

Evaluating 1:1 Computing Programs in Elementary and Middle Schools

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In the following report, Hanover Research reviews best practices for evaluating 1:1 computing programs in elementary and middle schools, with recommendations for establishing program goals and measuring progress towards those goals.

TABLE OF CONTENTS

Executive Summary and Key Findings	3
Section I: Establishing Goals and Expected Outcomes	5
DEFINING ONE-TO-ONE COMPUTING PROGRAMS.....	5
EVIDENCE OF EFFECTIVENESS	5
GOALS AND EXPECTED OUTCOMES	7
Section II: Monitoring and Evaluation Practices	15
OVERVIEW OF EVALUATION PRINCIPLES AND METHODOLOGIES	15
EVALUATING STUDENT OUTCOMES	17
EVALUATING TEACHER OUTCOMES	19
Section III: Profiles	22
ST. HELENA UNIFIED SCHOOL DISTRICT, CALIFORNIA	22
KENT SCHOOL DISTRICT, WASHINGTON	24
SUNNYSIDE UNIFIED SCHOOL DISTRICT, ARIZONA	26
Appendix A: Evaluation Principles for Educational Technology Programs.....	29
Appendix B: Evaluation Questions: Teacher-Centered Goals	30
Appendix C: Experience Sampling Protocol	31
Appendix D: Sample Teacher and Student Survey Questions	33

EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

In this report, Hanover Research explores best practices in the development of goals for and evaluation of one-to-one (1:1) computing programs in elementary and middle schools. This report includes a review of research-based evidence regarding the potential outcomes of 1:1 computing, as well as student- and teacher-focused goals commonly set by schools and districts. Additionally, the report includes a basic framework for the evaluation of progress towards these goals and three detailed profiles of exemplary 1:1 computing programs implemented at districts across the United States. This report comprises the following three sections:

- **Section I: Establishing Goals and Expected Outcomes** draws upon the current literature to establish a consistent definition of 1:1 computing and investigate the evidence of effectiveness and potential outcomes of such programs. This section also draws upon secondary literature and implementation manuals from K-12 school districts to explore common student- and teacher-centered goals for 1:1 computing programs.
- **Section II: Monitoring and Evaluation Practices** examines the use of various forms of data in the assessment of program efficacy. This section includes a review of common practices in the evaluation of student and teacher progress toward both short- and long-term goals.
- **Section III: Profiles** examines the design and implementation of exemplary 1:1 computer programming at three school districts: St. Helena Unified School District, CA; Kent School District, WA; and Sunnyside Unified School District, AZ. These profiles provide practical examples of best practices in establishing 1:1 program goals and combining qualitative and quantitative methodologies to assess progress towards those goals.

KEY FINDINGS

- **Since the success of a 1:1 computing program depends on effective classroom implementation, evaluation of such programs should include assessment of outcomes for both students' learning and teachers' classroom practices.**
- **In terms of student outcomes, the most common goals for 1:1 computing programs include increased student engagement, development of "21st century skills," and improvements in academic performance.** Research has established that well-implemented 1:1 programs have significant potential to improve student outcomes in these three areas, making them suitable areas in which to establish objectives and conduct assessments.

- **Teacher-centered goals should focus on classroom practices that integrate technology into the learning experience consistently and effectively.** An evaluation scheme for a 1:1 program should assess the extent to which teachers' use of 1:1 computing devices reflect best practices in technology integration, which de-emphasize teacher-led instruction and enable student-directed learning. Furthermore, teachers must be proficient in the use of the technologies implemented in a 1:1 program, so 1:1 program evaluation should measure teachers' knowledge and skill regarding relevant education-based technology.
- **Both quantitative and qualitative methodologies are effective tools for evaluating progress towards 1:1 program goals.** Many well-designed and comprehensive evaluations of 1:1 programs have utilized multiple methodologies concurrently to discover both how and how much 1:1 programs are changing the learning experience.
- **Quantitative methodologies can be especially useful in tracking large-scale trends in outcomes such as student achievement and dropout rates.** These methods include comparing student test scores before the implementation of a 1:1 program with those observed after the program begins, and quasi-experimental comparisons of test scores from students in a 1:1 program with those of similar, non-1:1 populations.
- **Qualitative methodologies can help evaluators gain insight into the details of how 1:1 computing is affecting the learning process and student-teacher interactions.** Surveys, interviews, and focus groups of students and teachers can provide an understanding of both groups' attitudes towards the program and the activities and assignments used by the teachers implementing the program. Classroom observations by administrators or outside observers can also be a useful component of program evaluations, by documenting a third-party perspective on program implementation behavior and the attitudes of teachers and students.

