. The second stage of the evaluation will examine the initiative's potential impact on student outcomes, and will be reported in a separate document at a later date. The evaluation questions that guided this stage of the study were:

1. What were the experiences and perceptions of the technology initiative stakeholders?

2. What was the impact of the professional learning component of the initiative?
   This question was addressed using Guskey's (2000) framework for evaluating professional development:
   - Level 1. Participants' reactions
   - Level 2. Participants' learning
   - Level 3. Organization support and change
   - Level 4. Participants' use of new knowledge and skills
   - Level 5. Student learning outcomes (Level 5 will be addressed in stage 2 of the evaluation.)

## Summary of Methodology

The evaluation used a non-experimental mixed method design with both quantitative and qualitative measures. In this first stage of the evaluation, data were collected through surveys of

school-based staff—teachers, and principals—and technology instructional specialists; classroom observations; and usage data for students. The evaluation focused on the implementation of the initiative in elementary schools, in Grades 3, 4, and 5, where the new technology—Chromebooks and Google Apps for Education—was introduced in the 2014–2015 and 2015–2016 school years. Descriptive statistics were used to summarize the structured survey responses of teachers, principals, and technology instructional specialists, the data collected from classroom observations, and the technology usage data. Teacher, principal, and instructional specialist responses to open-ended questions on the surveys were analyzed and reported in terms of themes and categories that emerged from the responses.

## Summary of Findings

### Evaluation Question 1. What were the experiences and perceptions of the technology initiative stakeholders?

***Teachers' and principals' use of the technology.*** Nearly two thirds of the teachers surveyed reported using the new technologies every day or most days to access online resources for teaching, and planning and creating lessons, and about half of the responding teachers used the technologies every day or most days for maintaining student records or grading student work. Forty percent or more of the responding principals reported that they used the new technology most days to analyze student and/or school performance, plan for meetings, and facilitate meetings.

***Students' use of technology.*** More than one third of the teachers reported that students used the technologies every day for working on documents or projects and accessing teacher-identified content, with higher percentages of Grade 5 teachers reporting students' every-day use.

More than one half of the teachers who responded to open-ended questions reported that their students were more engaged, more motivated and eager to learn. About one quarter of the teachers reported that students' writing has improved and students have gained presentation skills. Concerns were expressed by some teachers that students face more distractions and were more difficult to monitor with the new technology, and some teachers also indicated that typing is hard for some students.

Results from classroom observations indicated that students were using the Chromebooks during most of the observation visits (92% overall). Chromebook use in Grades 3, 4, and 5 classrooms and by subject lesson (English/language arts, mathematics, science, and social studies) were similar.

***Teachers' and principals' time on activities.*** For teachers, the largest change reported was more time spent on planning and developing lessons and instructional materials. Principals reported spending about the same amount of time on most activities since the new technology was introduced, but less time on planning for meetings.

### Evaluation Question 2: What was the impact of the professional learning component of the initiative?

***Professional learning participation.*** The professional learning opportunities attended by the largest percentages of Grades 3 through 5 responding teachers were workshops or staff meetings facilitated by an instructional technology specialist, coaching/planning during a collaborative team meeting, and the continuing PD course IT-85. The professional learning opportunities attended by the largest percentages of responding principals were workshops or sessions that were offered during elementary principals Professional Learning Community (PLC) meetings.

***Participants' reactions to professional learning.*** The professional learning opportunities reported as most helpful by the largest percentages of both teachers and principals were training related to Chromebooks and Google Apps, and training provided by instructional technology specialists in small groups or workshops. Similarly, the learning opportunities that were judged "very helpful" by the largest percentage of instructional technology specialists were individual or small group support, coaching during collaborative team planning, continuing professional development course IT-85, and principals' PLCs.

***Participants' reports of their learning.*** A large majority of the responding teachers and principals agreed that the learning opportunities improved their ability to manage and organize work, provided new ideas or strategies, improved their ability to teach with technology (teachers), improved their ability to support and promote the use of technology (principals), improved their confidence in the use of technology, and were relevant to their learning needs.

***Participants' reports of support.*** Teachers and principals expressed high levels of support for implementation of the technology. A large majority of teachers reported that administrators actively support their use of Chromebooks and Google Apps for Education.

Teachers, principals, and technology instructional specialists were consistent in their judgments of helpful learning opportunities to support current implementation. The highest percentages from each group named in-school face-to face training as a helpful support for implementation. Grade- or subject-alike groups, modeling lessons, and coaching by instructional specialists also were judged most helpful by high percentages of respondents in each group.

***Participants' use of the new knowledge and skills.*** Teachers noted ways that the technology has improved their ability to manage their work, such as increased efficiency in communicating with students and giving assignments. Teachers also commented that they are making greater use of online resources, sharing sites, and Google Classroom, and that the new technology has allowed more differentiation, small group work, and individual work with students.

Among all teachers who responded to the survey, one third judged themselves currently at high levels of technology integration, while three quarters indicated that they would be at high levels of integration at the end of the school year. Teachers' feedback about the supports and obstacles that influence where they are in their integration of technology revealed that support from staff members—instructional specialist, media specialist, or other teachers—is an important factor. Obstacles named by teachers included lack of time, student behavior, and the need for more training and more support.

Feedback from instructional technology specialists noted the importance of leadership support in the successful integration of the new technology. Obstacles named by the instructional technology specialists included the lack of confidence or reluctance to change on the part of teachers and teachers' lack of time.

Classroom observations of instructional strategies using technology revealed that the strategy observed most frequently was "Provide students with multiple mediums for accessing lesson content" (observed in 59% of classrooms). More than one third of the observations found evidence for enabling students to make thinking visible, and promoting student choice. Many of the observed activities were evident at similar rates across grades; some strategies were observed at different rates in classrooms of different subjects.

**Conclusion**

Findings from the evaluation provided evidence that as the new technology is being implemented, progress is being made toward the goals of the project. The professional learning opportunities provided through the initiative sought to help teachers and principals build their skills and knowledge of classroom technology, and enable them to integrate the new technology into instruction. These goals were addressed by improving the ability of teachers and principals to manage their work using technology, and by generating new ideas and strategies for using technology in instruction. Evidence of progress toward these goals was shown through feedback from teachers and principals, as well as direct observation of the use of technology in classrooms.

**Recommendations**

Recommendations were based on data collected through surveys and classroom observations.

1. **Build in dedicated time for teachers to learn and grow in their use of technology.** A challenge to implementation that was named by teachers, principals, and instructional specialists was the need for more time to explore, try out, and practice the new technology. Teachers need time to learn the technology, explore resources, and develop new materials.
2. **Develop additional ways to provide ongoing information and guidance about available Apps**. More than half the teachers and half the principals who responded to surveys reported that they felt overwhelmed by the number of applications available with the new technology and that it was a challenge to find time to learn about them. Explore ways to help teachers learn what is available and most relevant to their instructional needs.
3. **Better integrate technology in Curriculum 2.0**. Currently teachers must develop or re-create materials because the curriculum is not integrated into the new technology. Instructional technology specialists suggested ways to work toward better integration.
4. **Ensure that every teacher accesses technology professional learning opportunities, both initially and ongoing.** Almost all principals participated in learning opportunities at the principal PLCs. Teachers, however, were more varied in their reports of participation in various learning opportunities, although almost all attended some form of technology professional learning. However, more than one third of the responding teachers did not agree that practices are in place to provide ongoing professional learning for using Chromebooks and Google Apps.

5. **Work with principals to promote a climate of safe and supported risk-taking**. Support from leadership, along with an administration that values risk-taking were identified by instructional specialists as key to successful integration of technology. In addition, teachers, principals, and instructional technology specialists recognized the need for teachers to build confidence, and have opportunities to safely try new methods. Principals are key in setting the expectations and supportive conditions for staff and student learning.
6. **Explore ways to address teachers' concerns with classroom management software**. The technology component identified as a challenge by the largest percentage of teachers was the use of classroom management software. Many teachers requested support for implementing the current platform used to manage student devices, and help with resolving difficulties associated with use of the software.

# Evaluation of the 21st Century Learning Spaces Initiative in MCPS

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The Office of Shared Accountability (OSA) in partnership with the Office of the Chief Technology Officer (OCTO) is conducting a study of the 21st Century Learning Spaces Initiative in Montgomery County Public Schools (MCPS). The multiyear effort aims to provide greater access to the school system's expanding digital curriculum and allow instructional staff to create 21st Century learning spaces in all schools (MCPS, 2015). The 21st Century Learning Spaces Initiative is a pivotal strategy proposed in the MCPS Strategic Technology Plan, which articulates the overarching goal that "[a]ll learners will participate in technology-enriched learning communities that inspire intellectual curiosity and prepare them with the knowledge and skills to excel in college and chosen careers in an evolving digital age" (MCPS, 2014).

## Background

### Description of 21st Century Learning Spaces Initiative

During the 2014–2015 school year, mobile technology was infused into classrooms across MCPS. Approximately 30,000 Chromebooks were deployed in all Grades 3, 5, and 6 classrooms, enough for every student in every class. In high schools, the technology was implemented by content area across grade levels; approximately 10,000 devices were introduced in high school Social Studies classes. In addition to the Chromebooks, the Google Apps for Education platform was introduced. Dovetailed with the introduction of these technologies was the installation and improvement of the wireless network infrastructure across MCPS. During the 2015–2016 school year, approximately 12,000 Chromebook devices were deployed to all Grade 4 classrooms at a ratio of one per student, and to about 150 Grade 7 classrooms throughout the district.

Coupled with the device deployments, a comprehensive plan for professional learning was implemented. As teachers in each cohort of schools received devices for their classrooms, instructional specialists from the OCTO met with them in their schools to provide an orientation to the initiative and an opportunity to begin exploring the technologies. The teachers were provided options for professional learning experiences to implement high quality instructional practices that integrate digital technologies in teaching and learning. In addition, two instructional specialists were assigned to each school to provide ongoing job-embedded coaching and support.

The professional learning opportunities provided through the initiative sought to help teachers and principals build their skills and knowledge of classroom technology, and enable them to integrate the new technology into instruction. The professional learning experiences addressed these goals by improving the ability of teachers and principals to manage their work using technology, and by generating new ideas and strategies for using technology in instruction. The professional learning and support that was offered in the initiative was tailored to the needs of each school and its teachers; an array of districtwide learning opportunities was offered, as well as individualized coaching and support in the classroom and in school staff meetings.

## Goals of the 21st Century Learning Spaces Initiative

The strategic technology plan specifies goals for teacher learning and use of knowledge, and outcomes for students. The plan states (MCPS Strategic Technology Plan, 2014):

We strive to help teachers:

- Use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in face-to-face and virtual environments.
- Design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context.
- Exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society.
- Continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources.

So that students can:

- Demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
- Use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
- Participate fully in learning communities that are universally designed with multiple modalities, entry points, and ways to represent their thinking and what they know.
- Apply digital tools to gather, evaluate, and apply knowledge and skills to synthesize information and solve real world problems.
- Use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

The 21st Century Learning Spaces Initiative expands staff and student access to the new digital learning infrastructure, with the aim of creating technology-enriched learning communities. The new technology provides tools for teachers to build upon and enhance their classroom practices, enabling greater student engagement and access. The instructional objectives of the initiative included:

- engage students in inquiry
- enable students to make their thinking visible
- engage students in self-reflection
- provide meaningful feedback to students
- formatively assess students' learning
- differentiate learning opportunities
- provide students with multiple mediums for accessing lesson content
- scaffold learning opportunities
- present tasks in an authentic context
- promote student choice
- promote collaborative problem-solving

Using the new technology, students have opportunities to collaborate in new ways, to use different technology tools to enrich and deepen their learning, and to demonstrate their learning in a variety of ways. The overarching goals of the initiative—inspiring intellectual curiosity and providing students with the knowledge and skills to excel in college and careers—align with and support the vision and core values of MCPS.

## Review of Select Literature

The 21st Century Learning Spaces Initiative in MCPS also aligns with the Maryland state plan for educational technology. The Maryland Instructional Technology Advisory Council (MITAC), provides guidance for the implementation of the State plan for educational technology (MITAC, 2011). MITAC recommends that students have access to one-to-one computer devices in order for them to become digital citizens and accomplish student learning goals. In their report, MITAC posits a theory of change, proposing that providing greater access to digital tools and resources, along with increased knowledge and skills for educators through professional learning, will lead to changes in classroom practices and improved student achievement.

As recommended by MITAC, a fundamental component of the 21st Century Learning Spaces Technology Initiative is one-to-one Chromebooks for every student in Grades 3, 4, and 5. Thus, as part of this evaluation, it is relevant to highlight findings from other studies of K-12 technology that incorporated one-to-one devices. Recent research provides some data that can inform implementation and begin to build evidence of the effects of technology on student outcomes.

The impact of one-to-one laptop computer programs on student achievement in kindergarten through Grade 12 was examined in a recent meta-analysis (Zheng, 2016). In total, 96 journal articles and doctoral dissertations from 2001–2015 were reviewed; 10 studies met criteria for the meta-analysis. The analysis of the 10 qualified studies found a positive impact for one-to-one laptop programs on academic achievement across five subjects examined, with a small effect size for science, (Cohen's $d$ = .25) and writing ($d$ = .20). Effect sizes for math ($d$ = .17), English ($d$ = .15) and reading ($d$ = .12) were not large enough to be considered practically significant in an educational setting using Cohen's definition of small ($d$ = .20), medium ($d$ = .50), and large ($d$ = .80) effect sizes (Cohen, 1988). Descriptive findings from the additional 96 studies which were reviewed included: a) an increased frequency and breadth of student technology use; b) increased student-centered, individualized, and project-based learning; c) increased quantity and genres of writing; and d) improved teacher-student and home-school relationships. The review also found that students had positive attitudes towards laptop programs. In addition, teachers were more confident in their use of technology when sufficient training and support were provided, and negative perceptions of laptop programs were expressed by teachers when adequate support was not provided. Some studies indicated that laptop programs increased students' technology proficiency and ability to locate internet resources, and some found that students' learning autonomy, collaborative skills, and problem-solving skills improved. In all, the study concluded that the research supports evidence that laptops promote 21st-century learning skills. The review also found inconclusive evidence regarding whether laptop programs can reduce gaps in academic achievement, despite a number of studies reporting the positive impact on disadvantaged students. Further, the authors also pointed out that the number of studies which utilize rigorous experimental

or quasi-experimental methods is small, and that larger and longer studies of laptop programs are needed.

In the state of Maine, a one-to-one laptop program, the Maine Learning Technology Initiative (MLTI), was implemented throughout middle schools beginning in the 2002–2003 and 2003–2004 school years (Silvernail & Lane, 2004). In this initiative, all Grades 7 and 8 students (over 17,000) and their teachers in the state of Maine received laptop computers, wireless internet, technical assistance and professional development for integrating technology into their instruction. A study utilizing surveys and site visits was conducted in the initial 15 months (i.e. Phase I) of the initiative to measure the usage and impacts of the MLTI. The study concluded that the laptops were being widely used, especially for lesson planning among teachers, and conducting research and completing classwork among students. Teachers and students also reported an increase in student learning, student engagement, and interaction between teachers and students and between students and other students. Challenges that were cited were technical problems, more need for support and professional development, and lack of time to explore and learn more about how to use the laptops. Furthermore, the study concluded that the schools with reportedly greater success had three common characteristics: 1) key individual(s) at the school leading the initiative; 2) some teachers involved in the initiative from the beginning who also shared professional development; and 3) students were allowed to bring their laptops home (Silvernail & Lane, 2004).

In 2009, a randomized control trial study was conducted to examine the impact of a professional development program on the MLTI; specifically, integrating laptop technology into mathematics instruction. The study's findings concluded that there was evidence of increased student achievement following sustained professional development and high fidelity of implementation (Silvernail & Buffington, 2009). In 2011, an evaluation of the MLTI found that the program had "a significant impact on curriculum instruction, and learning in Maine's middle schools" and that although many teachers have adopted integration of the technology, reported implementation was lower in math compared to other core disciplines (i.e. Language Arts, Social Studies, and Science) and the technology was not used as frequently as expected for assessments and teaching 21st Century skills. Teachers gave positive feedback about the initiative, indicating that laptops helped them "teach more, in less time, and with greater depth, and to individualize their curriculum and instruction more" (Silvernail, Pinkham, Wintle, Walker & Bartlett, 2011).

In an evaluation of a one-to-one laptop program implemented with Grades 3−7 students across three California schools, laptops were found to be used consistently by students, more often in language arts and reading than in math (Grimes, 2008). Positive feedback about the laptop program was received from both students and teachers. Teachers' survey responses indicated that writing and revising papers was one of the most common uses of the laptop technology. Teachers reported that students wrote more extensively and the laptops allowed a variety of formats. However, some teachers reported that weak keyboarding skills inhibited writing for some students. The majority of respondents reported that students used laptops to access the internet for background knowledge, independent learning, and research. Teachers from one of the schools in the study reported administrative problems and a difficult learning curve due to large proportion of families in poverty, high percentages of English language learners, students receiving special education services, and students with less exposure to computers at home.

Examining the effects of teacher, school, and contextual characteristics on classroom technology integration and teacher use of technology, Ritzhaupt and his colleagues (2012) surveyed 732

teachers at all levels from 107 different schools in Florida. A path model analysis showed that teachers' level of education and technology teaching experience positively influenced their use of technology. Professional development in school technology and access were positively related to teachers' use of technology. Grade level and average number of students per class were negatively related to the extent to which technology was integrated—technology was used more frequently in elementary and middle grades than in high school. The study further concluded that teachers' use of technology was related to classroom technology integration and student use of technology, and that how a teacher integrates the technology explains how frequently students use the technology.

The *Technology Integration Matrix* from the Florida Center for Instructional Technology (FCIT, 2016) provides a framework for assessing the level of technology integration in instruction. The *Technology Integration Matrix* (TIM; excerpted in Figure 1) illustrates how teachers can use technology to enhance student learning by describing five levels of technology integration (i.e., entry, adoption, adaptation, infusion, and transformation).

TIM was originally created in 2006, and updated in 2011, by the Florida Department of Education and the Florida Center for Instructional Technology (FCIT), which is based at the University of South Florida's College of Education. It was created to "be a comprehensive framework for evaluating technology integration in instructional settings" (FCIT, 2016). It is also intended to provide a foundation for professional development and to provide a common vocabulary when integrating technology. A team of Florida educators conducted focus groups and interviews with teachers, technology specialists, principals, district personnel, and university researchers as well as conducted classroom observations, for the creation of TIM. The matrix describes five levels of technology integration--entry, adoption, adaptation, infusion, and transformation—and overlays them in five types of classroom learning environments—active, constructive, goal directed, authentic, and collaborative. Descriptions of the overall levels (i.e., across classroom learning environments) of technology integration are shown in Figure 1.