SECTION I: ESTABLISHING GOALS AND EXPECTED OUTCOMES

In this section, Hanover Research develops a consistent definition of 1:1 computing programs and reviews research-based evidence regarding the effectiveness and expected outcomes of these programs. This section also provides a discussion of common student- and teacher-centered goals for 1:1 computing programs, as proposed by education technology experts and employed by elementary and middle schools across the United States.

DEFINING ONE-TO-ONE COMPUTING PROGRAMS

One-to-one computing refers to programs that provide each student with an electronic device for academic use, in contrast to academic computing programs that use shared computers (e.g., in a school computer lab), or rely on students to use personal devices for academic purposes. The devices provided may be laptop computers or tablets, and may utilize any of a number of operating systems. According to the One-to-One Institute, a nonprofit specializing in promoting and supporting 1:1 computing in schools, “students use their devices for everything from research and inquiry-based projects to collaboration, presentations, content creation, and assessments.”¹ Therefore, 1:1 programs are compatible with many educational practices, which may limit or enhance the effectiveness of the program. As Damian Bebell and Laura O’Dwyer of the Lynch School of Education at Boston College note, **“...the term ‘one-to-one’ simply refers to the access that students have to technology and says nothing about pedagogical paradigms, desired learning outcomes, or other educational practices.”**²

EVIDENCE OF EFFECTIVENESS

One-to-one programs are relatively new to education; therefore, investigations of their effects are ongoing, with many unknowns.³ However, current research has established that 1:1 computing programs can offer a number of educational benefits, some of which may or may not be useful to administrators.⁴ In order to establish appropriate goals for assessable

¹ “One-to-One Learning.” The One-to-One Institute. http://www.one-to-oneinstitute.org/docs/OTO_Flyer_-_final.pdf

² Bebell, D. and L. O’Dwyer. “Educational Outcomes and Research from 1:1 Computing Settings.” *Journal of Technology, Learning, and Assessment*, 9:1, January, 2010.

³ [1] Bebell and O’Dwyer, Op. Cit.

[2] Bebell, D. and Kay, R. “One to One Computing: A Summary of the Quantitative Results from the Berkshire Wireless Learning Initiative.” *Journal of Technology, Learning, and Assessment*, 9:1, January, 2010. <http://napoleon.bc.edu/ojs/index.php/jtla/article/viewFile/1607/1462>

[3] Zucker, A. “Developing a research agenda for ubiquitous computing in schools.” *Journal of Educational Computing Research* 30:4, 2004, p. 371-386.

⁴ [1] Bebell and O’Dwyer, Op. Cit.

[2] Hu, W. “Seeing no progress, some schools drop laptops.” *The New York Times*, May 7, 2007. <http://www.nytimes.com/2007/05/04/education/04laptop.html?pagewanted=all&module=Search&mabReward=relbias%3Ar&r=0>

1:1 programs, administrators should understand both the potential benefits and limitations of these programs. While this report primarily focuses on the establishment and assessment of goals and objectives for a 1:1 program, the available literature on the effects of these programs can inform the process of identifying appropriate goals, as well as criteria for assessing progress towards those goals.

Researchers have amassed evidence linking 1:1 computing with increased student engagement and motivation, improved “21st Century skills,” and improvements in students’ writing skills.⁵ One-to-one computing programs may also improve overall academic performance, decrease disciplinary problems, and boost attendance, though the correlation between 1:1 computing and these outcomes is less substantial, and any such benefits will likely take several years to emerge after initiating a 1:1 program.⁶

Regarding **engagement and motivation**, in a study of 447 classrooms in 54 K-12 schools across 11 Florida districts, classroom observations revealed that “the greatest baseline to end-of-year differences were seen in increased ‘high student attention, interest, and engagement.’”⁷ A more indirect measure of engagement and motivation is provided by dropout rates: in Project RED, a 2010 national study of technology use in 997 schools, researchers found that 58 percent of schools with 1:1 programs experienced a dropout rate reduction.⁸ One-to-one programs seem particularly effective at improving dropout rates when utilized consistently in “intervention classes” (e.g., classes for English Language Learners).⁹

Regarding **academic achievement**, evidence varies by subject area. Several studies have established the benefits of 1:1 computing for students’ writing skills.¹⁰ Evidence for

[3] Sauers, N. and S. McLeod. “What Does the Research Say About School One-to-One Computing Initiatives?” UCEA Center for the Advanced Study of Technology Leadership in Education, University of Kentucky, May 1, 2012, p. 5.

http://schooltechleadership.org/wordpress/wp-content/uploads/2012/06/CASTLEBrief01_LaptopPrograms.pdf

⁵ [1] Bebell and Kay, Op. Cit.