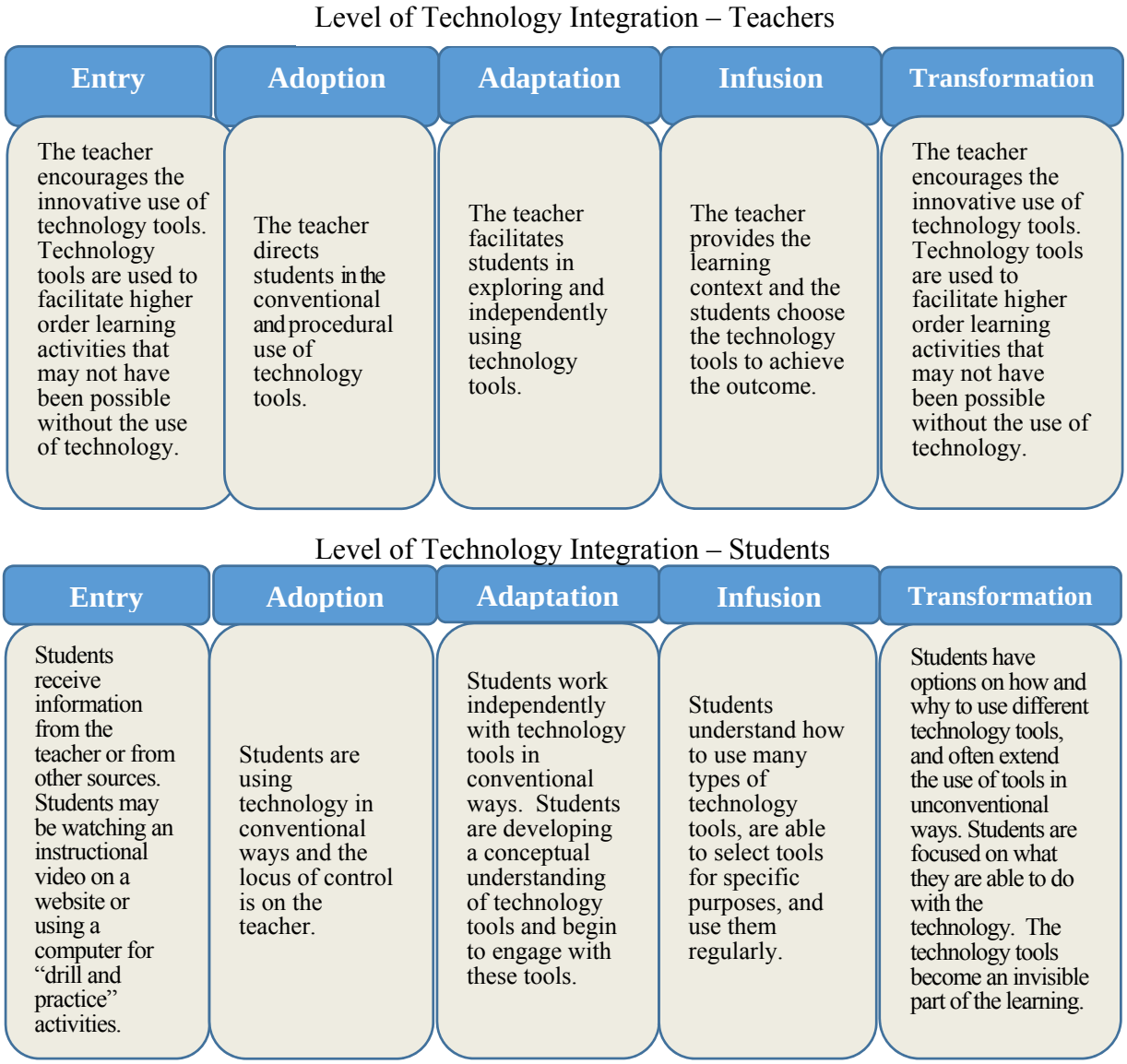


*Figure 1. Levels of technology integration*. From the *Technology Integration Matrix,* produced by the College of Education, University of South Florida © 2011-2016.

## Evaluation Scope and Questions

The evaluation of the 21st Century Learning Spaces Initiative is being conducted in two stages. The first stage, reported here, examined the implementation of the technology initiative, including the professional learning opportunities that were provided alongside the deployment of the new technology. The goal of this stage of the evaluation was to provide detailed descriptions of teachers' and principals' use of the new technology, and their experiences and perceptions of the professional development and support received for the technology implementation. The second stage of the evaluation will examine the initiative's impact on student outcomes, and will be reported in a separate document at a later date.

The evaluation questions that guided this stage of the study were:

**Evaluation Question 1**. **What were the experiences and perceptions of the technology initiative stakeholders?** How did teachers, principals, and technology instructional specialists working in schools experience implementation of the initiative?

**Evaluation Question 2. What was the impact of the professional learning component of the initiative?** Based on Guskey's (2000) framework for evaluating professional development, the specific evaluation questions were:

- Level 1. Participants' reactions. Did they like it? Was it useful?
- Level 2. Participants' learning. Did participants acquire the intended knowledge and skills?
- Level 3. Organization support and change. Was implementation advocated, accommodated, facilitated and supported by the organization?
- Level 4. Participants' use of new knowledge and skills. Did participants effectively apply the new knowledge and skills?
- Level 5. Student learning outcomes. What was the impact on students? (Stage 2 of the evaluation will address Level 5.)

## Methodology

### Evaluation Design, Overview and Sample

The evaluation used a non-experimental mixed method design with both quantitative and qualitative measures. In this first stage of the evaluation, data were collected through surveys of teachers, principals, and instructional technology specialists; classroom observations; and usage data. Stakeholders' perceptions of the implementation of the new technology and of the professional development and support received were examined using surveys. Surveys and observations were used to examine the ways that the technology is being used in the classroom, for all students throughout MCPS elementary schools, and for subgroups of students, such as grade level (Grades 3, 4, and 5) and lesson subjects (English/language arts , mathematics, science, and social studies).

The study sample comprised all MCPS elementary schools with Grades 3, 4, and 5 ($N$ = 128). Data were collected during the 2015–2016 school year.

### Data Sources and Instruments

***Teacher surveys*** were offered to all Grade 3, 4, and 5 teachers to obtain information about their experiences and perceptions of the technology initiative, as well as their perceptions of learning opportunities associated with the new technology. Data from the teacher surveys were used to address Evaluation Questions 1 and 2.

Surveys were administered online in December 2015. An email invitation with a survey link was distributed by a contact person designated by the principal at each elementary school, and one reminder was sent before the survey window was closed. A total of 748 teachers completed surveys; the estimated response rate for teachers in Grades 3, 4, and 5 was 49%[1].

The grade level and years of teaching experience reported by the teachers who responded to the survey is presented in Appendix A, Table A-1. Responding teachers were fairly evenly divided among Grade 3 (30%), Grade 4 (32%), and Grade 5 (30%), with another 8% in other positions, such as ESOL teachers, special educators, and resource teachers. More than half (56%) of the responding teachers had over ten years of teaching experience. Only three percent were in their first year of teaching (see Table A-1, Appendix A).

***Principal surveys*** were administered to principals in all 128 elementary schools with Grades 3 through 5 to obtain information about school practices related to the new technology, ways and extent the technology is used, and perceptions of learning opportunities associated with the new technology. Data from the principal surveys were used to address Evaluation Questions 1 and 2.

Surveys were administered online in February 2016 with a link sent by OSA to each of the 128 elementary principals. One reminder was sent before the survey window was closed. Ninety-five elementary principals completed the survey, representing a response rate of 74%. Surveys were received from principals in all 19 MCPS clusters and consortiums.

Table A-2 in Appendix A summarizes the years of experience reported by the responding principals. More than one third of the responding principals had more than ten years of experience as an elementary school principal; about ten percent of the respondents were in their first year as an elementary principal (see Table A-2, Appendix A).

***Instructional technology specialist surveys*** were administered to 17 instructional specialists to obtain information about their experiences and perceptions of the implementation of the technology initiative and the learning opportunities associated with the new technology. As part of the technology initiative, technology instructional specialists were assigned to each elementary school to provide ongoing job-embedded professional learning and support. A list of instructional technology specialists who support elementary schools ($N = 17$) was obtained from OCTO, and a link was sent from OSA to each instructional technology specialist in June 2016. Instructional technology specialists could complete the survey at their convenience during a two-week survey window; in addition, time was provided during a staff meeting for those who needed it. All 17 instructional technology specialists completed the survey, representing a response rate of 100%. Data from the instructional technology specialist surveys were used to address Evaluation Questions 1 and 2.

Instructional technology specialists who responded to the survey were highly experienced educators (see Table A-3, Appendix A). More than half of the respondents had more than 20 years of experience as an educator (53%) and all of the respondents had been an instructional technology

[1] Since survey links were sent to teachers by the contact person in the school, it is not known exactly how many teachers received the survey request. An average of four teachers per grade was estimated using *Schools at a Glance* (MCPS, 2016); 128 schools were contacted for the evaluation, so the total number of teachers (12 x 128) was estimated to be 1,536.

specialist for two years or more. Positions previously held by the instructional technology specialists included elementary teacher ($n$ = 13), middle school teacher ($n$ = 3), high school teacher ($n$ = 3), staff development teacher ($n$ = 5), and technology teacher or media specialist ($n$ = 4). Among the respondents, seven instructional technology specialists reported that they spent more than half their time supporting elementary schools, two reported that they spent more than half their time supporting middle schools, and one reported spending more than half their time supporting high schools.

***Classroom observations*** were conducted in Grades 3, 4, and 5 classrooms. From the 128 elementary schools that had Grades 3 through 5, schools were stratified by their rate of Free and Reduced-price Meals System (FARMS) participation, and four schools from each FARMS rate quintile were randomly selected for observation. In other words, the sample included four schools with the highest percentages of students participating in FARMS, four from schools with the second highest levels of FARMS participation, four from the middle fifth of FARMS participation, and so on. Twenty schools were selected, but one school opted not to participate, resulting in a sample of 19 schools for observations. Six classrooms (two each in Grades 3, 4, and 5) were observed in 18 of the schools, and five classrooms were observed in the remaining school, totaling 113 observations.

Each observation was conducted for 45 minutes and was scheduled to begin at the start of a lesson. Observers arranged times with teachers to ensure that the observation period would not conflict with testing or special events in the classroom. Classroom observations were conducted during lessons in mathematics, language arts, science, and social studies. The observation protocol (see Appendix B) included indicators of technology integration based on the *Technology Integration Matrix* (FCIT, 2016), the use of technology tools by teachers and students, and the use of technology to support instructional goals. Data from the observations were used to address Evaluation Questions 1 and 2.

Observers were staff from the Program Evaluation Unit in the Office of Shared Accountability, and technology instructional specialists from the Office of the Chief Technology Officer. Observers were trained on the protocol; about one half of the observations were conducted by OSA evaluators and about one half were conducted by OCTO instructional specialists. Observers met to review the observation protocol in detail, and small groups of observers (two or three) conducted pilot observations before scheduling observations for the study. Ten of the observations were conducted independently by two observers and the reliability of the ratings was analyzed using Kappa; inter-observer agreement is reported in Appendix B, Table B-1. Observation measures with Kappa values of .21 or higher (classified as fair or better by Landis & Koch [1977]) were included in the study results. One measure of instructional objectives, "Presents tasks in authentic context," had a Kappa of .19 and percent agreement of 50, and was not included in the reported results.

***Usage data of students and teachers*** were accessed by OCTO and provided to OSA evaluators for analysis. The mean number of minutes logged on during two-week periods in each of the four marking periods during the 2015–2016 school year was reported using device-level data aggregated to school level. The numbers of Google files owned and shared was reported using account-level data, aggregated to grade level for students. Records of Google files are cumulative—files are associated with accounts over the years of the account.

## Analysis of Data

Descriptive statistics were used to summarize the survey responses of teachers, principals, and technology specialists to questions about their experiences and perceptions of the technology initiative and the associated learning opportunities. Teachers' survey responses were reported by grade level taught. Teacher, principal, and instructional technology specialist responses to open-ended questions on the surveys were analyzed and reported in terms of themes and categories that emerged from the responses, and examples were used to illustrate the findings. Usage data were summarized with descriptive statistics; when possible the data were disaggregated by grade level.

Descriptive statistics were used to summarize data collected in the classroom observations. Use of technology and level of technology integration in instruction were summarized by grade level and by lesson subject (English/language arts, mathematics, science, or social studies). Examples of strategies and activities observed were used to illustrate findings.

## Strengths and Limitations of the Methodology

Collaborative development of the surveys and observation protocol was a strength of this first stage of the evaluation. OCTO and OSA worked together to develop the three surveys (teachers, principals, instructional technology specialists) and the protocol for classroom observations. Surveys from three sources and classroom observations allowed triangulation of the findings, and similarities and differences in reports from different sources are discussed. Response rates were high for principals (74%) and instructional technology specialists (100%) and adequate for teachers (estimated at 49%). The responding sample of teachers was large; a total of 748 teachers completed the survey.

The classroom observation sample and protocol, also planned in collaboration with OCTO, were another strength of the study. A stratified sample of schools was identified, so that equal numbers of school at different levels of FARMS participation were included in the observation sample. Almost all planned observations were completed, resulting in a large sample of observations ($N$ = 113), 37 or 38 at each grade level. Reliability was measured with paired (independent) observations, and only observation components with fair or better reliability were included in the study.

A number of limitations must be noted. Much of the data for this stage of the evaluation was provided by surveys from teachers, principals, and instructional specialists, in many cases the respondent reported on her/his own work, so the possibility of self-report bias must be considered. Further, although the overall survey response rates were acceptable, fewer teachers and principals responded to many of the open-ended questions, yielding a lower response rate for some of the survey questions.

In addition, findings from the classroom observations must be viewed with caution. Observations are only a snapshot; some strategies or activities are not likely to be evident during the 45-minute observation window, such as using technology to provide feedback to students; or may not have been apparent to observers, such as differentiating learning opportunities. On the other hand, teachers were aware that observers would be visiting, and their technology use during the observation could have been influenced by that knowledge.

Finally, usage data—time logged on the Chromebooks and numbers of files owned and shared—were examined with the aim of validating findings from other measures. While the usage data did offer an additional measure of technology use, the data provided were at a very coarse level (i.e., some data could not be disaggregated by grade), so limited inferences could be made.

# Results

## Evaluation Question 1. What were the experiences and perceptions of the technology initiative stakeholders?

### Technology use by teachers.

Teachers who responded to the 21st Century Learning Spaces Initiative survey were asked to rate their knowledge of the use of technology in education; their responses provided context for their reported experiences with the initiative. The majority of responding teachers rated themselves as either 'Competent' (35%) or 'Proficient' (50%) in their knowledge of technology in education (Table 1). The findings reflected teacher self-ratings made midway through the 2015–2016 school year; most had participated in one or more professional learning opportunities about the technology initiative by that time.

Table 1
Self-Ratings of Teachers in Knowledge of Technology

| Teachers ($N$ = 747) | *n* | *%* |
|---|---|---|
| Self-rating of knowledge of teaching using technology | | |
| Novice or Beginner | 63 | 8.4 |
| Competent | 259 | 34.7 |
| Proficient | 372 | 49.8 |
| Expert | 53 | 7.1 |

Examination of self-ratings in relation to the number of years teaching showed that larger percentages of teachers with 16 or more years of elementary teaching experience indicated that they were at the "Novice" or "Beginner" level in their knowledge of the use of technology in education. Higher percentages of teachers with between 2 and 15 years of elementary teaching experience rated themselves "Proficient" or "Expert" compared with first year teachers or those with 16 or more years of experience (see Table C-1a and C-1b in Appendix C).

***Use of technology on tasks.*** Teachers reported the frequency of their use of Chromebooks and Google Apps for various tasks. Tables 2a, 2b, and 2c summarize teachers' reported use of the technologies on a range of instructional tasks.

The tasks reported with greatest frequency by the responding teachers were accessing online resources for teaching, lesson planning and grading, and posting lessons for students. About one third of the responding teachers reported using the new technologies every day for accessing online

resources for teaching, and for planning and creating lessons. Another third of the responding teachers reported using the technologies for these tasks most days (see Table 2a).

Table 2a
Teachers' Use of Chromebooks and Google Apps for Education for Lesson Planning Tasks

| | | Every day or every lesson | | Most days or most lessons | | About half the time | | Less than half the time | | Never | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* [a] | *n* | % | n | % | n | % | n | % | n | % |
| Access online resources for teaching | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 575 | 189 | 32.9 | 178 | 31.0 | 109 | 19.0 | 78 | 13.6 | 21 | 3.7 |
| Grade 3 | 187 | 54 | 28.9 | 67 | 35.8 | 39 | 20.9 | 22 | 11.8 | 5 | 2.7 |
| Grade 4 | 200 | 66 | 33.0 | 52 | 26.0 | 41 | 20.5 | 32 | 16.0 | 9 | 4.5 |
| Grade 5 | 188 | 69 | 36.7 | 59 | 31.4 | 29 | 15.4 | 24 | 12.8 | 7 | 3.7 |
| Planning and creating lessons | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 577 | 177 | 30.7 | 180 | 31.2 | 105 | 18.2 | 92 | 15.9 | 23 | 4.0 |
| Grade 3 | 189 | 53 | 28.0 | 65 | 34.4 | 31 | 16.4 | 37 | 19.6 | 3 | 1.6 |
| Grade 4 | 200 | 56 | 28.0 | 58 | 29.0 | 44 | 22.0 | 32 | 16.0 | 10 | 5.0 |
| Grade 5 | 188 | 68 | 36.2 | 57 | 30.3 | 30 | 16.0 | 23 | 12.2 | 10 | 5.3 |

[a] In this table and other tables reporting teacher survey responses by grade level, teachers who were classified as other than grade-level classroom teachers are not included, but are presented in Appendix D.

About a quarter of the responding teachers reported using the technologies every day, and another quarter reported using it most days, for maintaining student records or grading student work (see Table 2b).

Table 2b
Teachers' Use of Chromebooks and Google Apps for Education for Grading, Posting Lessons, and Feedback

| | | Every day or every lesson | | Most days or most lessons | | About half the time | | Less than half the time | | Never | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* [a] | *n* | % | n | % | n | % | n | % | n | % |
| Maintaining student records or grading/assessing student work | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 575 | 156 | 27.1 | 152 | 26.4 | 105 | 18.3 | 120 | 20.9 | 42 | 7.3 |
| Grade 3 | 187 | 41 | 21.9 | 53 | 28.3 | 43 | 23.0 | 41 | 21.9 | 9 | 4.8 |
| Grade 4 | 199 | 47 | 23.6 | 47 | 23.6 | 38 | 19.1 | 43 | 21.6 | 24 | 12.1 |
| Grade 5 | 189 | 68 | 36.0 | 52 | 27.5 | 24 | 12.7 | 36 | 19.0 | 9 | 4.8 |
| Post lessons or notes for student access | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 580 | 123 | 21.2 | 188 | 32.4 | 128 | 22.1 | 115 | 19.8 | 26 | 4.5 |
| Grade 3 | 189 | 30 | 15.9 | 66 | 34.9 | 41 | 21.7 | 45 | 23.8 | 7 | 3.7 |
| Grade 4 | 200 | 40 | 20.0 | 58 | 29.0 | 53 | 26.5 | 41 | 20.5 | 8 | 4.0 |
| Grade 5 | 191 | 53 | 27.7 | 64 | 33.5 | 34 | 17.8 | 29 | 15.2 | 11 | 5.8 |
| Provide feedback to students | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 577 | 64 | 11.1 | 101 | 17.5 | 171 | 29.6 | 182 | 31.5 | 59 | 10.2 |
| Grade 3 | 189 | 12 | 6.3 | 30 | 15.9 | 53 | 28.0 | 69 | 36.5 | 25 | 13.2 |
| Grade 4 | 197 | 15 | 7.6 | 33 | 16.8 | 65 | 33.0 | 61 | 31.0 | 23 | 11.7 |
| Grade 5 | 191 | 37 | 19.4 | 38 | 19.9 | 53 | 27.7 | 52 | 27.2 | 11 | 5.8 |

[a] In this table and other tables reporting teacher survey responses by grade level, teachers who were classified as other than grade-level classroom teachers are not included, but are presented in Appendix D.

About one fifth of the responding teachers reported using the technologies every day to communicate with colleagues, specifically sharing lessons and ideas, and another quarter of the

respondents reported using the technologies in this way most days. Large percentages of teachers reported that they never used the technologies to communicate with students outside of school (54%) or to communicate with parents (42%) (see Table 2c).