[2] Sauers and McLeod, Op. Cit.

[3] “Waltham Public Schools 1:1 Learning Initiative.” Waltham Public Schools.

<http://www.walthampublicschools.org/1to1Learning.pdf>

⁶ [1] Bebell and Kay, Op. Cit.

[2] Bebell and O’Dwyer, Op. Cit.

[3] Sauers and McLeod, Op. Cit.

[4] Zucker, Op. Cit.

[5] “1:1 Computing: A Guidebook to Help You Make the Right Decisions.” *Technology and Learning*, 2005. p. 4. http://www.techlearning.com/techlearning/events/techforum06/LeslieWilson_onetoone2.pdf

⁷ Dawson, K., C. Cavanaugh, and A. Ritzhaupt. “Florida’s EETT Leveraging Laptops Initiative and Its Impact on Teaching Practices.” *Journal of Research on Technology in Education*, 45:2, p. 148.

⁸ Greaves, T. et al. “Project RED Key Findings.” 2010. p. 12.

http://www.kent.k12.wa.us/cms/lib/WA01001454/Centricity/Domain/567/Project_RED_Presentation_121010.pdf

⁹ Ibid., p. 6.

¹⁰ [1] Silvernail, D. and A. Gritter. “Maine’s Middle School Laptop Program.” University of Southern Maine, 2007. http://maine.gov/mlti/resources/Impact_on_Student_Writing_Brief.pdf

[2] Lowther, D., S. Ross, and G. Morrison. “When Each One Has One: The Influences on Teaching Strategies and Student Achievement of Using Laptops in the Classroom. *Educational Technology Research and Development*, 51:3, 2003.

improvements in math and science, however, is mixed. A 2002 Center for Children & Technology study of a 1:1 program at an urban middle school found math score improvements among 1:1 students, as compared to their non-1:1 peers, in the second and third year of the program.¹¹ However, a 2007 study, also conducted at an urban middle school, found no improvements in math scores, and improvements in science scores were observed, but only among male students.¹²

A key lesson to emerge from existing research on 1:1 programs is that **these programs depend primarily on teachers for their success** — teachers must effectively integrate computing into the classroom to achieve the benefits described above. Accordingly, professional development and training for teachers are vital components of successful 1:1 computing programs.¹³ In particular, **when integrating 1:1 computing, teachers should avoid using computers merely as more expensive modes of implementing traditional teaching methods** (what one administrator has called the “\$1,000 pencil” model of 1:1 programs);¹⁴ rather, computers should be treated as “cognitive tools that are holistically integrated.”¹⁵ **Therefore, evaluations of 1:1 computing programs should include an evaluation of teachers’ knowledge, skills, and practices, in addition to an evaluation of student-centered outcomes.**

GOALS AND EXPECTED OUTCOMES

In this section, Hanover Research reviews best practices for establishing goals and desired outcomes for a 1:1 computing program. Information in this section is drawn from research regarding the efficacy of 1:1 computing programs, secondary literature published by education and technology experts, and computing protocols developed by school districts.

<http://www.educ.msu.edu/epfp/meet/01-24-05files/when%20each%20one%20has%20one.pdf>

[3] Bebell and Kay, Op. Cit.

¹¹ Light, D., M. McDermott, and M. Honey. “Project Hiller: The Impact of Ubiquitous Portable Technology on an Urban School.” *Center for Children and Technology*, 2002.

<http://cct.edc.org/sites/cct.edc.org/files/publications/Hiller.pdf>

¹² Dunleavy, M. and W. Heinecke. “The Impact of 1:1 Laptop Use on Middle School Math and Science Standardized Test Scores.” *Computers in the Schools*, 24:3-4, 2007.

http://elisa1.ugm.ac.id/files/wahyu_psy/YxAVJV1W/Laptop%2520Use%2520%2520Desain%2520penelitian%2520dengan%2520menggunakan%2520ANCOVA.pdf

¹³ [1] Drayton, B. et al. “After Installation: Ubiquitous Computing and High School Science in Three Experienced, High-Technology Schools.” *Journal of Technology, Learning, and Assessment*, 9:1, January, 2010. <https://napoleon.bc.edu/ojs/index.php/jtla/article/viewFile/1608/1461>

[2] Shapley, K. et al. “Evaluating the Fidelity of Technology Immersion and Its Relationship with Student Achievement.” *Journal of Technology, Learning, and Assessment*, 9:1, January, 2010.

<https://ejournals.bc.edu/ojs/index.php/jtla/article/viewFile/1609/1460>

[3] Sauers and McLeod, Op. Cit.

[4] Greaves et al. “Project RED Key Findings.”

http://www.kent.k12.wa.us/cms/lib/WA01001454/Centricity/Domain/567/Project_RED_Presentation_1210.pdf

¹⁴ November, A. “Why Schools Must Move Beyond One-to-One Computing.” *November Learning*, February 10, 2013.

<http://novemberlearning.com/educational-resources-for-educators/teaching-and-learning-articles/why-schools-must-move-beyond-one-to-one-computing/>

¹⁵ Senge, P., et al. *Presence: Exploring Profound Change in People, Organizations, and Society*. New York: Doubleday. 2005. Quoted in Bebell and O’Dwyer, Op. Cit., p. 8.

Having clear goals for the program is the first step to planning and implementing a program evaluation: the program should be evaluated in terms of progress towards the specific goals administrators have identified. Section II will expand on this discussion by reviewing methods for evaluating progress towards the various goals identified in this section.

STUDENT-CENTERED GOALS AND OUTCOMES

As reviewed above, 1:1 programs may be directed at achieving a variety of goals with regard to student learning and behavior. Thus, **districts implementing a 1:1 program should consider their unique needs and objectives in order to identify appropriate goals and outcomes for students.** This subsection reviews the most common student-centered goals associated with 1:1 programs, along with challenges districts should consider when choosing which goals to prioritize and monitor most closely.

Common student-centered goals for 1:1 programs include increasing student engagement and motivation, fostering the development of 21st century information skills, and improving academic achievement (Figure 1.1). However, as noted above, current research has not established a definitive connection between 1:1 programs and overall academic performance; such effects will likely be unobservable until the programs have been operational for several years. Therefore, **administrators should set goals with reasonable expectations as to the likely effects of the program and determine when these effects might emerge.** As we review in Section II, it can be helpful to distinguish between short-term, “immediate” goals — desired effects that can be assessed in the first year or two after the launch of the program — and “long-term” goals that can only be assessed after the program has been in place for several years.

Figure 1.1: Student-Centered Goals

GOAL TYPE	GOAL
Improving Student Engagement and Motivation	• Increased student interest in learning • Increase in students’ sense of ownership of learning process • Deemphasize traditional, lecture-style instruction; giving students more control
Developing 21 st Century Skills	• Improved computer operations skills • Increased information literacy • Improved collaboration skills
Improving Academic Achievement	• Improved writing skills • Higher standardized test scores in math and science
Miscellaneous Goals	• Increase equity in technology access • Improve attendance • Improve classroom behavior/reduce disciplinary problems

Source: 1:1 Computing: A Guidebook to Help You Make the Right Decisions¹⁶

¹⁶ Figure adapted from: “1: 1 Computing: A Guidebook to Help You Make the Right Decisions.” Op. Cit.

Increasing **student motivation and engagement** with the learning process is a common goal for 1:1 programs that is backed by the available research. “Student engagement” is used here to encompass a broad range of student attitudes and behaviors, including motivation to learn, classroom participation, self-directed learning, satisfaction with school, and maintenance of attention to assigned tasks.¹⁷ As explained in Section II, evaluators can assess each of these outcomes through qualitative methodologies, including focus groups and surveys with students and reports from teachers and classroom observers.

Sudbury Public Schools in Massachusetts is among the many districts to include increasing student engagement as the primary goal their 1:1 program. In 2013, Sudbury launched a pilot 1:1 program, distributing 90 Chromebooks to students at Ephraim Custis Middle School. A proposal for the pilot included the following goal and explanation:

Enhanced student engagement, motivation, and ownership for learning. In a 1:1 environment, the learning shifts from the more traditional instructor-led model to a more student-centered focus. Accessibility to online learning tools gives students choices and options that naturally engage them in the learning process. With effective differentiation and choices provided for learning and demonstrating understanding, student engagement and motivation increases.¹⁸

Improving **21st Century Skills** – namely computing skills and informational literacy – are, naturally, core goals of most 1:1 programs. The Programme for International Student Assessment characterizes literacy in information and communication technologies as “the interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate and evaluate information, construct new knowledge, and communicate with others in order to participate effectively in society.”¹⁹ This definition summarizes three core components of 21st century skills: **technological competence, informational literacy**, and facility with **collaboration and communication**.²⁰ Each of these components can serve as the basis for a 1:1 program objective.