Table 2c
Teachers' Use of Chromebooks and Google Apps for Education for Communicating with Colleagues, Students, and Parents

| | | Every day or every lesson | | Most days or most lessons | | About half the time | | Less than half the time | | Never | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* [a] | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Share lessons and ideas with colleagues | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 576 | 110 | 19.1 | 152 | 26.4 | 135 | 23.4 | 139 | 24.1 | 40 | 6.9 |
| Grade 3 | 188 | 36 | 19.1 | 57 | 30.3 | 40 | 21.3 | 46 | 24.5 | 9 | 4.8 |
| Grade 4 | 199 | 31 | 15.6 | 42 | 21.1 | 51 | 25.6 | 57 | 28.6 | 18 | 9.0 |
| Grade 5 | 189 | 43 | 22.8 | 53 | 28.0 | 44 | 23.3 | 36 | 19.0 | 13 | 6.9 |
| Communicate with parents | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 578 | 48 | 8.3 | 82 | 14.2 | 82 | 14.2 | 122 | 21.1 | 244 | 42.2 |
| Grade 3 | 188 | 8 | 4.3 | 26 | 13.8 | 27 | 14.4 | 38 | 20.2 | 89 | 47.3 |
| Grade 4 | 199 | 16 | 8.0 | 28 | 14.1 | 19 | 9.5 | 42 | 21.1 | 94 | 47.2 |
| Grade 5 | 191 | 24 | 12.6 | 28 | 14.7 | 36 | 18.8 | 42 | 22.0 | 61 | 31.9 |
| Communicate with students outside of school | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 576 | 36 | 6.3 | 41 | 7.1 | 49 | 8.5 | 140 | 24.3 | 310 | 53.8 |
| Grade 3 | 188 | 5 | 2.7 | 11 | 5.9 | 11 | 5.9 | 41 | 21.8 | 120 | 63.8 |
| Grade 4 | 199 | 9 | 4.5 | 11 | 5.5 | 13 | 6.5 | 47 | 23.6 | 119 | 59.8 |
| Grade 5 | 189 | 22 | 11.6 | 19 | 10.1 | 25 | 13.2 | 52 | 27.5 | 71 | 37.6 |

[a] In this table and other tables reporting teacher survey responses by grade level, teachers who were classified as other than grade-level classroom teachers are not included, but are presented in Appendix D.

Overall, larger percentages of Grade 5 teachers compared with teachers of other grades reported using the new technologies every day for the various tasks presented in the survey. The largest difference between Grade 5 teachers and others was in the daily use of technology for maintaining student records or grading student work, posting lessons, and for providing feedback to students.

Survey data from instructional technology specialists provided additional information about teachers' use of the new technologies. Responses from the instructional specialists about teachers' use of the new technology were consistent with reports from teachers. Regular use of the new technology was reported most frequently for planning and developing instructional materials, accessing online resources, and maintaining student records (see Table 3). Since the judgments of the instructional specialists were based on an average of the schools and classrooms they supported, the response categories were different and not directly aligned with those of the responding teachers. However, the relative amounts of reported use of the technology for the areas questioned were very consistent for the two groups of respondents.

Table 3
Instructional Technology Specialists' Reports of Teachers' Use of Chromebooks and Google Apps for Education for Instructional Tasks ($N = 17$)

| | Regular use of the new technology | | Some use of the new technology | | Little or no use of the new technology | | Not sure/ Not enough information | |
|---|---|---|---|---|---|---|---|---|
| | *n* | % | N | % | n | % | n | % |
| Planning and developing instructional materials | 16 | 94.1 | 1 | 5.9 | 0 | 0.0 | 0 | 0.0 |
| Accessing online resources for teaching | 15 | 88.2 | 1 | 5.9 | 0 | 0.0 | 1 | 5.9 |
| Maintaining student records or grading/assessing student work | 13 | 76.5 | 4 | 23.5 | 0 | 0.0 | 0 | 0.0 |
| Sharing lessons and ideas with colleagues in their school | 12 | 70.6 | 5 | 29.4 | 0 | 0.0 | 0 | 0.0 |
| Differentiating learning opportunities | 9 | 52.9 | 8 | 47.1 | 0 | 0.0 | 0 | 0.0 |
| Posting lessons or notes for student access | 9 | 52.9 | 5 | 29.4 | 2 | 11.8 | 1 | 5.9 |
| Providing feedback to students | 8 | 47.1 | 9 | 52.9 | 0 | 0.0 | 0 | 0.0 |
| Promoting student collaboration | 6 | 35.3 | 10 | 58.8 | 1 | 5.9 | 0 | 0.0 |
| Facilitating learning beyond the school day | 5 | 29.4 | 9 | 52.9 | 2 | 11.8 | 1 | 5.9 |
| Communicating with parents/school community | 3 | 17.6 | 11 | 64.7 | 2 | 11.8 | 1 | 5.9 |
| Sharing lessons and ideas with colleagues beyond their school | 2 | 11.8 | 9 | 52.9 | 5 | 29.4 | 1 | 5.9 |
| Communicating with students outside of school | 0 | 0.0 | 11 | 64.7 | 6 | 35.3 | 0 | 0.0 |

***Aspects of the new technology most and least accessible for teachers.*** Teachers reported, in response to open-ended questions, which components of the new technology were most readily accessible for them and most challenging. A total of 380 respondents (51%) provided comments about the most accessible components and 319 respondents (43%) provided comments about challenging components. Tables 4 and 5 summarize their responses to these two questions.

The largest percentage of teachers (72%) reported that Google Classroom was among the most accessible component (Table 4); many teachers noted that they use Google Classroom to post assignments, share documents, and provide feedback for students. Close to one half of the teachers reported (45%) that they have integrated Google Drive and Google Apps into their classrooms.

Table 4
Teachers' Responses to Open-Ended Question About the Most Accessible Components of New Technology ($N = 380$)[a]

| | *n* | % | Representative comments (paraphrased) |
|---|---|---|---|
| Google classroom, posting assignments, upload materials | 274 | 72.1 | • Integrating Google Classroom into learning<br>• Sharing information and documents via Google Classroom<br>• Students type up writing pieces within Google Classroom<br>• Google Classroom allows me to post questions, links, and assignments, and give instant feedback to the kids |
| Google Drive/Google Apps/Suite | 169 | 44.5 | • Google Apps have been very accessible and user-friendly<br>• Great way for kids to work together, create presentations and demonstrate learning |
| Internet access/research ability/online resources | 45 | 11.8 | • I'm finding that students can research and present findings in high interest ways; great for science and social studies<br>• The Chromebooks allow students to research independently and to write collaboratively |
| Math Apps, uses specific to math | 37 | 9.7 | • The apps for math games and websites to reinforce skills learned |
| Other Apps/choice of apps/skill-building apps | 32 | 8.4 | • Apps to practice the skills, videos that review the skills<br>• Specific Apps that correspond with instructional content |
| Chromebooks | 17 | 4.5 | • I love being able to have easy access to the Chromebooks. It makes researching and typing so much easier. |
| Writing/feedback on writing | 16 | 4.2 | • Giving feedback on students writing assignments<br>• Writing application is very good |
| Other (mentioned fewer than 10 times) | 61 | 16.1 | |

[a] Upper-case N (*N*) represents the number of teachers responding to the open-ended question. Lower-case ns (*n*) represent the number of comments coded to that category. A single comment may have been coded in more than one category, and teachers may have responded with more than one comment, so percentages add to more than 100%. Only categories with 10 or more comments are reported.

Reporting on challenges to the implementation of the technology, the largest percentage of teachers (36%) named the transition in classroom management software, specifically to LanSchool from Hapara[2] (see Table 5). Concerns about LanSchool were numerous, in part pertaining to the difficulty monitoring students; several teachers noted that LanSchool can only be viewed on their desktop computer, which is located away from where they are working with small groups. Teachers also reported that having time to research and evaluate applications has been a challenge (21%) (Table 5).

[2] LanSchool and Hapara are education/classroom management systems; from their "dashboard," teachers can view students' online activities and documents, and send files and messages to students.

Table 5
Teachers' Responses to Open-Ended Question About the Most Challenging Components of New Technology ($N = 319$)[a]

| | *n* | % | Representative comments (paraphrased) |
|---|---|---|---|
| Transition to LanSchool | 114 | 35.7 | • The hardest thing to implement for most teachers is monitoring students on websites --LanSchool just doesn't do it.<br>• Monitoring student Chromebook use—Hapara, which worked well, couldn't restrict students. Then we got LanSchool which allows us to limit web access but has many glitches.<br>• Not being able to see what my students are doing on their Chromebooks when I am not at my desktop; many students are off task when I am focused on small group |
| Time to research/collect materials/ evaluate apps/ manage technology | 66 | 20.7 | • So many apps and not enough time to learn what is out there and how to use them<br>• Just trying to decide which apps to use and how to teach them to the students prior to adding in curriculum content |
| Providing feedback /communication with students | 33 | 10.3 | • Commenting on student work is very time consuming<br>• Being able to email my whole class at once without having to use Google Classroom |
| Students' typing ability, computer skills | 19 | 6.0 | • It is difficult for the students to learn how to type and I think this slows down their writing process.<br>• Teaching students the process of submitting documents and creating documents |
| Grading | 17 | 5.3 | • I prefer to look at paper text and to write comments and correct in that manner.<br>• I am unsure how to post grades, or if it is even necessary to do so. |
| Google Forms/Google Docs | 14 | 4.4 | • Need to find time to create Google Forms<br>• Uncomfortable with how to utilize the data once the students have entered it |
| Collaboration of students | 11 | 3.4 | • Difficult to fit collaborative projects into the school day with the 2.0 curriculum |
| Not all apps work/technical problems | 17 | 5.3 | • There are some programs in our curriculum that students cannot access on the Chromebooks<br>• The Chromebooks don't run all of the programs needed to support some online materials |
| Other (mentioned fewer than 10 times) | 85 | 26.6 | |

[a] Upper-case N (*N*) represents the number of teachers responding to the open-ended question. Lower-case ns (*n*) represent the number of comments coded to that category. A single comment may have been coded in more than one category, and teachers may have responded with more than one comment, so percentages add to more than 100%. Only categories with 10 or more comments are reported.

***Change in workload.*** Teachers reported on changes in the amount of time spent on various activities since the introduction of the new technology; their responses are shown in Table 6. The largest change reported by the responding teachers was more time spent on planning and developing lessons and instructional materials (41% reported spending more time). The activity that saw the least change since the introduction of the new technology was communicating with parents; 78% of the teachers reported spending the same amount of time on this activity as before the technology was implemented.

Table 6
Teachers' Report of Change in Time Spent on Activities Since the Introduction of New Technology

| | | More time | | About the same | | Less time | |
|---|---|---|---|---|---|---|---|
| *Activity* | *N* | *n* | % | *n* | % | *n* | % |
| Planning and developing lessons and instructional materials | 575 | 237 | 41.2 | 292 | 50.8 | 46 | 8.0 |
| Reviewing and providing feedback on student work | 570 | 144 | 25.3 | 344 | 60.4 | 82 | 14.4 |
| Collaborating with colleagues on lesson development | 574 | 132 | 23.0 | 362 | 63.1 | 80 | 13.9 |
| Classroom management | 575 | 121 | 21.0 | 380 | 66.1 | 74 | 12.9 |
| Maintaining student records and grades | 573 | 113 | 19.7 | 368 | 64.2 | 92 | 16.1 |
| Communicating with parents | 566 | 60 | 10.6 | 443 | 78.3 | 63 | 11.1 |

Teachers also reported on the impact of the new technology on their overall workload (Table 7). About one third of the teachers indicated that their workload is increased overall (36%). Another third reported that they are working about the same amount of time on most tasks and overall (34%) and more than a quarter reported that they are working about the same amount of time overall, but time spent on different tasks has changed (29%). Only two percent reported that their workload has reduced overall (Table 7).

Table 7
Teachers' Report of Change in Workload Since the Introduction of New Technology (*N* = 581)

| | *n* | % |
|---|---|---|
| My workload is increased overall. | 207 | 35.6 |
| I am working about the same amount of time on most tasks and overall. | 197 | 33.9 |
| I am working about the same amount of time overall, but time spent on different tasks has changed. | 167 | 28.7 |
| My workload is reduced overall. | 10 | 1.7 |

Teachers commented on the changes in workload in an open-ended survey question. In total, 187 (25% of all teacher survey respondents) provided comments; most of the comments were about workload increases, although some respondents noted that their workload in some areas has decreased. Most of the comments fell into the following areas (*n* represents the number of comments; some respondents made more than one comment, so total is more than 187):

- Added time to make flipcharts, find resources, upload materials, prepare centers (*n* = 55, 29%)
- More time in some areas in exchange for less time in other areas; more efficient, less copying (*n* = 50, 27%)
- More time at the start, but good for students, worth the time (*n* = 47, 25%)
- Need more time to learn, more training, more resources (*n* = 37, 20%)
- Additional time to adapt lessons, change resources from paper to online (*n* = 15, 8%)

## Technology use by students

***Student use of technology in the classroom reported by teachers.*** Teachers reported the frequency of use of Chromebooks and Google Apps by students during the school day. Table 8 summarizes their responses on students' use of the technologies on a range of classroom tasks. Across all grades, the largest percentages of teachers—more than one third—reported that students used the technologies every day for working on documents or projects (36%–50% of teachers) and accessing teacher-identified content (32%–38%).

Table 8
Teachers' Reports of Students' Use of Chromebooks and Google Apps for Education Within the School Day

| | | Every day or every lesson | | Most days or most lessons | | About half the time | | Less than half the time | | Never | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | n | % | n | % | n | % | n | % |
| Work on documents or projects | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 577 | 237 | 41.1 | 195 | 33.8 | 95 | 16.5 | 48 | 8.3 | 2 | 0.3 |
| Grade 3 | 186 | 69 | 37.1 | 59 | 31.7 | 40 | 21.5 | 18 | 9.7 | 0 | 0.0 |
| Grade 4 | 200 | 72 | 36.0 | 70 | 35.0 | 35 | 17.5 | 22 | 11.0 | 1 | 0.5 |
| Grade 5 | 191 | 96 | 50.3 | 66 | 34.6 | 20 | 10.5 | 8 | 4.2 | 1 | 0.5 |
| Access teacher-identified content | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 574 | 205 | 35.7 | 189 | 32.9 | 104 | 18.1 | 63 | 11.0 | 13 | 2.3 |
| Grade 3 | 185 | 69 | 37.3 | 56 | 30.3 | 32 | 17.3 | 22 | 11.9 | 6 | 3.2 |
| Grade 4 | 198 | 64 | 32.3 | 65 | 32.8 | 39 | 19.7 | 25 | 12.6 | 5 | 2.5 |
| Grade 5 | 191 | 72 | 37.7 | 68 | 35.6 | 33 | 17.3 | 16 | 8.4 | 2 | 1.0 |
| Collaborate on an assignment | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 575 | 77 | 13.4 | 152 | 26.4 | 158 | 27.5 | 152 | 26.4 | 36 | 6.3 |
| Grade 3 | 184 | 16 | 8.7 | 43 | 23.4 | 42 | 22.8 | 71 | 38.6 | 12 | 6.5 |
| Grade 4 | 200 | 19 | 9.5 | 55 | 27.5 | 64 | 32.0 | 45 | 22.5 | 17 | 8.5 |
| Grade 5 | 191 | 42 | 22.0 | 54 | 28.3 | 52 | 27.2 | 36 | 18.8 | 7 | 3.7 |
| Research relevant or interesting subjects | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 574 | 125 | 21.8 | 230 | 40.1 | 147 | 25.6 | 64 | 11.1 | 8 | 1.4 |
| Grade 3 | 186 | 29 | 15.6 | 81 | 43.5 | 55 | 29.6 | 20 | 10.8 | 1 | 0.5 |
| Grade 4 | 199 | 34 | 17.1 | 74 | 37.2 | 54 | 27.1 | 32 | 16.1 | 5 | 2.5 |
| Grade 5 | 189 | 62 | 32.8 | 75 | 39.7 | 38 | 20.1 | 12 | 6.3 | 2 | 1.1 |
| Ask questions or communicate with staff | | | | | | | | | | | |
| Total Grades 3, 4, 5 | 569 | 59 | 10.4 | 92 | 16.2 | 89 | 15.6 | 178 | 31.3 | 151 | 26.5 |
| Grade 3 | 182 | 10 | 5.5 | 26 | 14.3 | 30 | 16.5 | 58 | 31.9 | 58 | 31.9 |
| Grade 4 | 198 | 21 | 10.6 | 27 | 13.6 | 27 | 13.6 | 67 | 33.8 | 56 | 28.3 |
| Grade 5 | 189 | 28 | 14.8 | 39 | 20.6 | 32 | 16.9 | 53 | 28.0 | 37 | 19.6 |

On several of the tasks, higher percentages of Grade 5 teachers reported that their students used the technologies every day compared with teachers of other grades. Specifically, higher percentages of Grade 5 teachers reported that their students use the technologies every day to work on a document or project, collaborate on an assignment, or research relevant or interesting subjects (see Table 8).

***Student technology usage records.*** Consistent with the teachers' reports, usage records revealed that overall, students in Grades 3, 4, and 5 are creating and sharing Google files, including Google docs and Google slides. Grade 3 students owned, on average, 31 files, Grade 4 students owned an

average of 77 files, and Grade 5 students owned an average of 70 files (see Table 9). Similar differences by grade were observed for the number of files shared, as well as the number of Google slides and Google documents. File records are cumulative—files are associated with accounts over the years of the account, as students move from grade to grade. Since the students in Grade 4 were in their second year using Chromebooks in the classroom, while most Grade 3 and Grade 5 students were in their first year, the number of files associated with the accounts of Grade 4 students were the largest, as expected. However, the numbers of files on the Grade 5 accounts were close to those of the Grade 4 students, so Grade 5 students may have been using their Google accounts in previous years as well, or were very actively generating files during Grade 5 (see Table 9).

Table 9
Google Files Owned and Shared by Students in Grades 3, 4, and 5

| | *N students* | *Sum* | *Mean* | *Median* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|---|
| *Number of files owned* | | | | | | |
| Grade 3 | 12,395 | 384,566 | 31 | 24 | 1 | 646 |
| Grade 4 | 12,801 | 979,536 | 77 | 63 | 1 | 929 |
| Grade 5 | 12,293 | 855,955 | 70 | 51 | 1 | 1,593 |
| *Number of files shared* | | | | | | |
| Grade 3 | 12,395 | 203,141 | 16 | 12 | 0 | 414 |
| Grade 4 | 12,801 | 554,317 | 43 | 32 | 0 | 659 |
| Grade 5 | 12,293 | 507,094 | 41 | 25 | 0 | 536 |
| *Number of Google slides owned or shared* | | | | | | |
| Grade 3 | 12,395 | 68,979 | 6 | 3 | 0 | 74 |
| Grade 4 | 12,801 | 133,921 | 10 | 7 | 0 | 216 |
| Grade 5 | 12,293 | 91,661 | 7 | 5 | 0 | 130 |
| *Number of Google docs owned or shared* | | | | | | |
| Grade 3 | 12,395 | 263,992 | 21 | 17 | 0 | 216 |
| Grade 4 | 12,801 | 681,905 | 53 | 45 | 0 | 403 |
| Grade 5 | 12,293 | 603,469 | 49 | 37 | 0 | 473 |

The mean number of minutes logged on by students was examined across all elementary schools for a two-week period in each of the four marking periods. From individual device records, average (mean) minutes logged on per day was calculated; the mean minutes per day was calculated for each school, and the mean of the elementary schools is presented in Table 10.