¹⁷ [1] “1:1 computing: A Guidebook to Help You Make the Right Decisions.” Op. Cit.

[2] Sauers and McLeod, Op. Cit.

[3] “1:1 Evaluation Toolkit.” Intel Corporation, 2007.

http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=ftp%3A%2F%2Fdownload.intel.com%2Feducation%2FEvidenceOfImpact%2FEvaluationResourceDocuments%2F5_One_to_One_Computing_Evaluation_Toolkit%2FFullSet_of_One-to-One_Evaluation_Toolkit.pdf&ei=l2_GU7qqMe_msAT01YLoAQ&usg=AFQjCNElqYQ4yPj2cjiNHb5Cn3DFsH74Vg&sig2=svyNLpNp9z7_NCc3BjOpKg&bvm=bv.71126742,d.cWc

¹⁸ “Tools for Teaching, Tools for Learning: A 1:1 Pilot.” Sudbury Public Schools. p 3.

http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB0QFjAA&url=http%3A%2F%2Fwww.sudbury.k12.ma.us%2Findex.php%3Foption%3Dcom_weblinks%26task%3Dwebblink.go%26fd%3D73&ei=IW8U66AHcGjyASc5YGAAg&usg=AFQjCNE8evlte_L2HHx_pp7RSdYSRizOog&sig2=rD73M47A6tEYhHo5FYzbFQ&bvm=bv.70138588,d.aWw

¹⁹ Van Joolingen, W. “The PISA Framework for Assessment of ICT Literacy.”

http://www.ibertic.org/evaluacion/sites/default/files/biblioteca/7_pisa_framework.pdf

²⁰ Note that outcomes included in “21st century skills” may overlap with those of student engagement. For example, Sudbury Public Schools’ Technology Plan includes the following: “As demonstrated in many of our classrooms, and in particular, the 1:1 pilot at our middle school, students are becoming *more independent, self-directed and collaborative learners, skills that are critical for success in our current society.*” (Emphasis added.) “Technology Plan 2014-2019.” Sudbury Public Schools.

The promotion of 21st Century skills is a core goal of the 1:1 program of Niagara Wheatfield Central School District in New York. In 2010, Niagara Wheatfield, composed of four elementary schools and one middle school, began implementation of a 5-year 1:1 computing project, distributing a variety of “netbook” models to students in Grades 5 through 8.²¹ Among the goals identified for this initiative is to increase “information literacy, meaning the collection, evaluation and synthesis of information are all necessary skills and are facilitated by the use of a computer.”²² Niagara Wheatfield provides the following description of the need to promote these skills and the computer-based activities that will facilitate them:

Our students will need to collaborate with people from other cultures, time zones and physical places as a part of their daily routine.

Collaborations of this kind [will] take place face-to-face as well as in cyber space. Our students need these experiences within a safe environment so they are prepared. 1:1 computing, Internet safety instruction and the Internet are the tools necessary to teach students blogging, video conferencing, and online social networking for meaningful scholarly contributions and responsible behavior.²³

Improving **academic performance** is another popular goal of 1:1 programs, though as noted above the effects of 1:1 programs on academic achievement are currently unclear.²⁴ **Nevertheless, it is not unreasonable for districts to include improved academic achievement among their 1:1 program goals, as such improvements may arise either as a direct effect of access to computing technology or as an indirect effect of increased engagement.** Goals for improvements in academic performance are based in terms of standardized test scores, GPA, or teacher assessments of students’ work; different goals may be established for different subject areas.²⁵

Improved achievement goals for 1:1 programs are often directed specifically at improvements in “core” academic subject areas. For example, Michigan has established a state-wide 1:1 initiative, of which one goal is to “enhance student learning and achievement in core academic subjects,”²⁶ while Consolidated High School District 230 in Illinois lists “improved student learning in core subject areas” as a goal of its 1:1 program.²⁷

School districts with 1:1 program goals that include improved achievement do not always specify how they plan to assess the impact of the program on student achievement. However, external research typically uses standardized tests as measures of achievement. In

http://www.sudbury.k12.ma.us/index.php?option=com_docman&task=doc_view&gid=393&Itemid=324

²¹ “One-To-One Computing Project: Final Report.” Niagara Wheatfield Central School District.

http://www.nwcsd.k12.ny.us/cms/lib/NY19000569/Centricity/Domain/38/Research_Final_Report.pdf

²² “1:1 Computing Project/Increase 21st Century Skills.” Niagara Wheatfield Central School District.