On average, students were logged onto their Chromebooks for about one hour each day during the first three marking periods, and for about one and one quarter hours during marking period four. Even in schools with the lowest average log-in minutes, students averaged between 21 and 50 minutes per day; in schools with the highest average minutes, students were logged in, on average, between 105 and 130 minutes per day.

Table 10
Mean number of Minutes Logged on per day by Students in Grades 3, 4, and 5

| | *N schools* | *Mean* | *Median* | *Minimum* | *Maximum* |
|---|---|---|---|---|---|
| Marking Period 1 | 132 | 59.5 | 57.1 | 37.7 | 122.1 |
| Marking Period 2 | 134 | 59.1 | 57.4 | 41.1 | 104.7 |
| Marking Period 3 | 133 | 59.1 | 56.9 | 20.6 | 111.5 |
| Marking Period 4 | 133 | 76.8 | 75.7 | 49.7 | 130.0 |

***Use of technology in classroom observations.*** Classroom observations included recording the use of Chromebooks by students and the Promethean board by teachers and students. Although the Promethean boards were implemented prior to the new technologies, they are used in combination with many of the new Google Apps for Education, so the use of Promethean boards was included in the classroom observations. Table 11 shows the observed use of these technologies recorded during the classroom visits by grade.

Results indicated that students used Chromebooks[3] during most of the observation visits (92% overall). Chromebook use in Grades 3, 4, and 5 classrooms was similar, ranging from 89% (Grade 4) to 95% (Grade 5). In 80% of the classrooms the Promethean board was used by the teacher for active instruction (not simply to post schedule or instructions), and in 21% of the classrooms, students used the Promethean board during the lesson. In both cases, greater use of the Promethean board was observed in Grade 5 classes than in Grade 3 classes (see Table 11).

Table 11
Use of Chromebooks and Promethean Board During Classroom Observations by Grade

| Use during observation | Grade 3 ($N = 38$) | | Grade 4 ($N = 37$) | | Grade 5 ($N = 38$) | | Total ($N = 113$) | |
|---|---|---|---|---|---|---|---|---|
| | *n* | % | n | % | n | % | n | % |
| Chromebooks | 35 | 92.1 | 33 | 89.2 | 36 | 94.7 | 104 | 92.0 |
| Promethean board used for instruction by teacher | 27 | 71.1 | 31 | 83.8 | 32 | 84.2 | 90 | 79.6 |
| Promethean board used by students | 6 | 15.8 | 7 | 18.9 | 11 | 28.9 | 24 | 21.2 |

Table 12 shows the use of the Chromebooks and Promethean board observed during lessons in different subjects. Findings from the observations showed that students used Chromebooks in 93% of English/language arts and mathematics classes, in 80% of the science classes, and in 100% of the social studies classes. The teachers' use of the Promethean board ranged from 67% in English/language arts classes to 93% in science classes. Students' use of the Promethean board was highest in science (33%) and mathematics (32%) (see Table 12).

[3] To record evidence of the use of Chromebook in the observation, the evaluator must have observed one or more students using a Chromebook for the lesson during part or all of the observation period.

Table 12
Use of Chromebooks and Promethean Board During Classroom Observations by Subject

| | English/LA (*N* = 43) | | Mathematics (*N* = 44) | | Science (*N* = 15) | | Soc.Studies (*N* = 11) | |
|---|---|---|---|---|---|---|---|---|
| Use during observation | *n* | % | n | % | n | % | n | % |
| Chromebooks | 40 | 93.0 | 41 | 93.2 | 12 | 80.0 | 11 | 100.0 |
| Promethean board used for instruction by teacher | 29 | 67.4 | 38 | 86.4 | 14 | 93.3 | 9 | 81.8 |
| Promethean board used by students | 5 | 11.6 | 14 | 31.8 | 5 | 33.3 | 0 | 0.0 |

***Changes in students' engagement and ability to show what they know.*** Teachers responded to open-ended survey questions about changes in students' engagement and ability to show what they know since the new technology was introduced. Table 13 summarizes their responses.

Among the 362 teachers who responded to the first question (48% of total respondents), more than one half reported that their students were more engaged, more motivated and eager to learn (58%). Some specific types of student engagement reported by teachers were research (13%), working more independently (12%), and educational games and practice activities (10%). Concerns were expressed by some of the teachers: of the 362 teachers responding, 15% noted that students face more distractions and were more difficult to monitor with the new technology. As one teacher who expressed this concern explained, "Although some students are more engaged, I find that others are now easily distracted by the ability to access so much other information."

Among 305 teachers who responded to an open-ended question about changes in students' ability to show what they know and express their thoughts (41% of total respondents), about one quarter reported that students' writing has improved (25%) and they have gained presentation skills (22%). Teachers reported specific ways that the technology has helped students express themselves with comments such as this: "Students are more likely to reflect meaningfully on feedback because making changes is easier with the use of technology." Among the 8% of responding teachers who noted that students prefer to type their assignments, one teacher noted that "typing is a great vehicle for reluctant writers."

On the other hand, 10% of the 305 responding teachers indicated that typing is hard for some students, making the work harder as well, and 13% of the responding teachers reported no change in students' ability to show what they know and express their thoughts.

Table 13
Teachers' Responses to Open-Ended Survey Question About Changes in Students' Engagement and Ability to Show What they Know Following Implementation of New Technology

| | *n* | % |
|---|---|---|
| ***Following the implementation of the new technology, what changes, if any, do you see in students' engagement with the material?* (*N* = 362)[a]** | | |
| Higher level of engagement, students are more motivated, eager to learn | 208 | 57.5 |
| Concerns: more distractions, difficult to monitor, less engaged with other learning modes | 53 | 14.6 |
| Engaged with research, willing to look up information, definitions, ask questions | 46 | 12.7 |
| Enjoy education games, math practice activities, videos, interactive lessons | 37 | 10.2 |
| Students are working more independently, completing tasks, reading on-line books, self-paced | 45 | 12.4 |
| Students are more willing to write, enjoy typing vs. handwriting | 29 | 8.0 |
| More engaged because needs are met, more comfortable | 21 | 5.8 |
| Engaged in collaboration between/among students | 20 | 5.5 |
| Engaged with presentations, Google slides, additional ways to show what they know | 20 | 5.5 |
| Other | 25 | 6.9 |
| ***Following the implementation of the new technology, what changes, if any, do you see in students' ability to show what they know and express their thoughts?* (*N* = 305)[a]** | | |
| Writing has improved, students are expressing more, writing more details, revising is easier | 75 | 24.6 |
| Students have learned presentation skills, more options to show what they know, taking more risks, more sharing | 66 | 21.6 |
| No difference, no change | 39 | 12.8 |
| Students prefer to type, good for those struggling with handwriting, spelling has improved | 32 | 10.5 |
| Concern: typing is harder, makes work more difficult, need keyboard training | 29 | 9.5 |
| Generally helps learning | 29 | 9.5 |
| Students understand concepts better, greater access to information for understanding | 24 | 7.9 |
| Some show improvement and some do not—depends on typing skills | 16 | 5.2 |
| Other | 39 | 12.8 |

[a] Upper-case N (*N*) represents the number of teachers responding to the open-ended question. Lower-case ns (*n*) represent the number of comments coded to that category. A single comment may have been coded in more than one category, and teachers may have responded with more than one comment, so percentages add to more than 100%. Only categories with 10 or more comments are reported.

***Students' access to Internet from home.*** Teachers and principals also were asked to report, to the best of their knowledge, the percentage of students in their classroom that have access to the Internet from home. Table 14 shows the mean percentage of students who have Internet access reported by teachers in Grades 3, 4, and 5 and the elementary principals.

On average, teachers' responses indicated that more than three quarters of students in their classrooms had Internet access at home, although some teachers in each grade reported few or none of their students had access. Reported percentages were similar across grades. Consistent

with teachers' response, principals reported that 79% of students had Internet access (see Table 14).

Table 14
Percentage of Students with Access to Internet from Home Reported by Teachers and Principals

| | *N* | *Mean %* | *Median %* | *S.D.* | *Min.* | *Max.* |
|---|---|---|---|---|---|---|
| Teachers, Total Grades 3, 4, 5 | 479 | 78.6 | 90.0 | 23.8 | 0.0 | 100.0 |
| Grade 3 | 156 | 75.9 | 85.0 | 25.3 | 5.0 | 100.0 |
| Grade 4 | 158 | 78.2 | 85.0 | 23.7 | 1.0 | 100.0 |
| Grade 5 | 165 | 81.6 | 90.0 | 22.1 | 0.0 | 100.0 |
| Principals | 67 | 79.4 | 89.0 | 19.5 | 20.0 | 100.0 |

Teachers and principals also were asked, in an open-ended question, whether any adjustments were made to assignments if some students did not have Internet access from home. Table 15 summarizes their responses.

A total of 355 teachers (48% of all responding teachers) and 35 principals (37% of all responding principals) provided responses to this open-ended question. The largest percentage of responding teachers reported that they did not assign homework that required the use of a computer (46%); teachers also described ways that they supported and made adjustments for students without Internet access at home, including giving assignments on paper or giving students a choice of hand-written or typed (19%), and providing more time to work on computers at school (12%). Similarly, principals described various adjustments that are made for students who do not have access to the Internet at home, including providing additional opportunities for technology use at school (46%). Examples of these opportunities included: access to computers or Chromebooks before class and at the media center; students can come to school to use technology after hours; after school technology club; and more time allowed on computer or Chromebook.

Table 15
Teachers' and Principals' Responses to Open-Ended Survey Question About Adjustments for Students who do not have Internet Access at Home

| *Teachers* (*N* = 355) | *n* | % |
|---|---|---|
| Does not assign computer work for home | 164 | 46.2 |
| Assignments on paper, choice of hand-written or typed | 69 | 19.4 |
| No homework assigned, "No homework" policy | 55 | 15.5 |
| More opportunities/time for technology use provided at school | 41 | 11.5 |
| Other adjustments | 8 | 2.2 |
| No adjustments | 11 | 3.1 |
| *Principals* (*N* = 35) | | |
| More opportunities/time provided at school | 16 | 45.7 |
| Paper Communication | 6 | 17.1 |
| Other adjustments | 10 | 28.6 |
| No adjustments | 3 | 8.6 |

## Principals' use of technology

Like teachers, principals who responded to the 21st Century Learning Spaces Initiative survey rated their knowledge of the use of technology in education. Table 16 shows how the principals responded. The majority of responding principals rated themselves as either 'Competent' (43%) or 'Proficient' (45%) in their knowledge of technology in education. For principals, self-ratings of technology knowledge were not related to number of years as an elementary administrator (see Table C-2 in Appendix C). The findings reflected principal self-ratings made midway through the 2015–2016 school year; most had participated in one or more professional learning opportunities about the technology initiative by that time.

Table 16
Self-Ratings of Principals in Knowledge of Technology

| Principals ($N$ = 95) | | |
|---|---|---|
| Self-rating of knowledge of technology in education | | |
| Novice or Beginner | 7 | 7.4 |
| Competent | 41 | 43.2 |
| Proficient | 43 | 45.3 |
| Expert | 4 | 4.2 |

***Use of technology reported by principals.*** Principals reported the frequency of their use of the new technology—Chromebooks and Google Apps—for various tasks. Table 17 summarizes their use of the technology on a range of administrative tasks.

Forty percent or more of the responding principals reported that they used the new technology most days to analyze student and/or school performance (42%), plan for meetings (40%), and facilitate meetings (40%). More than a third of the principals reported that they used the new technology most days to communicate and engage with staff (38%), access and organize resources (37%), and conduct formal or informal classroom observations (35%) (see Table 17).

Table 17
Principals' Use of New Technology for Administrative Tasks ($N = 95$)

| | | Every day | | Most days | | About half the time | | Less than half the time | | Never | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | n | % | n | % | n | % | n | % |
| Analyze student and/or school performance data | 64 | 0 | 0.0 | 27 | 42.2 | 24 | 37.5 | 11 | 17.2 | 2 | 3.1 |
| Plan for meetings | 62 | 0 | 0.0 | 25 | 40.3 | 16 | 25.8 | 12 | 19.4 | 9 | 14.5 |
| Facilitate meetings | 68 | 0 | 0.0 | 27 | 39.7 | 18 | 26.5 | 11 | 16.2 | 12 | 17.6 |
| Communicate and engage with staff | 60 | 0 | 0.0 | 23 | 38.3 | 17 | 28.3 | 14 | 23.3 | 6 | 10.0 |
| Access and organize resources | 52 | 0 | 0.0 | 19 | 36.5 | 9 | 17.3 | 16 | 30.8 | 8 | 15.4 |
| Classroom observations (formal or informal) | 68 | 0 | 0.0 | 24 | 35.3 | 15 | 22.1 | 15 | 22.1 | 14 | 20.6 |
| Elicit and collect feedback from staff, students, and/or parents | 75 | 0 | 0.0 | 13 | 17.3 | 34 | 45.3 | 18 | 24.0 | 10 | 13.3 |
| Communicate and engage with parents | 70 | 0 | 0.0 | 12 | 17.1 | 17 | 24.3 | 20 | 28.6 | 21 | 30.0 |
| Collaborate with colleagues (administrators in other schools) | 69 | 0 | 0.0 | 9 | 13.0 | 11 | 15.9 | 31 | 44.9 | 18 | 26.1 |
| Communicate and engage with students | 78 | 0 | 0.0 | 6 | 7.7 | 14 | 17.9 | 30 | 38.5 | 28 | 35.9 |

***Aspects of technology most and least accessible for principals.*** Principals were asked which components of the technology they found the most readily accessible, and which components they found the most challenging to incorporate into their work. A total of 37 principals (39% of all responding principals) offered comments related to the most accessible components, and 34 principals (36% of all responding principals) responded with comments about challenging components. Table 18 summarizes their responses to these open-ended questions.

Although many of the responding principals noted that Google Drive and Google Apps were among the most accessible components of the new technology (57%), a number of the respondents also indicated that the transition to Google Drive has posed some challenges. Some principals reported that transferring files to Google and adjusting to Google format was difficult (47%). Several principals expressed the need for more time to learn and practice what is taught in Professional Learning sessions (see Table 18).

Table 18
Principals' Responses to Open-Ended Questions About the Most Accessible and the Most Challenging Components of New Technology

| | *n* | % | Representative comments (paraphrased) |
|---|---|---|---|
| **Technology components most accessible and easy to incorporate (*N* = 37)[a]** | | | |
| Google Drive | 21 | 56.8 | • Google drive and Google Apps |
| Microsoft Office | 6 | 16.2 | • Word, Outlook |
| MCPS Tech Resources | 3 | 8.1 | • *myMCPS*, OASIS |
| Other | 7 | 18.9 | |
| **Technology components most challenging to incorporate (*N* = *34*)** | | | |
| Transition to Google Drive (from Microsoft) | 16 | 47.1 | • Transferring files (docs) to Google<br>• Adjusting to Google formats<br>• Limited number of features when creating documents in Google<br>• Platform differences between Outlook and Google email |
| Time to learn | 4 | 11.8 | • Lack of exposure to tech on a daily basis<br>• Need follow up of PD sessions |
| Other | 14 | 41.2 | |

[a] Upper-case Ns (*N)* represent the number of principals responding to the open-ended question. Lower-case ns (*n)* represent the number of comments coded to that category. Only categories with 3 or more comments are reported.

***Change in workload.*** Principals reported on changes in the amount of time spent on various activities since the introduction of the new technology; their responses are shown in Table 19. The table is organized so that activities with the highest percentage of principals reporting more time are listed first.

On most activities, two thirds or more of the principals reported spending about the same amount of time since the new technology was introduced and the smallest percentage reported spending more time. One third of the principals indicated that they spent less time planning for meetings, and one quarter reported less time for facilitating meetings, analyzing student or school performance data, and collecting feedback from staff, students, and parents (see Table 19).

Table 19
Principals' Report of Change in Time Spent on Activities Since the Introduction of New Technology

| | | More time | | About the same | | Less time | |
|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | *n* | % | *n* | % |
| Analyze student and/or school performance data | 77 | 12 | 15.6 | 46 | 59.7 | 19 | 24.7 |
| Facilitate meetings | 72 | 8 | 11.1 | 45 | 62.5 | 19 | 26.4 |
| Access and organize resources | 74 | 8 | 10.8 | 52 | 70.3 | 14 | 18.9 |
| Plan for meetings | 77 | 8 | 10.4 | 44 | 57.1 | 25 | 32.5 |
| Elicit and collect feedback from staff, students, and/or parents | 76 | 7 | 9.2 | 48 | 63.2 | 21 | 27.6 |
| Communicate and engage with staff | 76 | 6 | 7.9 | 52 | 68.4 | 18 | 23.7 |
| Classroom observations (formal or informal) | 77 | 6 | 7.8 | 60 | 77.9 | 11 | 14.3 |
| Communicate and engage with parents | 75 | 5 | 6.7 | 65 | 86.7 | 5 | 6.7 |
| Collaborate with colleagues (administrators in other schools) | 75 | 1 | 1.3 | 66 | 88.0 | 8 | 10.7 |
| Communicate and engage with students | 75 | 4 | 5.3 | 65 | 86.7 | 6 | 8.0 |

Table 20 shows the principals' report on the impact of the new technology on their overall workload. One quarter of the principals indicated that their workload is increased overall (25%), more than one third reported that they are working about the same amount of time on most tasks and overall (37%), and more than one third reported that they are working about the same amount of time overall, but time spent on different tasks has changed (38%). No principal reported that their workload has reduced overall (see Table 20).

Table 20
Principals' Report of Change in Workload Since the Introduction of New Technology (*N*= 79)

| | *n* | % |
|---|---|---|
| My workload is increased overall. | 20 | 25.3 |
| I am working about the same amount of time on most tasks and overall. | 29 | 36.7 |
| I am working about the same amount of time overall, but time spent on different tasks has changed. | 30 | 38.0 |
| My workload is reduced overall. | 0 | 0.0 |

**Summary of Findings for Evaluation Question 1. What were the experiences and perceptions of the technology initiative stakeholders?**

***Teachers' experiences and perceptions.*** About two thirds of the teachers surveyed reported using the new technologies every day or most days to access online resources for teaching, and for planning and creating lessons; about one half of the responding teachers used the technologies every day or most days for maintaining student records or grading student work. Across the various tasks, larger percentages of Grade 5 teachers compared with teachers in Grades 3 and 4 reported using the new technologies every day.

The largest change in time on activities reported by teachers was more time on planning and developing lessons and instructional materials. Reporting on the impact of the new technology on their overall workload, about one third of the teachers indicated that their workload is increased overall, another third reported that they are working about the same amount of time on most tasks and overall, and more than a quarter reported that they are working about the same amount of time overall, but time spent on different tasks has changed. Only two percent reported that their workload has reduced overall.

***Students' experiences.*** Multiple sources of data were used to examine students' use of technology. More than one third of the teachers reported that students used the technologies every day for working on documents or projects and accessing teacher-identified content. Compared to Grade 3 and Grade 4 teachers, higher percentages of Grade 5 teachers reported that their students use the technologies every day to work on a document or project, collaborate on an assignment, or research relevant or interesting subjects.

Results from classroom observations indicated that students were using the Chromebooks during most of the observation visits (92% overall). Chromebook use in Grades 3, 4, and 5 classrooms were similar, ranging from 89% (Grade 4) to 95% (Grade 5). By the subject lesson, students were observed using Chromebooks in 93% of English/language arts classes, 93% of mathematics classes, 80% of science classes, and 100% of social studies classes.

Further, more than one half of the responding teachers reported that their students were more engaged, more motivated and eager to learn. Teachers also reported, in response to an open-ended question about changes in ability to show what they know, that students' writing has improved and they have gained presentation skills. Concerns were expressed by some teachers that students face more distractions and were more difficult to monitor with the new technology, and several indicated that typing is hard for some students, making the work harder as well.

***Principals' experiences and perceptions.*** Forty percent or more of the responding principals reported that they used the new technology most days to analyze student and/or school performance, plan for meetings, and facilitate meetings. More than a third of the principals reported that they used the new technology most days to communicate and engage with staff, access and organize resources, and conduct formal or informal classroom observations.

One third of the principals indicated that after implementation of the new technology, they spent less time planning for meetings, and one quarter reported less time facilitating meetings, analyzing student data, and eliciting feedback. On most activities, principals reported spending about the same amount of time since the new technology was introduced. Reporting on the impact of the new technology on their overall workload, about one quarter of the principals indicated that their workload is increased overall, more than one third reported that they are working about the same amount of time on most tasks and overall, and more than one third reported that they are working about the same amount of time overall, but time spent on different tasks has changed. No principal reported that their workload has reduced overall.

**Evaluation Question 2: What was the impact of the professional learning component of the initiative?**

As teachers in each cohort of schools received devices for their classrooms, instructional specialists from OCTO met with them in their schools to provide an orientation to the initiative and an opportunity to begin exploring the technologies. A range of professional learning options were offered for teachers and principals, both in school and districtwide. In addition, two instructional specialists were assigned to each school to provide ongoing job-embedded coaching and support.

The professional learning opportunities provided through the initiative sought to help teachers and principals build their skills and knowledge of classroom technology, and enable them to integrate the new technology into instruction. The professional learning experiences addressed these goals by improving the ability of teachers and principals to manage work using technology, and by generating new ideas and strategies for using technology in instruction. Objectives of the teachers' professional learning experiences addressed the instructional objectives outlined earlier (p. 2), and included preparing teachers to plan engaging lessons, encourage student collaboration, provide feedback to students, differentiate instruction, and offer students multiple ways to access material through the use of technology. Principals' professional learning included skills for using the technology for management tasks and collaboration, as well as supporting and promoting the use of technology in their school. The professional learning and support that was offered in the initiative was tailored to the needs of each school and its teachers; an array of districtwide learning opportunities was offered, as well as individualized coaching and support in the classroom and in school staff meetings.

***Professional Learning Opportunities attended.*** Nearly all of the teachers (96%) and principals (99%) responding to surveys reported that they attended at least one professional learning opportunity related to the new technology. Table 21 shows the percentage of responding teachers (in each grade) and principals who reported participating in various specified learning opportunities.

The professional learning opportunities attended by the largest percentages of Grades 3 through 5 responding teachers were workshops or staff meetings facilitated by an instructional technology specialist (68%–72%), coaching/planning during a collaborative team meeting (53%–58%), and the continuing PD course IT-85 (37%–52%). Attendance at most of the professional learning opportunities was similar across grades, with the exception of the PD IT-85 course, which was attended by a higher percentage of Grade 3 and Grade 5 teachers, and Appy Hour, which also was attended by a higher percentage of teachers in Grades 3 and 5 compared with Grade 4 teachers (see Table 21).

The professional learning opportunities attended by the largest percentages of responding principals were workshops or sessions that were offered during meetings, including elementary principals PLC meetings (92%), elementary principals curriculum update meetings (73%), and during Administrative and Supervisory meetings (72%) (see Table 21).

Table 21
Professional Learning Opportunities Attended by Teacher and Principal Survey Respondents

| Professional Learning Opportunity Attended | Grade 3 (*N* = 224) | | Grade 4 (*N* = 240) | | Grade 5 (*N* = 226) | | Principals (*N* = 95) | |
|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % |
| Workshop/staff meeting facilitated by an instructional technology specialist | 162 | 72.3 | 164 | 68.3 | 153 | 67.7 | 61 | 64.2 |
| Coaching/planning support during collaborative team planning | 121 | 54.0 | 128 | 53.3 | 131 | 58.0 | Not asked | |
| Continuing Professional Development course, IT-85 | 116 | 51.8 | 89 | 37.1 | 106 | 46.9 | <5 | -- |
| MCPS developed online resources | 75 | 33.5 | 63 | 26.3 | 67 | 29.6 | 18 | 18.9 |
| Non-MCPS online resources | 67 | 29.9 | 70 | 29.2 | 66 | 29.2 | 13 | 13.7 |
| Half-day orientation to Google Apps | 65 | 29.0 | 68 | 28.3 | 72 | 31.9 | 38 | 40.0 |
| Appy Hour | 52 | 23.2 | 30 | 12.5 | 50 | 22.1 | 19 | 20.0 |
| OCTO Technology Conference (Summer 2015) | 14 | 6.3 | 13 | 5.4 | 15 | 6.6 | <5 | -- |
| Workshop/sessions offered during Elementary Principals PLC meetings | Not asked | | | | | | 87 | 91.6 |
| Workshop/sessions offered during Elementary Principals Curriculum Update meetings | Not asked | | | | | | 69 | 72.6 |
| Workshop/sessions offered during Administrator and Supervisor meetings | Not asked | | | | | | 68 | 71.6 |
| Individualized training provided by an instructional technology specialist | Not asked | | | | | | 52 | 54.7 |
| "Leading with Technology" professional development workshops | Not asked | | | | | | 29 | 30.5 |

Table 22 shows teachers' and principals' reported frequency of participation in professional learning opportunities since the implementation of the new technology, and the number of hours participated.

Among all Grades 3, 4, and 5 teachers, more than three quarters (79%) reported that they participated in professional learning opportunities 'often' or 'sometimes.' Only 3% of the responding teachers indicated that they never participated. There were few differences in the reported frequency that learning opportunities were attended among teachers in different grades. Grade 4 teachers reported, on average, fewer hours participating in professional learning related to Chromebooks and/or Google Apps for Education (12 hours compared with 18 for Grade 3 teachers and 16 for Grade 5 teachers). The technology initiative was rolled out for Grades 3 and 5 a year earlier than for Grade 4, so it is likely that many Grades 3 and 5 teachers have participated in professional learning during the two years that the new technology has been in place, compared with the one year that Grade 4 classrooms have had the technology (see Table 22).

Principals' report of the frequency of their participation was similar to that of the teachers, but the mean number of hours spent participating in professional learning opportunities was less than reported by teachers (mean = 9 hours reported by principals, compared with 16 hours reported by teachers) (see Table 22).

Table 22
Frequency of Participation and Hours of Participation in Professional Learning Opportunities

| | | Often | | Sometimes | | Rarely | | Never | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | *n* | % | *n* | % | *n* | % |
| Reported frequency of participation in professional learning opportunities | | | | | | | | | |
| Total, Grades 3, 4, 5 | 609 | 162 | 26.6 | 319 | 52.4 | 108 | 17.7 | 20 | 3.3 |
| Grade 3 | 194 | 49 | 25.3 | 108 | 55.7 | 32 | 16.5 | 5 | 2.6 |
| Grade 4 | 208 | 58 | 27.9 | 97 | 46.6 | 46 | 22.1 | 7 | 3.4 |
| Grade 5 | 207 | 55 | 26.6 | 114 | 55.1 | 30 | 14.5 | 8 | 3.9 |
| Principals | 85 | 18 | 21.2 | 57 | 67.1 | 9 | 10.6 | 1 | 1.2 |
| Reported number of hours of participation in professional learning related to Chromebooks and/or Google Apps for Education | | | | | | | | | |
| | *N* | *Mean* | | *S.D.* | *Median* | *Min.* | | *Max.* | |
| Total, Grades 3, 4, 5 | 601 | 15.51 | | 22.0 | 5.0 | 0.0 | | 200.0 | |
| Grade 3 | 193 | 18.32 | | 24.7 | 6.0 | 0.0 | | 200.0 | |
| Grade 4 | 207 | 12.27 | | 17.5 | 5.0 | 0.0 | | 100.0 | |
| Grade 5 | 201 | 16.14 | | 23.1 | 6.0 | 0.0 | | 150.0 | |
| Principals | 82 | 9.24 | | 8.0 | 6.0 | 1.0 | | 40.0 | |

**Guskey Level 1: Participants' reactions**

Teachers and principals responded to open-ended survey questions asking which professional learning opportunities were the most helpful during the implementation of the new technology. Teachers and principals participated in different learning opportunities, according to their needs, so this question provided an opportunity for teachers and principals to identify the opportunities that were most helpful. A total of 461 teachers (62% of all responding teachers) and 53 principals (56% of all responding principals) responded to this open-ended question with their feedback about the most helpful professional learning opportunities. Table 23 summarizes their responses.

The professional learning opportunities reported as most helpful by the largest percentages of both teachers and principals were training related to Chromebooks and Google Apps, and training provided by instructional technology specialists in small groups or workshops (see Table 23).

Table 23
Teachers' and Principals' Reports of Most Helpful Professional Learning Opportunities During the Implementation of New Technology

| **Teachers** (*N* = 461) | Count | % |
|---|---|---|
| Chromebooks, Google training, Google Classroom, Google Apps | 129 | 28.0 |
| Technology instructional specialists: with small groups, workshops, training, in-school, one-on-one | 124 | 26.9 |
| IT-85 Class | 95 | 20.6 |
| Other teachers/peers/collaboration/team planning/teammates/see others work/PLC | 81 | 17.6 |
| My own exploration/practice/real time practice/hands on/time to explore | 46 | 10.0 |
| LanSchool training, Hapara training | 23 | 5.0 |
| In-house trainings/school workshops/SDT/Media Specialist training | 21 | 4.6 |
| Technology conference/Institute/summer training | 18 | 3.9 |
| Appy Hour/Appy Hour by Media Specialist | 10 | 2.2 |
| Other (with fewer than 5 mentions) | 34 | 7.4 |
| None/not helpful/there has not been any/need more | 36 | 7.8 |
| **Principals** (*N* = 53) | | |
| Training related to Google Apps | 26 | 49.1 |
| PLC, small group training | 12 | 22.6 |
| Technology instructional specialists: one-on-one coaching, workshops, school support | 6 | 11.3 |
| Other (with fewer than 5 mentions) | 9 | 17.0 |

*Note.* Upper-case Ns (*N)* represent the number of teachers and principals responding to the open-ended question. Lower-case ns (*n)* represent the number of comments coded to that category. A single comment may have been coded in more than one category. Only categories with 5 or more comments are reported.

Instructional technology specialists were asked to rate the level of helpfulness of the learning opportunities that were provided at the time of the new technology implementation. Table 24 summarizes their responses.

The learning opportunities that were judged 'very helpful' by the largest percentage of instructional specialists were individual or small group support (94%), coaching during collaborative team planning (88%), continuing professional development course IT-85 (88%), and principals' PLCs (77%). These ratings were consistent with the responses from teachers and principals; both groups named support from instructional technology specialists and small group support of PLCs among the most helpful learning opportunities (see Table 24).

Table 24
Instructional Technology Specialists' Rating of the Helpfulness of Learning Opportunities ($N = 17$)

| | Very helpful | | Somewhat helpful | | Not helpful | | I don't have information | |
|---|---|---|---|---|---|---|---|---|
| | *n* | % | *N* | % | *n* | % | *n* | % |
| Individual or small group support as needed | 16 | 94.1 | 0 | 0.0 | 1 | 5.9 | 0 | 0.0 |
| Coaching or support during collaborative team planning | 15 | 88.2 | 1 | 5.9 | 0 | 0.0 | 1 | 5.9 |
| Continuing Professional Development course, IT-85 | 15 | 88.2 | 2 | 11.8 | 0 | 0.0 | 0 | 0.0 |
| Elementary Principal PLCs | 13 | 76.5 | 4 | 23.5 | 0 | 0.0 | 0 | 0.0 |
| OCTO Technology Conference | 12 | 70.6 | 5 | 29.4 | 0 | 0.0 | 0 | 0.0 |
| School-based workshop | 10 | 58.8 | 6 | 35.3 | 0 | 0.0 | 1 | 5.9 |
| Half-day orientation to Google Apps | 8 | 47.1 | 8 | 47.1 | 1 | 5.9 | 0 | 0.0 |
| MCPS-developed online resources | 6 | 35.3 | 10 | 58.8 | 0 | 0.0 | 1 | 5.9 |
| Appy hour | 3 | 17.6 | 10 | 58.8 | 1 | 5.9 | 3 | 17.6 |

**Guskey Level 2: Participants' learning**

Teachers and principals responded to survey questions with their perceptions about what they learned and how they benefited from the learning opportunities that they attended. Table 25 summarizes the responses of teachers.

More than three quarters of the responding teachers agreed (responded strongly agree or agree) that they gained knowledge and skills through the professional learning opportunities. Specifically, 88% of the teachers agreed that the learning opportunities provided new ideas or strategies to teach using technology; 87% agreed that the learning opportunities improved their ability to teach with technology; and 86% agreed that the learning opportunities had improved their ability to manage and organize work (see Table 25).

Table 25
Teachers' Responses About Knowledge and Skills Gained from Professional Learning Experiences

| | | Strongly Agree | | Agree | | Disagree | | Strongly Disagree | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | *n* | % | *n* | % | *n* | % |
| The learning opportunities provided me with new ideas and/or strategies to teach using technology | 648 | 166 | 25.6 | 404 | 62.3 | 63 | 9.7 | 15 | 2.3 |
| The learning opportunities improved my ability to teach using technology | 655 | 161 | 24.6 | 410 | 62.6 | 62 | 9.5 | 22 | 3.4 |
| The learning opportunities improved my ability to manage and organize my work using technology. (ex. team planning, accessing resources) | 656 | 150 | 22.9 | 417 | 63.6 | 69 | 10.5 | 20 | 3.0 |
| The learning opportunities improved my confidence to teach using technology | 643 | 133 | 20.7 | 390 | 60.7 | 100 | 15.6 | 20 | 3.1 |
| The learning opportunities were relevant to my needs as a learner | 650 | 115 | 17.7 | 418 | 64.3 | 94 | 14.5 | 23 | 3.5 |
| The learning opportunities adequately prepared me to teach using technology | 648 | 112 | 17.3 | 374 | 57.7 | 131 | 20.2 | 31 | 4.8 |

The responses of principals with regard to their experience with professional learning opportunities are shown in Table 26.

Overall, large percentages of principals indicated that they had gained knowledge and skills from the professional learning opportunities associated with the new technology. Eight-five percent or more of the responding principals agreed (responded strongly agree or agree) that the learning opportunities: provided new ideas or strategies; were relevant to their needs as a learner; improved their ability to manage and organize their work; improved their ability to support and promote the use of technology; and prepared them to use the technology in their work (see Table 26).

Table 26
Principals' Responses About Knowledge and Skills Gained from Professional Learning Experiences

| | | Strongly Agree | | Agree | | Disagree | | Strongly Disagree | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | n | % | n | % | n | % |
| The learning opportunities provided me with new ideas and/or strategies for using technology in my work | 86 | 34 | 39.5 | 52 | 60.5 | 0 | 0.0 | 0 | 0.0 |
| The learning opportunities were relevant to my needs as a learner | 83 | 32 | 38.6 | 50 | 60.2 | 1 | 1.2 | 0 | 0.0 |
| The learning opportunities improved my ability to manage my work using technology | 85 | 30 | 35.3 | 45 | 52.9 | 10 | 11.8 | 0 | 0.0 |
| The learning opportunities improved my confidence in the use of technology in my work | 86 | 24 | 27.9 | 51 | 59.3 | 11 | 12.8 | 0 | 0.0 |
| The learning opportunities improved my ability to support and promote the use of technology in my school | 86 | 22 | 25.6 | 52 | 60.5 | 12 | 14.0 | 0 | 0.0 |
| The learning opportunities adequately prepared me to use the technology in my work | 86 | 21 | 24.4 | 52 | 60.5 | 13 | 15.1 | 0 | 0.0 |

**Guskey Level 3: Organization support and change**

Teachers and principals responded to survey questions about the support provided for their learning. Their responses are summarized in Table 27.

Most of the survey items regarding support for implementation had high levels of agreement from both teachers and principals. The highest level of teachers' agreement was in response to the survey item stating that administrators actively support their use of Chromebooks and Google Apps for Education (87% agreed). The highest level of principals' agreement was in response to the survey item stating that they felt supported when using technology (91%). More than half of the teachers (58%) and more than half of the principals (56%) agreed that they felt overwhelmed by the number of applications available with the new technology.

Table 27
Teachers' and Principals' Responses About Support for the Implementation of the New Technology

| | | *Strongly Agree* | | *Agree* | | *Disagree* | | *Strongly Disagree* | |
|---|---|---|---|---|---|---|---|---|---|
| | | *n* | % | n | % | n | % | n | % |
| Administrators actively support our use of Chromebooks and/or Google Apps for Education to support teaching and learning | Teachers (*N*= 642) | 199 | 31.0 | 361 | 56.2 | 62 | 9.7 | 20 | 3.1 |
| | Principals | Not asked | | | | | | | |
| I feel supported when (teaching) using technology | Teachers (*N* = 651) | 105 | 16.1 | 391 | 60.1 | 136 | 20.9 | 19 | 2.9 |
| | Principals (*N* = 85) | 32 | 37.6 | 45 | 52.9 | 8 | 9.4 | 0 | 0.0 |
| I know where I can learn what I need to implement the new technology | Teachers (*N* = 642) | 96 | 15.0 | 353 | 55.0 | 176 | 27.4 | 17 | 2.6 |
| | Principals (*N* = 85) | 27 | 31.8 | 45 | 52.9 | 13 | 15.3 | 0 | 0.0 |
| I feel supported if technical issues arise when teaching using technology | Teachers (*N* = 645) | 92 | 14.3 | 375 | 58.1 | 157 | 24.3 | 21 | 3.3 |
| | Principals (*N* = 84) | 34 | 40.5 | 40 | 47.6 | 10 | 11.9 | 0 | 0.0 |
| I (teacher survey)/Staff at my school (principal survey) have opportunities to collaborate and share ideas related to integrating Chromebooks and/or Google Apps for Education to support teaching and learning | Teachers (*N* = 648) | 90 | 13.9 | 359 | 55.4 | 174 | 26.9 | 25 | 3.9 |
| | Principals (*N* = 86) | 30 | 34.9 | 46 | 53.5 | 10 | 11.6 | 0 | 0.0 |
| I feel overwhelmed by the number of applications available with the new technology | Teachers (*N* = 643) | 124 | 19.3 | 246 | 38.3 | 226 | 35.1 | 47 | 7.3 |
| | Principals (*N* = 86) | 15 | 17.4 | 33 | 38.4 | 31 | 36.0 | 7 | 8.1 |
| Practices are in place to provide ongoing professional learning for using Chromebooks and Google Apps for Education to support teaching and learning | Teachers (*N* = 631) | 64 | 10.1 | 296 | 46.9 | 228 | 36.1 | 43 | 6.8 |
| | Principals (*N* = 84) | 20 | 23.8 | 46 | 54.8 | 17 | 20.2 | 1 | 1.2 |

Overall, somewhat larger percentages of principals than teachers indicated that they felt supported in the implementation of the new technology. For example, 88% of the principals compared with 72% of the teachers agreed that they felt supported if technical issues arise when using technology, and 85% of the principals compared with 70% of the teachers agreed that they know where they can learn what is needed to implement the new technology. Differences also were observed in principals' and teachers' reported perception that they have opportunities to collaborate (88% of principals and 69% of teachers agreed) and that practices are in place to provide ongoing professional learning (79% of principals and 57% of teachers agreed) (see Table 27).