<http://www.nwcsd.k12.ny.us/Page/257>

²³ Ibid.

²⁴ Bebell and O’Dwyer, Op. Cit.

²⁵ [1] Sauters and McLeod, Op. Cit. p. 2-3. [2] “1:1 Evaluation Toolkit.” Op. Cit.

²⁶ “1:1 computing: A Guidebook to Help You Make the Right Decisions.” Op. Cit., p. 8.

²⁷ “1:1 Program Goals.” Consolidated High School District 230. <http://d230.org/departments/technology/1-1-device-program/goals/>

their introduction to a 2010 1:1 programs-focused issue of the *Journal of Technology and Assessment*, Bebell and O'Dwyer note that "three of the four empirical studies focus... on quantitative measures of student achievement, typically state assessment scores."²⁸ Examples of measures used in these studies include the Texas Assessment of Knowledge and Skills,²⁹ English Language Arts (ELA) assessments,³⁰ and the Michigan Educational Assessment Program.³¹ Additionally, some studies rely on GPA as a measure of student achievement when evaluating the effects of a 1:1 program.³²

Evidence for the impact of 1:1 programs on writing skills is somewhat more robust than evidence for the impact on science or mathematics scores, though some research suggests improvement in these areas as well. **Therefore, districts may consider establishing separate 1:1 program-related goals for improvements in writing versus math and science fields.**

Finally, districts with wide socioeconomic disparities in their student population may use 1:1 computing programs to **increase equity in access to technology** resources across socioeconomic groups.³³ 1:1 programs provide a way of guaranteeing that all students have reliable access to modern computing devices and internet services.

The "digital divide" was of special concern to administrators at Sunnyside Unified School District in Arizona (profiled below), where 84 percent of students qualify for a free or reduced lunch. Two of the district's 1:1 program goals are:

- Bridge the digital divide in our community with respect to internet access and technology
- Triple students' access to technology within three years.³⁴

A recent profile of technology equity efforts by Sunnyside also characterizes improving equity in technology access as a primary goal of the district's 1:1 program:

Beyond the initiative's curricular and instructional impact, the district's leadership immediately saw the potential to bridge the digital divide in the surrounding community... Many students would be the first in their families to have a laptop, and inevitably would teach parents and other relatives about digital technology.³⁵

²⁸ Bebell and O'Dwyer, Op. Cit., p. 7.

²⁹ Shapley et al., Op. Cit. For information about the Texas Assessment, see the Texas Education Agency's website at <http://www.tea.state.tx.us/student.assessment/taks/>

³⁰ Bebell and Kay, Op. Cit., Suhr et al. "Laptops and Fourth-Grade Literacy: Assisting the Jump over the Fourth-Grade Slump." *Journal of Technology, Learning, and Assessment*, 9:1, 2010.

³¹ Lowther et al., Op. Cit. For information about the Michigan Educational Assessment Program, see the Michigan Department of Education at http://www.michigan.gov/mde/0,1607,7-140-22709_31168---,00.html

³² Lei, J. and Zhao, Y. "One-to-One Computing: What Does It Bring to Schools?" *Journal of Educational Computing Research*, 39:2, 2008.
http://late-dpedago.urv.cat/site_media/papers/One-To-One_Computing_What_Does_It_Bring_To_Schools.pdf

³³ "Ed Tech: Closing the Digital Divide." TeachHub.com. <http://www.teachhub.com/ed-tech-closing-digital-divide>

³⁴ "Program Goals." Sunnyside Unified School District. <http://www.susd12.org/program-goals>

³⁵ Pratt, T. "Bridging the Digital Divide for Low-Income Students." Digital Promise.
<http://www.digitalpromise.org/blog/entry/11-learning-24-7-at-sunnyside-unified-school-district>

TEACHER-CENTERED GOALS AND OUTCOMES

Teacher-centered goals for 1:1 programs center on two elements: Teachers' knowledge of and skill with academic and pedagogical technology and the practices they employ when integrating technology into the learning process. In order to implement a 1:1 program effectively at the classroom level, teachers must have adequate knowledge of how to use program hardware and software and the best practices for incorporating this technology into the curriculum.³⁶ Figure 1.2 offers a summary of the two goal types discussed within this subsection: knowledge-based goals and practice-based goals.

Figure 1.2: Teacher Centered Goals

GOAL TYPE	GOAL
Knowledge-Based Goals	• Knowledge of best practices in technology integration • Knowledge of academic computing hardware • Knowledge of academic computing software
Practice-Based Goals	• Consistent integration of technology across classrooms • Participation in professional development activities • Daily use of technology in the classroom

Knowledge-based goals for teachers center on teachers' knowledge of educational computing hardware and software, or their knowledge of pedagogical best practices with regard to academic technology.³⁷ In order to integrate 1:1 computing into the classroom effectively, teachers should have a high level of comfort with and knowledge of the technological tools they will be using.³⁸ Thus, a knowledge-based goal for a district might be to have a certain percentage of teachers reporting that they are very comfortable and familiar with their devices, and that they are aware of effective strategies for implementing computer use into various classroom activities, including writing, group work, research, and student presentations.³⁹

Since consistent use of 1:1 computing devices in the classroom is an essential component of an effective 1:1 program,⁴⁰ **practice-based goals** for teachers should include benchmarks for frequency and type of use. As noted above, computers must be integrated holistically in order to be maximally effective in improving the student learning experience. That is, **teachers should take advantage of the unique capabilities of computing devices to enhance students' engagement and experiences.** According to researchers at Harvard University and the University of Virginia, the benefits of computing devices over traditional classroom materials include "an enhanced ability to find and retrieve relevant information via the web, an increased level of real-time formative assessment enabling individualized

³⁶ [1] Drayton, B. et al., Op. Cit.

[2] Shapley et al., Op. Cit.

[3] Greaves et al., Op. Cit.

[4] Goodwin, Op. Cit.

³⁷ "1:1 Evaluation Toolkit." Op. Cit.

³⁸ Bebell and O'Dwyer, Op. Cit.

³⁹ "1:1 Evaluation Toolkit." Op. Cit., p. 134.

⁴⁰ Greaves et al., Op. Cit.

instruction, or the creation of virtual communities that allow students to communicate inside and outside of the classroom.”⁴¹ **Goals for instructional practice using technology should track not only how frequently these tools are used, but also whether they are being used effectively.**

To help classify uses of technology into “more meaningful” and “less meaningful” categories, the authors of a 2006 study on the use of laptops in Florida classrooms provide the following scale:

1. **Low level use of computers:** activities in general required no critical thinking, e.g., used computer applications for copying text or free-time drawing or used educational software for drill and practice, tutorials, or games.
2. **Somewhat meaningful use of computers:** activities in general required very little problem-solving or critical thinking and used computer applications or educational software in a limited manner.
3. **Meaningful use of computers:** activities were problem-based, required some critical thinking skills and some use of computer applications to locate and/or process information or some manipulation of educational software variables to reach solutions.
4. **Very meaningful use of computers:** activities were based on meaningful problems, required critical thinking skills, and required appropriate use of computer applications to locate and/or process information or manipulation of educational software variables to reach solutions.⁴²

Finally, since research has established that teacher learning, collaboration, and idea-sharing are key components of 1:1 program success,⁴³ evaluators may wish to establish goals concerning teachers’ level of training or participation in professional development and the availability of opportunities for teachers to share experiences and insights regarding 1:1 implementation.

⁴¹ Dunleavy, M., S. Dexter, and W. Heinecke. “What Added Value Does a 1:1 Student to Laptop Ratio Bring to Technology-Supported Teaching and Learning?” *Journal of Computer Assisted Learning*, 23:5, 2007. <http://blog.amersol.edu.pe/g9-1to1/files/2011/10/LaptopTeacherPD.pdf>

⁴² List taken verbatim from Dawson et al., Op. Cit., p. 152.

⁴³ Greaves et al., Op. Cit.

ADMINISTRATOR-CENTERED GOALS

Several studies have concluded that administrative buy-in and support for 1:1 programs are key elements of the success of these programs.⁴⁴ Therefore, an **evaluation should seek to measure the extent that administrators are effectively guiding the program's implementation.** Researchers' recommendations for administrators are generally less focused on specific outcomes or measures, and are instead framed in terms of a general orientation towards providing teachers with needed support and professional development opportunities. The researchers of Project RED list "Change management leadership by principal," a practice where "[l]eaders provide time for [monthly] teacher professional learning and collaboration," as a highly important practice that predicts success in a 1:1 program.⁴⁵ Similarly, Bebell and Kay note that the studies they reviewed on the effectiveness of 1:1 programs emphasize "the need for school level leadership support for 1:1 initiatives and programs."⁴⁶ Accordingly, administrators may perform an informal self-evaluation of their level of support for the 1:1 program, and solicit feedback from teachers about their needs in implementing the program.