***Current support needed.*** Teachers, principals, and instructional technology specialists indicated which learning opportunities would be beneficial in supporting the current, ongoing implementation of Chromebooks and Google Apps for Education. In other words, respondents were asked to report on the kinds of support or professional learning activities they would find helpful now that the implementation of the initiative is well underway. Table 28 summarizes their responses.

Table 28
Teachers', Principals', and Instructional Technology Specialists' Reports of Learning Opportunities Beneficial in Supporting Current Implementation

| Learning Opportunity | Grade 3 (*N*=224) | | Grade 4 (*N*=239) | | Grade 5 (*N*=225) | | Principals (*N*=95) | | ITS (*N* = 17) | |
|---|---|---|---|---|---|---|---|---|---|---|
| In-school face to face workshops/training | 160 | 71.4 | 151 | 63.2 | 152 | 67.6 | 72 | 75.8 | 13 | 76.5 |
| Grade-alike/subject-alike / School administrator focus groups | 126 | 56.3 | 119 | 49.8 | 129 | 57.3 | 42 | 44.2 | 12 | 70.6 |
| Model lessons and instructional materials | 120 | 53.6 | 123 | 51.5 | 109 | 48.4 | Not asked | | 11 | 64.7 |
| Coaching/modeling from instructional technology specialists [a] | 125 | 55.8 | 113 | 47.3 | 106 | 47.1 | 63 | 66.3 | 14 | 82.4 |
| Self-paced online learning opportunities | 86 | 38.4 | 99 | 41.4 | 108 | 48.0 | 38 | 40.0 | 6 | 35.3 |
| Instructor-guided online learning opportunities | 84 | 37.5 | 83 | 34.7 | 77 | 34.2 | 49 | 51.6 | 7 | 41.2 |
| Out-of-school face to face learning opportunities provided by MCPS | 51 | 22.8 | 57 | 23.8 | 61 | 27.1 | 35 | 36.8 | Not asked | |
| None needed—I'm doing fine with the new technology | 9 | 4.0 | 8 | 3.3 | 18 | 8.0 | 3 | 3.2 | Not asked | |
| Appy Hour | Not asked | | | | | | Not asked | | 5 | 29.4 |
| Individual or small group support | Not asked | | | | | | Not asked | | 14 | 82.4 |
| Continuing professional development course | Not asked | | | | | | Not asked | | 16 | 94.1 |
| OCTO Technology Conference | Not asked | | | | | | Not asked | | 10 | 58.8 |

*Note.* ITS = Instructional technology specialist.
[a] Instructional technology specialist survey was worded "Coaching or support during lesson implementation."

Teachers, principals, and instructional technology specialists were consistent in their judgments of helpful learning opportunities to support current implementation. High percentages from each group (63% to 77%) named in-school face-to face training as a helpful support for current implementation. Grade- or subject-alike groups, modeling lessons, and coaching by instructional technology specialists were also judged most helpful by high percentages of respondents in each group. The learning opportunity judged helpful by the smallest percentages of teachers and principals (23% to 37%) was out-of school face-to-face learning opportunities provided by MCPS (see Table 28).

### Guskey Level 4: Participants' use of new knowledge and skills

The use of the new knowledge and skills by teachers and principals was measured by surveys (self-reported use of knowledge), classroom observations (direct observation of knowledge use), and device usage data (direct measure of the use of the technology). Each source provided a different view of this aspect of implementation.

#### *Self-reported use of knowledge*

***Impact of new technology on instruction and teaching strategies.*** Teachers responded to an open-ended survey question about the ways their teaching strategies changed after implementation of the new technology. Out of 747 respondents, 311 (42%) provided comments; Table 29 summarizes the main categories of responses that were offered by the teachers, and includes examples of comments that were coded in those categories.

The largest percentage of the 311 responding teachers noted that the technology has increased efficiency in giving out assignments and providing students with lesson materials (16%). Fifteen percent of the teachers also commented that they are making greater use of online resources, sharing sites, and Google Classroom, and fifteen percent reported the new technology has allowed more differentiation, small group work, and individual work with students (see Table 29). These reported changes are aligned with major objectives of the professional learning experiences—using technology to manage work in the, providing greater access to resources, promoting student collaboration, and differentiating lessons.

Table 29
Teachers' Reports of Changes in Teaching Strategies Following Implementation of New Technology ($N$ = 311)

| | *n* | % | Representative comment (paraphrased) |
|---|---|---|---|
| **Managing work in the classroom** | | | |
| Efficiency in giving assignments/organizing | 51 | 16.4 | • Instead of passing out a pile of papers, the students all have a copy of their work on their Chromebooks<br>• Writing assignments and writing convention activities are completed online<br>• It helps to maintain organization and access to materials<br>• More time to teach with students' ability to access materials right away through the classroom |
| More online resources/sharing site/use Google Classroom | 48 | 15.4 | • We have more resources and the content can be presented in a more interesting and engaging way<br>• The technology has been a great way to have students access new information, practice their math skills, and use adaptive software |
| More technology integration/technology focus/more confident/open | 37 | 11.9 | • I feel that my room has truly become a cohesive 21st century learning space<br>• I can readily make information/content and projects accessible to my students and colleagues |
| Providing more feedback to students | 34 | 10.9 | • Feedback is given to students at a quicker pace along with direct highlighting of where improvements can be made<br>• I am much more effective as a teacher. I feel better able to give meaningful, specific feedback to my students and to check in on their understanding at more regular intervals using the technology.<br>• Faster feedback, real time learning, faster paced learning |
| **New ideas for lessons, instructional strategies, access to wider range of materials** | | | |
| More research/inquiry projects/critical thinking | 31 | 10.0 | • More research/inquiry and use of Promethean boards for multimedia presentations for and made by the kids<br>• Students participate in more inquiry because activities no longer require media time or computer room use. Students may research and work on papers any time on their Chromebooks. Students may also submit papers and research notes to me and get immediate 'editing' support and feedback on content |
| Promote student collaboration | 30 | 9.6 | • Far less 'chalk and talk' in social studies lesson, much more collaborative work using documents (power points converted to slides) provided by the county<br>• Having students collaborate with each other on projects<br>• Collaborative conversations between students and/or teacher |
| More interactive lessons/games/fun way to learn | 30 | 9.6 | • Creating web-quests for kids to explore new topics and ideas<br>• Use of virtual manipulatives during instruction<br>• Technology provides access to fun and exciting ways to present information and explain concepts |

Table 29 (Continued)
($N$ = 311)

| | *n* | % | Representative comment (paraphrased) |
|---|---|---|---|
| **Differentiating instruction, providing choices** | | | |
| Differentiate/ individualize/small groups | 47 | 15.1 | • Students can check Google Classroom for their assignment and get started; it frees me up to work with small groups<br>• The new technology is allowing me to differentiate assignments to better fit the needs of students<br>• Providing more scaffolding support through apps and extensions<br>• It has made my teaching more exciting, more individualized, and I feel renewed as an educator |
| Give more choices/options/ independent/student paced | 39 | 12.5 | • I am able to allow more of the lessons to be student driven rather than teacher driven<br>• I am giving students more choices, I can give them a variety of resources to use in learning<br>• I am using more types of resources because greater availability (ebooks, books read aloud, video clips, new stories, etc.)<br>• Providing students with different ways to show what they learned |
| **Challenges, concerns** | | | |
| Disadvantages/concerns stated | 14 | 4.5 | • There is not always time--time for me to use it and time for me to help students use it effectively<br>• Concern about parents (especially at elementary) not wanting children to have too much exposure to screens/technology<br>• With our internet issues I always have to plan two activities/lessons in case the internet goes out<br>• Need to monitor student activities more closely |
| **Other** (mentioned fewer than 5 times) | 42 | 13.5 | |

*Note.* Upper-case N ($N$) represents the number of teachers responding to the open-ended question. Lower-case ns ($n$) represent the number of comments coded to that category. A single comment may have been coded in more than one category. Only categories with 5 or more comments are reported.

Principals also reported their perceptions of changes in teachers' approach to teaching in their classrooms since the new technology was implemented. A total of 41 principals (43% of all responding principals) responded to this open-ended question; Table 30 summarizes their responses and presents examples of their comments.

The largest percentage (37%) of responding principals reported that the technology has had an impact on teachers' work management and planning. In addition, one third (34%) of the principals noted that teachers are using new ideas for lessons, finding enriching and engaging resources to support instruction, and 10% reported that the technology has allowed increased differentiation and individualized instruction (see Table 30).

Table 30
Principals' Report of Changes in Teachers' Approach to Teaching the Curriculum Following the Implementation of the New Technology ($N = 41$)

| | *n* | % | Representative comments (paraphrased) |
|---|---|---|---|
| Managing work and planning | 15 | 36.6 | • Technology is very much incorporated into planning<br>• Teachers collaborate more in grades 3,4,5 using Google Chrome; their planning was more efficient<br>• Teachers are providing feedback to students through the Google Drive |
| New ideas for lessons; availability and use of engaging resources | 14 | 34.1 | • Teachers are providing enriching and exciting resources to support instruction; they are also taking projects to a new level<br>• More interactive, varied selections of resource materials, sharing resources/information, producing shared documents, providing and receiving immediate instructional feedback<br>• Teachers are embracing more written tasks and utilizing the features on the Chromebook to assist students in the writing process |
| Differentiation, greater use of individualized instruction, feedback to students | 4 | 9.8 | • Improved individualization of instruction<br>• More independent follow up, differentiated assignments, and better feedback from teachers |
| Other (mentioned fewer than 3 times) | 8 | 19.5 | |

*Note.* Upper-case N (*N*) represents the number of principals responding to the open-ended question. Lower-case ns (*n*) represent the number of comments coded to that category. A single comment may have been coded in more than one category. Only categories with 3 or more comments are reported.

***Impact of new technology on principals' administrative tasks.*** Principals also described how their own work has changed following the implementation of the new technology. A total of 34 principals (36% of all responding principals) provided responses to an open-ended survey question about changes in their administrative work. Table 31 summarizes the principals' responses.

The largest percentage of responses pertained to improvements in managing their work (38%). Principals pointed out a number of ways that the technology has improved efficiency, including simplifying observations and providing ways to better use data.

Table 31
Principals' Responses to Open-Ended Questions About the Changes in Administrative and Instructional Work Following the Implementation of the New Technology ($N = 34$)

| | *n* | % | Representative comments (paraphrased) |
|---|---|---|---|
| Managing work/ improved efficiency | 13 | 38.2 | • Gathering and manipulating data efficiently<br>• Simplicity for informal observations<br>• Easier to organize and access documents and information<br>• Can work from home more easily |
| Communication/collaboration | 10 | 29.4 | • Share documents via Google Drive with others (sharing is easier)<br>• Easier to collaborate on documents (for example, the SIP or Action Plan)<br>• Efficiently collaborating with the instructional leadership (core) team |
| Issues needing improvement | 7 | 20.6 | • Need for instructional data assistant to coordinate and facilitate testing and assessment<br>• Need for timesheets, leave forms to be submitted online<br>• Training needed for secretaries to collaborate on use of documents on Google platform |
| I don't know/ not sure/ other | 4 | 11.8 | |

*Note.* Upper-case Ns (*N*) represent the number of principals responding to the open-ended question. Lower-case ns (*n*) represent the number of comments coded to that category. A single comment may have been coded in more than one category. Only categories with 3 or more comments are reported.

***Technology integration.*** The *Technology Integration Matrix* (see Figure 1, p. 6) was used to assess self-reported levels of technology integration for: (1) principals, who were asked to characterize the average level of teachers in grades 3, 4, and 5 at their school, before the technology initiative was implemented and at the time of the survey (February 2016); and (2) teachers, who were asked to characterize their own current level (at the time of the survey—December 2015) and the level expected at the end of the school year. In addition, teachers were asked to characterize the current level of their students. Principal and teacher surveys contained a description of the levels of technology integration, as shown in Figure 1 of this report. A summary of the survey responses from principals and teachers is presented in Table 32.

Responses from the principals indicated a clear progression for the level of technology integration of teachers from before the implementation of the technology initiative to currently. Principals judged that, before the initiative, more than half of the teachers were at the Entry (i.e., technology used to deliver curriculum) or Adoption (i.e., conventional use of technology, directed by teacher) level. Principals' ratings of teachers' current level of implementation, however, indicated that less than 15% of teachers were at those lower levels of technology integration, and the largest proportion of teachers were judged to be at the Adaptation (i.e., some student choice and exploration) and Infusion (i.e., student choice and self-direction in the use of technology) levels (see Table 32).

Teachers' ratings of their own current level of technology integration showed the largest percentage of teachers (50% across the three grades) at the Adaptation level (see Table 32). However, teachers expected that they would reach higher levels of integration—Infusion or

Transformation—by the end of the school year: 75% of the responding teachers indicated that they would be at one of those high levels of technology integration.

Table 32
Level of Technology Integration[a] Reported by Teachers and Principals

| | Entry | | Adoption | | Adaptation | | Infusion | | Transformation | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | n | % | n | % | n | % | n | % |
| **Principals' Report of Teachers' Level of Integration -- Prior to Initiative** | | | | | | | | | | |
| Grade 3 (*N* = 79) | 19 | 24.1 | 34 | 43.0 | 15 | 19.0 | 9 | 11.4 | 2 | 2.5 |
| Grade 4 (*N* = 79) | 20 | 25.3 | 33 | 41.8 | 16 | 20.3 | 9 | 11.4 | 1 | 1.3 |
| Grade 5 (*N* = 78) | 14 | 17.9 | 32 | 41.0 | 18 | 23.1 | 13 | 16.7 | 1 | 1.3 |
| **Principals' Report of Teachers' Level of Integration -- Current** | | | | | | | | | | |
| Grade 3 (*N* = 79) | 0 | 0.0 | 7 | 8.9 | 40 | 50.6 | 18 | 22.8 | 14 | 17.7 |
| Grade 4 (*N* = 78) | 2 | 2.6 | 9 | 11.5 | 36 | 46.2 | 21 | 26.9 | 10 | 12.8 |
| Grade 5 (*N* = 79) | 0 | 0.0 | 2 | 2.5 | 33 | 41.8 | 26 | 32.9 | 18 | 22.8 |
| **Teachers' Self-Reported Current Level of Integration** | | | | | | | | | | |
| Total Grade 3, 4, 5 (*N* = 563) | 15 | 2.7 | 86 | 15.3 | 279 | 49.6 | 135 | 24.0 | 48 | 8.5 |
| Grade 3 (*N* = 182) | 3 | 1.6 | 34 | 18.7 | 92 | 50.5 | 46 | 25.3 | 7 | 3.8 |
| Grade 4 (*N* = 195) | 10 | 5.1 | 28 | 14.4 | 105 | 53.8 | 35 | 17.9 | 17 | 8.7 |
| Grade 5 (*N* = 186) | 2 | 1.1 | 24 | 12.9 | 82 | 44.1 | 54 | 29.0 | 24 | 12.9 |
| **Teachers' Self-Reported Predicted Level of Integration at End of School Year** | | | | | | | | | | |
| Total Grade 3, 4, 5 (*N* = 557) | 3 | 0.5 | 8 | 1.4 | 127 | 22.8 | 258 | 46.3 | 161 | 28.9 |
| Grade 3 (*N* = 180) | 0 | 0.0 | 1 | 0.6 | 44 | 24.4 | 89 | 49.4 | 46 | 25.6 |
| Grade 4 (*N* = 194) | 3 | 1.5 | 5 | 2.6 | 45 | 23.2 | 89 | 45.9 | 52 | 26.8 |
| Grade 5 (*N* = 183) | 0 | 0.0 | 2 | 1.1 | 38 | 20.8 | 80 | 43.7 | 63 | 34.4 |
| **Students' Current Level of Integration Reported by Teachers** | | | | | | | | | | |
| Total Grade 3, 4, 5 (*N* = 555) | 15 | 2.7 | 103 | 18.6 | 272 | 49.0 | 146 | 26.3 | 19 | 3.4 |
| Grade 3 (*N* = 179) | 6 | 3.4 | 42 | 23.5 | 93 | 52.0 | 36 | 20.1 | 2 | 1.1 |
| Grade 4 (*N* = 191) | 6 | 3.1 | 34 | 17.8 | 92 | 48.2 | 55 | 28.8 | 4 | 2.1 |
| Grade 5 (*N* = 185) | 3 | 1.6 | 27 | 14.6 | 87 | 47.0 | 55 | 29.7 | 13 | 7.0 |

[a] Levels of technology integration as characterized in the *Technology Integration Matrix,* produced by the College of Education, University of South Florida © 2011-2016.

A comparison of the principals' judgment of teachers' current level with the judgment of the teachers themselves reveals that the principals reported higher levels of integration of the teachers than the teachers reported themselves. This difference appeared to be most pronounced for Grade 4 and Grade 5 teachers. Principals reported that 40% of the Grade 4 and 56% of the Grade 5 teachers were currently at one of the two highest levels of integration--Infusion or Transformation. However, the teachers who responded to the survey judged themselves at lower levels of integration: only 27% of the Grade 4 teachers and 42% of the Grade 5 teachers reported that they were currently at those high levels (see Table 32).

A higher percentage of Grade 5 teachers (42%) judged their current level of integration to be at the highest levels—Infusion or Transformation—than did either Grade 4 teachers (27%) or Grade 3 teachers (29%).

Teachers also were asked how they would characterize their students' level of technology integration on the student version of the TIM. Teachers' reports of their students' level of technology integration were very similar to their ratings of their own level (see Table 32). Since ratings were based on technology use in the same classroom, the similarity in levels would be expected. Similar to the teachers' self-reported levels, a higher percentage of Grade 5 students

were judged to be at the highest levels (37% compared with 31% of Grade 4 students and 21% of Grade 3 students).

***Perceived supports and obstacles for technology integration.*** Teachers were asked to comment on the supports and obstacles that influence where they are in their integration of technology. Table 33 summarizes their responses to this open-ended question.

Among 350 teachers (47% of all responding teachers) who provided a response about supports and obstacles in their own technology integration, relatively few comments were about supports; the largest number of those referred to support from staff members: media specialist, instructional specialist, or other teachers. The large majority of comments from the responding teachers identified obstacles, and the most frequently named was lack of time—to plan, to learn, to explore. Student factors, such as the need to monitor students, student behavior, and age and maturity of the students, were also named by nearly one quarter of the teachers as obstacles to technology, and nearly one quarter of the respondents cited the need for more training and more support.

Table 33
Teachers' Reports of Supports and Obstacles Influencing Technology Integration ($N = 350$)

| | *n* | *%* |
|---|---|---|
| Supports | | |
| • Staff support: media specialist, SDT, instructional specialist, other teachers | 18 | 5.1 |
| • Already comfortable with technology | 14 | 4.0 |
| • Other supports | 24 | 6.9 |
| Obstacles | | |
| • Time: time to plan and integrate, time to learn, time for training, time to explore resources; too many demands | 163 | 46.6 |
| • Student factors: monitoring students, student behavior, student age and maturity level, students' lack of technology knowledge or experience, need time to teach students, students need typing skills, students with special needs | 84 | 24.0 |
| • Training: need more training, need more support, need to learn more about Apps, tools, what to use | 79 | 22.6 |
| • Equipment, technical: lack of teacher Chromebooks, technical problems, internet connection problems | 24 | 6.9 |
| • Lack of experience, comfort, confidence | 20 | 5.7 |
| • Other obstacles | 38 | 10.9 |

*Note.* Upper-case N (*N*) represents the number of principals responding to the open-ended question. Lower-case ns (*n*) represent the number of comments coded to that category. A single comment may have been coded in more than one category. Only categories with 10 or more comments are reported.

Teachers also were asked to comment on the supports and obstacles that influence where their students are in their integration of technology. Table 34 summarizes teachers' responses.

Among 307 teachers (41% of all responding teachers) who provided a response to this open-ended question, the most frequently mentioned support was students' access to technology at home or experience with Chromebooks last year. A larger number of the teachers' comments identified

obstacles; the most frequently mentioned obstacles were unfamiliarity with the technology; student behavior or immaturity; teacher's lack of knowledge, comfort, or training; and lack of time.

Table 34
Teachers' Reports of Supports and Obstacles Influencing Technology Integration by Students
($N$ = 307)

| | *n* | % |
|---|---|---|
| Supports | | |
| • Experience with technology: computer at home, access to technology outside of school, used Chromebooks last year | 49 | 16.0 |
| • Classroom access: daily access, regular use, access to Chromebooks | 17 | 5.5 |
| • Motivation: student behavior, they love Chromebooks | 12 | 3.9 |
| • Other supports | 13 | 4.2 |
| Obstacles | | |
| • Student experience, skills, and knowledge: not familiar with technology, lots to teach, students need instruction, students need keyboarding skills, students need to learn Apps, students at different levels | 93 | 30.3 |
| • Student factors: student behavior, student age and maturity level, learning issues, distraction | 63 | 20.5 |
| • Teacher factors: lack of knowledge, comfort level, need more training, more App knowledge | 50 | 16.3 |
| • Time: students need time to explore, time for planning, time on curriculum | 46 | 15.0 |
| • Other obstacles | 38 | 12.4 |

*Note.* Upper-case N ($N$) represents the number of principals responding to the open-ended question. Lower-case ns ($n$) represent the number of comments coded to that category. A single comment may have been coded in more than one category. Only categories with 10 or more comments are reported.

***Instructional technology specialists' reports of supports for technology integration.*** Based on their work in multiple schools, instructional technology specialists reported their observations of structures and supports where the technology is being successfully integrated, as well as obstacles and challenges to successful integration. Table 35 summarizes their comments.

Among the 17 responding instructional technology specialists, 11 (65%) noted the importance of leadership support in the successful integration of the new technology; 10 (59%) reported that a strong partnership with the specialist promotes successful integration of the technology. The obstacle named by the largest percentage of instructional technology specialists was the lack of confidence or reluctance to change on the part of teachers ($n$ = 9, 53%). In addition, teachers' lack of time was identified as a barrier by six of the instructional specialists (35%) (see Table 35).

Table 35
Instructional Technology Specialists' Responses to Open-Ended Questions About Supports and Obstacles to Successful Integration of New Technology

| | *n* | % | Representative comments (paraphrased) |
|---|---|---|---|
| **Supports and structures promoting successful integration of technology** (*N* = 17) | | | |
| Support from leadership | 11 | 64.7 | • Administration and core team understand the importance of technology coaching and PD<br>• Administration pursues ways to increase technology use |
| Partners with instructional technology specialists | 10 | 58.8 | • Strong connections with ITS<br>• ITS is a guide for the school<br>• Just-in-time learning opportunities |
| School encourages and supports risk-taking | 6 | 35.3 | • An administration that values risk-taking and encourages reflection<br>• Principals allowing teachers the freedom to take risks and try new strategies |
| Strong collaborative planning model | 5 | 29.4 | • Teachers have dedicated chunks of time to plan in cohorts<br>• Grade level teams using GAFE to collaborate and plan |
| **Obstacles and challenges to successful integration of technology** (*N* = 17) | | | |
| Staff fears, reluctance to change, lack of confidence | 9 | 52.9 | • Some teachers are reluctant to move away from traditional teaching methods<br>• Some teachers feel overwhelmed in learning the new technology<br>• Depends on the confidence of the teacher |
| Teachers need more time | 6 | 35.3 | • Time barriers to working with school staff<br>• Need time, build into the school work day<br>• Teachers need time to develop materials |
| Curriculum is not integrated and compatible with GAFE and Chromebooks | 4 | 23.5 | • Instruction Center is not fully compatible with GAFE<br>• Curriculum was written prior to new technology, so few resources; teachers are recreating materials |
| Principal not supporting or setting expectation | 4 | 23.5 | • Principals not setting the expectation that students will be engaged with technology<br>• Lack of support from leadership |
| Not enough ITS time | 3 | 17.6 | • Limited time for specialists to get to schools on a regular schedule<br>• Not enough time to support large number of ES planning meetings |

*Note.* Upper-case Ns (*N)* represent the number of instructional technology specialists responding to the open-ended question. Lower-case ns (*n)* represent the number of comments coded to that category. A single comment may have been coded in more than one category.

Finally, instructional technology specialists provided recommendations for ways to increase the extent to which technology is integrated into instruction in elementary schools. Their comments included specific ideas for moving schools forward in their technology integration, which are included in Appendix E, Table E-1. Their recommendations addressed four main themes:

1. Develop and provide additional continued professional development
2. Meet the needs of the learners

3. Ensure dedicated time for learning and growing in the use of technology
4. Collaborate with instructional staff to develop new strategies

### *Direct observation of knowledge use*

***Instructional objectives.*** Teachers' integration of the new technology using the new knowledge and skills gained during the implementation was also examined with classroom observations. Evaluators recorded observed instances of the use of technology in support of a range of instructional objectives. Findings from the observations, with examples of the strategies or activities observed, are presented in Table 36.

The technology-supported strategy observed in the most classrooms was "Provide students with multiple mediums for accessing lesson content." Fifty-nine percent of the observations recorded evidence of the use of technology to support this strategy. More than one third of the observations found evidence of the use of technology to enable students to make thinking visible, and to promote student choice (see Table 36).

Table 36
Observed Use of Technology Supporting Instructional Objectives of the Initiative ($N$ = 113)

| Instructional objective | *n* | % | Examples of strategies observed |
|---|---|---|---|
| Provide students with multiple mediums for accessing lesson content | 67 | 59.3 | • Lesson was presented both by audio and text on Chromebooks, and teacher demonstrated on Promethean board (PB)<br>• Students listened to video song, lyrics in text on PB and lyrics in Google doc<br>• Students were reading text or listening to story/fable on Chromebooks |
| Enable students to make thinking visible | 44 | 38.9 | • Students used online geoboards to try out shapes with different characteristics<br>• Students put their ideas on a large timeline |
| Promote student choice | 40 | 35.4 | • Each group was given choices of follow-up tasks they will complete - all posted in Google Classroom<br>• The teacher provided several different online sites that students could select for their research |
| Promote collaborative problem solving | 32 | 28.3 | • Students worked in pairs on shapes problems, sharing Chromebooks<br>• Students collaborated watching Zoo Cam to determine if habitat is meeting animal's needs<br>• Small groups were working collaboratively on article, posting to same document in different colors |
| Scaffold learning opportunities | 30 | 26.5 | • Students were using the extension "Readability" to make article easier to read.<br>• Students were reading the text while listening and using highlighter |
| Engage students in inquiry | 29 | 25.7 | • Students watched video with the purpose of determining effects of invasive species<br>• Opening question: What does this grid tell you? What can you learn from it?<br>• Students compared four zoo habitats on Zoo Cam |
| Differentiate learning opportunities | 25 | 22.1 | • Students accessed different tasks on Chromebooks based on their math level<br>• Students were in four differentiated groups based on reading levels, with different tools to support note taking |
| Formatively assess students' learning | 21 | 18.6 | • Students took quiz on Chromebooks after reading articles<br>• Students posted answers to book club questions |
| Provide meaningful feedback to students | 17 | 15.0 | • The teacher gave feedback to a student on presentation slides by inserting comments in his work<br>• Teacher reviewed activator responses in whole group with Word Cloud, using PB to highlight important words in responses |
| Engage students in self-reflection | 7 | 6.2 | • Students used summary checklists to make sure their summaries contained all the required parts<br>• Students wrote in Chromebooks the steps used as they solved a math problem |

Table 37 presents the observation findings by grade and lesson subject.

Table 37
Observed Use of Technology Supporting Instructional Objectives of the Technology Initiative by Grade and Lesson Subject ($N$ = 113)

| | Percentage of observations with activity evident | | | | | |
|---|---|---|---|---|---|---|
| *Observed strategy* | Grade 3 ($N$=38) | Grade 4 ($N$=37) | Grade 5 ($N$=38) | English/LA ($N$ = 43) | Math ($N$ = 44) | Science/ Soc.Studies ($N$ = 26) |
| Provide students with multiple mediums for accessing lesson content | 57.9 | 62.2 | 57.9 | 53.5 | 63.6 | 61.6 |
| Enable students to make thinking visible | 42.1 | 35.1 | 39.5 | 39.5 | 29.5 | 53.8 |
| Promote student choice | 34.2 | 40.5 | 31.6 | 41.9 | 38.6 | 19.2 |
| Promote collaborative problem solving | 28.9 | 29.7 | 26.3 | 27.9 | 27.3 | 30.8 |
| Scaffold learning opportunities | 36.8 | 21.6 | 21.1 | 32.6 | 18.2 | 30.8 |
| Engage students in inquiry | 28.9 | 13.5 | 34.2 | 34.9 | 13.6 | 30.8 |
| Differentiate learning opportunities | 23.7 | 24.3 | 18.4 | 18.6 | 36.4 | 3.8 |
| Formatively assess students' learning | 21.1 | 18.9 | 15.8 | 20.9 | 13.6 | 23.1 |
| Provide meaningful feedback to students | 13.2 | 18.9 | 13.2 | 20.9 | 13.6 | 7.7 |
| Engage students in self-reflection | 5.2 | 10.8 | 2.6 | 9.3 | 4.5 | 3.8 |

Many of the technology-supported activities were evident at similar rates across grades. The largest differences by grade were "Scaffold learning opportunities" (observed in 37% of the Grade 3 classrooms, 22% of the Grade 4 classrooms, and 21% of the Grade 5 classrooms) and "Engage students in inquiry" (29% in Grade 3, 14% in Grade 4, and 34% in Grade 5 classrooms) (see Table 37).

Several strategies were observed at different rates in classrooms of different subjects. The strategy "Differentiate learning opportunities" was observed in a higher percentage of mathematics classes than classes in the other subjects, while "Scaffold learning opportunities" and "Engage students in inquiry" were observed in a smaller percentage of the mathematics classes than in classes in other subjects (see Table 37).

***Level of technology integration***. Ratings of the overall level of technology integration, using the *Technology Integration Matrix (see Figure 1),* also were made by observers for each classroom observed. Table 38 shows the overall levels of technology integration evidenced in the classroom observations, by grade level and lesson subject.

The largest percentage of classes (50%) were rated at the Adoption level of integration—i.e., conventional use of technology, directed by the teacher. About one quarter (26%) of the observed classes, across grades and subjects, were rated at the Adaptation level (i.e., some student choice in the use of technology), and about 7% were at the Infusion level (i.e., student choice and self-direction in the use of technology). Some variations by grade and lesson subject were observed, but most differences were small.

Table 38
Overall Level of Technology Integration Based on Classroom Observations, by Grade and Lesson Subject

| | *Entry* | | *Adoption* | | *Adaptation* | | *Infusion* | | *Transformation* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| *Grade level* | | | | | | | | | | |
| Grade 3 (*N* = 38) | 6 | 15.8 | 17 | 44.7 | 14 | 36.8 | 1 | 2.6 | 0 | 0.0 |
| Grade 4 (*N* = 37) | 8 | 21.6 | 19 | 51.4 | 8 | 21.6 | 2 | 5.4 | 0 | 0.0 |
| Grade 5 (*N* = 38) | 5 | 13.2 | 21 | 55.3 | 7 | 18.4 | 5 | 13.2 | 0 | 0.0 |
| *Lesson subject* | | | | | | | | | | |
| English/LA (*N* = 43) | 9 | 20.9 | 13 | 30.2 | 15 | 34.9 | 6 | 14.0 | 0 | 0.0 |
| Mathematics (*N* = 44) | 7 | 15.9 | 28 | 63.6 | 8 | 18.2 | 1 | 2.3 | 0 | 0.0 |
| Science/ Soc. Studies (*N* = 26) | 3 | 11.5 | 16 | 61.5 | 6 | 23.1 | 1 | 3.8 | 0 | 0.0 |
| *All classes* | 19 | 16.8 | 57 | 50.4 | 29 | 25.7 | 8 | 7.1 | 0 | 0.0 |

In addition to the overall ratings for each classroom, observers also assigned technology integration ratings for three of the attributes of classroom learning environments characterized in the *Technology Integration Matrix*: active, collaborative, and constructive.[4] The active attribute reflects the classroom environment vis à vis the student's level of engagement, i.e., from passively receiving information (entry level) to actively discovering and applying knowledge (infusion or transformation). The collaborative attribute reflects the degree to which students utilize technology to work with peers and outside experts. The constructive attribute reflects students' use of technology to build knowledge (FCIT, 2016).

Table 39 shows ratings of technology integration within each of the three attributes, by grade level.

[4] These three attributes were selected for the study by program administrators because they most closely reflected the areas covered in the technology professional learning.

Table 39
Level of Technology Integration Based on Classroom Observations, by Grade and Lesson Subject

| | *Entry* | | *Adoption* | | *Adaptation* | | *Infusion* | | *Transformation* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| *Active / Engagement* | | | | | | | | | | |
| Grade 3 (*N* = 38) | 6 | 15.8 | 13 | 34.2 | 18 | 47.4 | 1 | 2.6 | 0 | 0.0 |
| Grade 4 (*N* = 37) | 6 | 16.2 | 17 | 45.9 | 11 | 29.7 | 3 | 8.1 | 0 | 0.0 |
| Grade 5 (*N* = 38) | 7 | 18.4 | 13 | 34.2 | 12 | 31.6 | 5 | 13.2 | 1 | 2.6 |
| *Collaborative* | | | | | | | | | | |
| Grade 3 (*N* = 38) | 24 | 63.2 | 7 | 18.4 | 6 | 15.8 | 1 | 2.6 | 0 | 0.0 |
| Grade 4 (*N* = 37) | 24 | 64.9 | 9 | 24.3 | 3 | 8.1 | 1 | 2.7 | 0 | 0.0 |
| Grade 5 (*N* = 38) | 20 | 52.6 | 15 | 39.5 | 1 | 2.6 | 2 | 5.3 | 0 | 0.0 |
| *Constructive* | | | | | | | | | | |
| Grade 3 (*N* = 38) | 7 | 18.4 | 12 | 31.6 | 18 | 47.4 | 1 | 2.6 | 0 | 0.0 |
| Grade 4 (*N* = 37) | 10 | 27.0 | 16 | 43.2 | 8 | 21.6 | 3 | 8.1 | 0 | 0.0 |
| Grade 5 (*N* = 38) | 6 | 15.8 | 19 | 50.0 | 8 | 21.1 | 3 | 7.9 | 2 | 5.3 |

In all three grades, technology integration was observed at higher levels in relation to the active/engagement and constructive dimensions of classroom instruction than in the collaborative dimension. In the collaborative dimension, more than half of the classrooms in all three grades were rated at the Entry level, which indicates that students in these classrooms were using technology individually, not to collaborate with others.

**Summary of findings for Evaluation Question 2**

***Professional learning opportunities attended.*** The professional learning opportunities attended by the largest percentages of Grade 3 through 5 responding teachers were workshops or staff meetings facilitated by an instructional technology specialist (68%–72%), coaching/planning during a collaborative team meeting (53%–58%), and the continuing PD course IT-85 (37%–52%). The professional learning opportunities attended by the largest percentages of responding principals were workshops or sessions that were offered during elementary principals PLC meetings (92%), during elementary principals curriculum update meetings (73%), and during Administrator and Supervisor meetings (72%).

About one quarter of the responding teachers (27%) reported that they participated often in professional learning opportunities; teachers reported a mean of 16 hours of participation in professional learning. Twenty-one percent of the principals reported participating often in professional learning opportunities, and their mean number of hour participating was nine.

***Participants' reactions.*** The professional learning opportunities reported as most helpful by the largest percentages of both teachers and principals were training related to Chromebooks and Google Apps, and training provided by technology instructional specialist in small groups or workshops. Similarly, the learning opportunities that were judged "very helpful" by the largest percentage of instructional technology specialists were individual or small group support, coaching during collaborative team planning, continuing professional development course IT-85, and principals' PLCs.

***Participants' learning.*** More than 80% of the responding teachers agreed (responded strongly agree or agree) that the learning opportunities: provided new ideas or strategies to teach using technology; improved their ability to teach with technology; improved their ability to manage and organize work; improved their confidence; and were relevant to their learning needs. Principals, too, reported that they gained knowledge and skills from the professional learning experiences. Eight-five percent or more of the responding principals agreed (responded strongly agree or agree) that the learning opportunities: provided new ideas or strategies; were relevant to their needs as a learner; improved their confidence; improved their ability to manage and organize their work; improved their ability to support and promote the use of technology; and prepared them to use the technology in their work.

***Organization support and change.*** Most of the survey items regarding support for implementation had high levels of agreement from both teachers and principals. The highest level of teachers' agreement was in response to the survey item stating that administrators actively support their use of Chromebooks and Google Apps for Education (87% agreed). The highest level of principals' agreement was in response to the survey item stating that they felt supported when using technology (91%). Overall, somewhat greater percentages of principals than teachers indicated that they felt supported in the implementation of the new technology. For example, 88% of the principals compared with 72% of the teachers agreed that they felt supported if technical issues arise when using technology, and 85% of the principals compared with 70% of the teachers agreed that they know where they can learn what is needed to implement the new technology.

Teachers, principals, and instructional technology specialists were consistent in their judgments of helpful learning opportunities to support their current experience with the initiative's implementation. The highest percentages from each group (63% to 77%) named in-school face-to face training as a helpful support for implementation. Grade- or subject-alike groups, modeling lessons, and coaching by instructional specialists also were judged most helpful by high percentages of respondents in each group.

***Participants' use of new knowledge and skills.*** In response to a survey question about the ways their teaching strategies changed after implementation of the new technology, the largest percentages of the responding teachers reported improvements in managing their work, such as increased efficiency in the classroom (16%) and greater use of online resources, sharing sites, and Google Classroom (15%). Further, 15% of the responding teachers reported the new technology has allowed more differentiation, small group work, and individual work with students.

The largest percentage (37%) of responding principals reported that the technology has had an impact on teachers' management of their work, particularly in lesson planning and collaboration. Further, nearly one third (31%) of the principals noted that teachers are using enriching and engaging resources to support instruction, and 10% reported that the technology has allowed increased differentiation and individualized instruction.

*Technology integration.* Among all Grades 3, 4, and 5 teachers who responded to the survey, 33% judged themselves currently at the highest levels of technology integration—Infusion or Transformation, while 50% rated themselves at the Adaptation level. In response to a survey question about where they expect to be by the end of the school year, 75% indicated that they would be at the Infusion or Transformation level of technology integration.

Teachers commented on the supports and obstacles that influenced where they are in their integration of technology. The largest number of comments indicating support referred to staff members—instructional technology specialist, media specialist, or other teachers. Comments identifying obstacles most frequently named lack of time, student factors, and the need for more training and more support.

Nearly two thirds of the instructional technology specialists (65%) noted the importance of leadership support in the successful integration of the new technology; more than half of the respondents (59%) reported that a strong partnership with the specialist promotes successful integration of the technology. The obstacle named by the largest percentage of instructional technology specialists was the lack of confidence or reluctance to change on the part of teachers (53%). In addition, teachers' lack of time was identified as a barrier by more than one third of the instructional specialists (35%). Instructional technology specialists provided recommendations for ways to increase the extent to which technology is integrated into instruction in elementary schools. Their recommendations included:

1. Develop and provide additional continued professional development
2. Meet the needs of the learners
3. Ensure dedicated time for learning and growing in the use of technology
4. Collaborate with instructional staff to develop new strategies

Classroom observations of instructional strategies using technology revealed that the strategy observed most frequently was "Provide students with multiple mediums for accessing lesson content" (observed in 59% of classrooms). More than one third of the observations found evidence for enabling students to make thinking visible, and promoting student choice. Many of the observed activities were evident at similar rates across grades. The largest differences by grade were "Scaffold learning opportunities," observed in a higher percentage of Grade 3 classes, and "Engage students in inquiry," observed in higher percentages in Grade 3 and Grade 5 classes. A few strategies also were observed at different rates across classrooms of different subjects.

Across the three grades, ratings of technology integration made during classroom observations revealed that the largest percentage of classes were rated at the Adoption level (i.e., teacher-directed, conventional use of technology) in overall integration (45% to 55%). In general, English/language arts classes were rated at higher levels of integration than classes in other subjects. Ratings made on three dimensions of instruction—active/engagement, collaboration, and constructive—revealed that classes were rated at higher levels of technology integration on the active/engagement and constructive dimensions, compared to the collaborative dimension.

# Discussion

***Addressing goals of the initiative.*** Data and reports from teachers, principals, instructional technology specialists, and classroom observations showed that as the new technology is being implemented, the goals of the project are being addressed. The professional learning opportunities provided through the initiative sought to help teachers and principals build their skills and knowledge of classroom technology, and enable them to integrate the new technology into instruction. These goals were addressed by improving the ability of teachers and principals to manage work using technology, and by generating new ideas and strategies for using technology in instruction.

Evidence of progress toward these goals was shown by the following findings:

1) *Managing work using technology*. About three quarters of the teachers who responded to the survey reported using the new technology half the time or more for planning and creating lessons, posting lessons, accessing online resources for teaching, and maintaining student records or grading student work. Further, 86% of teachers agreed that the learning opportunities had improved their ability to manage their work using technology. Two thirds or more of the responding principals reported using the new technology half the time or more to analyze student data, plan for meetings, and engage with staff; 88% of the principals agreed that the learning opportunities had improved their ability to manage their work using the new technology.

2) *Generating new ideas and strategies*. Eighty-eight percent of the surveyed teachers agreed that the learning opportunities provided them with new ideas and strategies to teach using technology. Teachers reported increased use of research and inquiry-based activities, greater student collaboration, and more interactive lessons. All of the responding principals (100%) agreed that the learning opportunities provided them with new ideas or strategies for using technology in their work; principals reported improved use of data and greater collaboration using the new technology.

Teachers reported the use of specific strategies that were the instructional objectives of the initiative (described in the Introduction of this report) in their classroom instruction, particularly: providing students with more choice and independence; providing meaningful feedback to students; differentiating instruction to better fit students' needs; engaging students in inquiry; and promoting collaborative problem-solving. Direct observation of these strategies revealed that many of them were in use in the sample of classrooms visited. The strategies observed in the largest percentage of classrooms were: providing students with multiple mediums for accessing lesson content; enabling students to make thinking visible; and promoting student choice.

***Findings from multiple sources.*** This study collected information from multiple sources about the implementation of the new technology in the schools. Feedback from multiple stakeholders allowed corroboration and triangulation of viewpoints. Surveys from teachers and instructional specialists as well as usage data indicated that, overall, teachers are using the new technology on a regular basis: about two thirds of teachers reported that they use the technology every day or most days to access online resources for teaching and for planning and creating lessons, while more than three quarters of instructional technology specialists indicated that teachers are regularly

using the new technology for those tasks. Both teachers and principals reported that Google Classroom and Google Drive were the components of the new technology that were most readily accessible and easy to incorporate into their work.

Some differences in the perceptions of principals and teachers emerged in their responses to questions about the professional learning opportunities and support that they have received since the implementation of the new technology. Overall, greater percentages of principals than teachers indicated that they felt supported in the implementation of the new technology; for example, 88% of the principals compared with 72% of the teachers agreed that they felt supported if technical issues arise when using technology, and 79% of the principals and 57% of the teachers agreed that practices are in place to provide ongoing professional learning. Almost all principals reported attending a technology learning opportunity during elementary principals PLC meetings (92%); none of the learning opportunities for teachers had a similarly high rate of reported attendance. Teachers reported attending learning opportunities at staff meetings and workshops (68%–72%), collaborative team meeting (53%–58%), and the continuing PD course IT-85 (37%–52%).

***Differences by grade***. In reports from teachers about their use of the technology in instruction, as well as their reports of students' use during class, higher percentages of Grade 5 teachers compared with Grade 3 or Grade 4 teachers indicated frequent use for most instructional tasks. For example, higher percentages of Grade 5 teachers reported daily use of technology for maintaining student records or grading student work, posting lessons, and providing feedback to students. It is likely that this difference results from a combination of experience with the new technology, student skills and development, and the types of work assigned. Grade 5 teachers and Grade 3 teachers were in their second year of using the Chromebooks and Google Apps, so teachers in these grades had an additional year of learning and experience compared with teachers in Grade 4. In addition, many of the tasks reported by teachers, such as posting lessons or notes for student access, or providing feedback to students, are likely to be in more frequent use in higher grades since they require a level of student independence. Similarly, higher percentages of Grade 5 teachers than Grades 3 or 4 teachers reported that their students use the technology every day or most days to work on documents or projects, collaborate on an assignment, or research subjects of interest.

***Self-report compared with observation.*** In general, classroom observation ratings of technology integration were at a lower level than survey self-ratings from teachers and principals. A number of factors may contribute to this difference. Observations captured only a 45-minute snapshot of the class day. Some of the strategies and activities on which the integration ratings were based may not be used throughout the day, or in every lesson, so were not evident during the observation window. Teachers may rate themselves based on what they know and what they are capable of implementing, as well as what they know they are expected to be implementing—but that level of integration may not be evident at all times. In addition, the study observers were carefully trained on the TIMS using the criteria specified by the University of South Florida, whereas survey respondents may have made their ratings based only on the short descriptions included in the survey. Finally, some activities and strategies are not likely to be seen during a class observation; for example, observers may not have been aware of scaffolding while a student was working on their Chromebook, or would not see feedback that was provided to the student on their Google document.

# Recommendations

Recommendations were based on data collected through surveys and classroom observations.

1. **Build in dedicated time for teachers to learn and grow in their use of technology.** A challenge to implementation that was named by teachers, principals, and instructional specialists was the need for more time to explore, try out, and practice the new technology. Teachers need time to learn the technology, explore applicable resources, and develop new materials.
2. **Develop additional ways to provide ongoing information and guidance about available Apps**. More than half the teachers and half the principals who responded to surveys reported that they felt overwhelmed by the number of applications available with the new technology and that it was a challenge to find time to learn about them. Explore ways to help teachers learn what is available and most relevant to their instructional needs.
3. **Better integrate technology into Curriculum 2.0**. Currently teachers must develop or re-create materials because Curriculum 2.0 is not integrated into the new technology. Instructional specialists suggested ways to work toward better integration.
4. **Ensure that every teacher accesses technology professional learning opportunities, both initially and ongoing.** Almost all principals participated in learning opportunities at the principal PLCs. Teachers, however, were more varied in their reports of participation in various learning opportunities, although almost all attended some form of technology professional learning. However, more than one third of the responding teachers did not agree that practices are in place to provide ongoing professional learning for using Chromebooks and Google Apps.
5. **Work with principals to promote a climate of safe and supported risk-taking**. Support from leadership, along with an administration that values risk-taking were identified by instructional specialists as key to successful integration of technology. In addition, teachers, principals, and instructional specialists recognized the need for teachers to build confidence, and have opportunities to safely try new methods. Principals are key in setting the expectations and supportive conditions for staff and student learning.
6. **Explore ways to address teachers' concerns with classroom management software**. The technology component identified as a challenge by the largest percentage of teachers was the use of classroom management software. Many teachers requested support for implementing the current platform used to manage student devices, and help with resolving difficulties associated with use of the software.

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# Appendix A

Table A-1
Characteristics of Teachers Completing Technology Initiative Surveys ($N = 748$)

| Teacher Characteristics | *n* | *%* |
|---|---|---|
| Grade | | |
| Grade 3 | 224 | 29.9 |
| Grade 4 | 240 | 32.1 |
| Grade 5 | 226 | 30.2 |
| Other[a] | 58 | 7.8 |
| Years of teaching experience | | |
| First year teaching | 25 | 3.3 |
| 2 – 5 years | 159 | 21.3 |
| 6 – 10 years | 148 | 19.8 |
| 11 – 15 years | 178 | 23.8 |
| 16 – 20 | 109 | 14.6 |
| 21 or more | 129 | 17.2 |

[a] Respondents classified as "Other" included ESOL teachers, special educators, and resource teachers

Table A-2
Years of Experience of Elementary Principals Completing Technology Initiative Surveys ($N = 95$)

| Years of experience as an elementary principal | *n* | % |
|---|---|---|
| First year as an elementary principal | 9 | 9.5 |
| 2 – 5 years | 33 | 34.7 |
| 6 – 10 years | 20 | 21.1 |
| More than 10 years | 33 | 34.7 |

Table A-3
Years of Experience of Instructional Specialists Completing Technology Initiative Surveys ($N = 17$)

| | *n* | *%* |
|---|---|---|
| Years of experience as a technology instructional specialist | | |
| First year | 0 | 0.0 |
| 2 – 5 years | 3 | 17.6 |
| 6 – 10 years | 6 | 35.3 |
| More than 10 years | 8 | 47.1 |
| Years as an educator in MCPS or other districts | | |
| 10 or fewer years | 0 | 0.0 |
| 11 – 15 years | 2 | 11.8 |
| 16 – 20 years | 6 | 35.3 |
| 21 – 25 years | 4 | 23.5 |
| More than 25 years | 5 | 29.4 |

# Appendix B

## Classroom Observation

Classroom observation form for study of 21st Century Learning Spaces Initiative.

Your email address (**julie.wade@mcpsmd.net**) will be recorded when you submit this form. Not **julie.wade**? Sign out

**Name(s)**

**Paired Observation**

**Date**

Month Day 2016

**School**

**Teacher**

**Grade**

**Number of Students**

**Subject**

Main subject for the instructional block observed.

**Additional Subject**

If the lesson is cross-curriculuar, indicate the additional subject area observed (ex. Science curriculum was integrated into ELA block)

**Mastery Objective or Lesson Purpose/ Goal**

If the MO is not visible or stated, please indicate so by recording "Not posted or stated."

## Observation of Lesson

**Start Time**

## Technology Integration (0-15')

**Lesson Notes (0-15')**

**Chromebooks used by**

Promethean board in active use by teacher

Students using Promethean board

Response technology

## Technology Integration (16-30')

Lesson Notes (16-30')

Chromebooks used by

Promethean board in use

Students using Promethean board

Response technology

## Technology Integration (31-45')

Lesson Notes (31-45')

Chromebooks used by

Promethean board in use

Students using Promethean board

Response technology

Cite evidence/anecdotal notes in each area observed. If not observed, leave the field(s) blank.

**Present tasks in an authentic context.**

**Engage students in inquiry.**

**Promote collaborative problem solving.**

**Provide students with multiple mediums for accessing the lesson content (ex. text, video, audio, simulations, etc.)**

**Scaffold learning opportunities.**

**Differentiate the learning opportunities.**

**Enable students to make thinking visible.**

**Formatively assess students' learning.**

**Provide meaningful feedback to students.**

**Engage students in self-reflection.**

**Promote student choice.**

## Technology Integration (Levels)

Link to matrix: http://fcit.usf.edu/matrix/matrix.php

**Levels of Technology Integration**

Make a judgment based on the highest level of integration observed.

| | Entry | Adoption | Adaptation | Infusion | Transformation | N/A |
|---|---|---|---|---|---|---|
| Engagement | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Collaboration | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Constructive | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Overall | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**End Time**

Note the time that the observation was concluded.

**General Comments/Questions**

Submit

*Never submit passwords through Google Forms.*

Table B-1
Interrater Reliability of Classroom Observation Ratings: Percent Agreement and Kappa

| | *Number of cases* | % agreement | Kappa | Approx. Signif. | Interpretation of Kappa[a] |
|---|---|---|---|---|---|
| *Technology use* | | | | | |
| Students used Chromebooks | 10 | 100 | 1.00 | .002 | excellent |
| Teachers used Promethean board for active instruction | 10 | 100 | 1.00 | .002 | excellent |
| Students used Promethean board | 10 | 100 | 1.00 | .002 | excellent |
| *Evidence of project goals* | | | | | |
| Present tasks in authentic context | 10 | 50 | .19 | .301 | slight |
| Engage students in inquiry | 10 | 80 | .41 | .107 | moderate |
| Promote collaborative problem-solving | 10 | 100 | 1.00 | .002 | excellent |
| Provide multiple mediums for accessing content | 10 | 70 | .40 | .114 | fair |
| Scaffold learning opportunities | 10 | 70 | .35 | .260 | fair |
| Differentiate learning opportunities | 10 | 90 | .78 | .011 | substantial |
| Enable students to make thinking visible | 10 | 70 | .35 | .260 | fair |
| Formatively assess students' learning | 10 | 80 | .41 | .107 | moderate |
| Provide meaningful feedback | 10 | Not observed in reliability sample | | | |
| Engage students in self-reflection | 10 | Not observed in reliability sample | | | |
| Promote student choice | 10 | 70 | .21 | .490 | fair |
| Integration of technology in instruction[b] | | | | | |
| Active/Engagement | 10 | 60 | .52 | .007 | moderate |
| Collaboration | 10 | 70 | .35 | .260 | fair |
| Constructive/Knowledge building | 10 | 70 | .65 | .008 | substantial |
| Overall | 10 | 70 | .56 | .005 | moderate |

[a] Strength of agreement as characterized Landis & Koch (1977). Observation results for categories with agreements of "fair" or better are included in report.

[b] Kappas computed with linear weighting using 5 levels of integration.

# Appendix C

Table C-1a
Teachers' Years of Experience and Self-rated Knowledge of Technology

| | | First year (*N* = 27) | | 2 – 5 years (*N* = 187) | | 6 – 10 years (*N* = 150) | | 11 – 15 years (*N* = 168) | | 16 + years (*N* = 207) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | *n* | % | *n* | % | *n* | % | *n* | % |
| Novice or Beginner | 62 | 3 | 11.1 | 9 | 4.8 | 7 | 4.7 | 10 | 6.0 | 33 | 15.9 |
| Competent | 255 | 14 | 51.9 | 62 | 33.2 | 46 | 30.7 | 57 | 33.9 | 76 | 36.7 |
| Proficient | 369 | 10 | 37.0 | 95 | 50.8 | 83 | 55.3 | 92 | 54.8 | 89 | 43.0 |
| Expert | 53 | 0 | 0.0 | 21 | 11.2 | 14 | 9.3 | 9 | 5.4 | 9 | 4.3 |

Chi-square = 39.1, *df* = 12, *p* = .000

Table C-1b
Principals' Years of Experience and Self-rated Knowledge of Technology

| | | First year (*N* = 9) | | 2 – 5 years (*N* = 33) | | 6 – 10 years (*N* = 20) | | 10 + years (*N* = 33) | |
|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | *n* | % | *n* | % | *n* | % |
| Novice or Beginner | 7 | 0 | 0.0 | 4 | 12.1 | 1 | 5.0 | 2 | 6.1 |
| Competent | 41 | 3 | 33.3 | 13 | 39.4 | 8 | 40.0 | 17 | 51.5 |
| Proficient | 43 | 5 | 55.6 | 16 | 48.5 | 10 | 50.0 | 12 | 36.4 |
| Expert | 4 | 1 | 11.1 | 0 | 0.0 | 1 | 5.0 | 2 | 6.1 |

Chi-square = 6.46, *df* = 9, *p* = .693.

# Appendix D

Table D-1
Non-classroom Teachers' Use of Chromebooks and Google Apps for Education for Instructional Tasks
($N$ = 40)

| | | Every day or every lesson | | Most days or most lessons | | About half the time | | Less than half the time | | Never | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | *n* | % | n | % | n | % | n | % | n | % |
| Access online resources for teaching | | | | | | | | | | | |
| Non-classroom teachers | 39 | 15 | 38.5 | 6 | 15.4 | 8 | 20.5 | 5 | 12.8 | 5 | 12.8 |
| Planning and creating lessons | | | | | | | | | | | |
| Non-classroom teachers | 40 | 9 | 22.5 | 8 | 20.0 | 8 | 20.0 | 9 | 22.5 | 6 | 15.0 |
| Maintaining student records or grading/assessing student work | | | | | | | | | | | |
| Non-classroom teachers | 36 | 6 | 16.7 | 6 | 16.7 | 5 | 13.9 | 5 | 13.9 | 14 | 38.9 |
| Post lessons or notes for student access | | | | | | | | | | | |
| Non-classroom teachers | 39 | 5 | 12.8 | 9 | 23.1 | 7 | 17.9 | 7 | 17.9 | 11 | 28.2 |
| Share lessons and ideas with colleagues | | | | | | | | | | | |
| Non-classroom teachers | 39 | 7 | 17.9 | 7 | 17.9 | 11 | 28.2 | 9 | 23.1 | 5 | 12.8 |
| Provide feedback to students | | | | | | | | | | | |
| Non-classroom teachers | 38 | 1 | 2.6 | 5 | 13.2 | 9 | 23.7 | 10 | 26.3 | 13 | 34.2 |
| Communicate with students outside of school | | | | | | | | | | | |
| Non-classroom teachers | 39 | 2 | 5.1 | 1 | 2.6 | 4 | 10.3 | 4 | 10.3 | 28 | 71.8 |
| Communicate with parents | | | | | | | | | | | |
| Non-classroom teachers | 39 | 1 | 2.6 | 1 | 2.6 | 7 | 17.9 | 10 | 25.6 | 20 | 51.3 |

*Note*. Non-classroom teachers included ESOL teachers, special educators, and resource teachers.

# Appendix E

Table E-1
Instructional Technology Specialists' Recommendations for Increasing Technology Integration (N = 17)

| Topic/theme | | Representative comments (paraphrased) |
|---|---|---|
| Develop and provide additional continued professional development (CPD) | *n* = 6 | • Develop additional CPD class offerings and run them throughout the school year<br>• Develop asynchronous opportunities—face-to-face opportunities for teachers to connect and share, and available for others who tune in later<br>• Examine what we believe is most important about the role of technology in teaching and learning and develop CPD offerings that reflect that |
| Meet the needs of learners | *n* = 4 | • Be visible to those already skilled so they know you are there if they need support; be available to those still growing their skills—offer regular coaching/training so they continue to grow; keep pushing those who are not yet ready to embrace the technology<br>• Provide a variety of opportunities that meet the needs of a large and varied audience—i.e., times, location, content. Be flexible and collaborative |
| Ensure dedicated time for learning and growing in the use of technology | *n* = 4 | • Ongoing times to meet with teachers and staff to suggest effective, efficient ways to use technology to enhance teaching and learning<br>• Build in professional development during duty hours to support teachers in learning and collaborating about effective use of technology |
| Collaborate with instructional staff to develop new strategies | *n* = 3 | • Provide opportunities for instructional technology specialists to work with curriculum writers to find different ways to integrate more technology into the curriculum. Technology is there—bring the curriculum up to date<br>• Provide professional development funding for teachers to work with OCTO to design instructional activities in a workshop environment |

*Note.* Upper-case N (*N*) represents the number of instructional specialists responding to the open-ended question. Lower-case ns (*n*) represent the number of comments coded to that category. A single comment may have been coded in more than one category.