⁴⁴ [1] Bebell and Kay, Op. Cit., [2] Drayton et al., Op. Cit., [3] Greaves et al., Op. Cit., p. 6.

⁴⁵ Greaves et al., Op. Cit., p. 6.

⁴⁶ Bebell and Kay, Op. Cit., p. 9.

SECTION II: MONITORING AND EVALUATION PRACTICES

In this section, Hanover Research reviews common practices in the monitoring and evaluation of 1:1 computing programs at elementary and middle schools. Building upon the goals and expected outcomes established in Section I of this report, this section provides a basic overview of the key considerations in developing monitoring and evaluation protocols and provides a basic framework for the evaluation of student- and teacher-centered goals and outcomes.

OVERVIEW OF EVALUATION PRINCIPLES AND METHODOLOGIES

CHOOSING EFFECTIVE QUESTIONS AND METHODS

In order to develop an effective evaluation scheme for a 1:1 initiative, administrators must first determine the most important elements of the program that require the most scrutiny. Barbara Means and Geneva Haertel of the Center for Technology and Learning have developed a set of guiding principles for evaluating technology programs in education settings.⁴⁷ Education researchers Alejandra Bonifaz and Andrew Zucker summarize these principles as follows:

- **Look for critical influences at multiple levels of the education system**
- **Figure out what you're especially trying to teach, and measure that**
- **Look for ways to evaluate the long-term costs and benefits of the technology infrastructure**
- **Let the research question drive the choice of method**⁴⁸

Additional information related to the use of these principles is provided in Appendix A.

DATA COLLECTION

Existing frameworks for 1:1 program evaluation — provided by school districts and education and technology experts — illustrate a variety of methods for collecting data that can serve as the basis for a 1:1 program evaluation.⁴⁹ Some data types will be readily available given pre-existing monitoring and evaluation practices, including standardized test

⁴⁷ Means, B. and G. Haertel. *Using Technology Evaluation to Enhance Student Learning*. New York: Teachers College Press. 2004.

⁴⁸ Bonifaz, A., and A. Zucker. "Lessons learned about providing laptops for all students." *Education Development Center*, 2004. p. 4 <http://perkinselementary.pbworks.com/f/LaptopLessonsRprt.pdf>

⁴⁹ [1] "1:1 Evaluation Toolkit." Op. Cit.

[2] Banks, K. "Evaluation of the Kent Technology Academy 2005-2007." December 2007.

http://www.kent.k12.wa.us/cms/lib/WA01001454/Centricity/Domain/567/kta_final_report.pdf

[3] "SHUSD 1:1 Chromebook Pilot Evaluation Fall 2013." St. Helena Unified School District. pp. 4-5.

<http://shusd.schoolwires.com/cms/lib6/CA01000647/Centricity/Domain/1/SHUSD%20Chromebook%20Pilot%20Report%20111213.pdf>

scores and attendance records. Other data will need to be gathered specifically for evaluating a 1:1 program: Surveys, interviews, focus groups, and classroom observations may all be used to collect additional data that can be compared against program goals.

DATA ANALYSIS

Data may be analyzed using quantitative and qualitative methods. The Intel Corporation has collaborated researchers to compile an “evaluation toolkit” for 1:1 programs. This toolkit reviews three **quantitative methodologies**:

- **Pre-post assessment of changes in outcomes:** Uses statistical analysis of an experimental group (students in the 1:1 program) and a control group (similar students not in the 1:1 program) to isolate the effects of the program. This methodology is resource-intensive, but can provide rigorous evidence of program impacts.
- **Quasi-experimental comparison to other groups.** A quasi-experimental design compares outcomes from two groups that have been matched on a predetermined set of characteristics, such as location, gender distribution, student test scores, or years of teacher experience. This design is not as rigorous as a randomized study, but can identify initial evidence of impact that leads to additional research.
- **Non-experimental methods:** In a non-experimental study, researchers compare variables within a single sample. For instance, researchers may correlate student attitudes toward technology with engagement in classroom activities. Non-experimental studies can identify the kinds of variables that may influence the impact of 1:1 computing programs. They can also confirm the expected paths to impact that are described in the logic model.⁵⁰

Any of these methods can be used once data have been quantified in some way. For example, evaluators can construct a survey with scaled-response questions to measure student attitudes towards technology, providing numerical measures of students’ attitudes. This survey can then be administered before and after the implementation of a 1:1 program, in order to conduct a pre-post assessment.

Alternatively, evaluators can employ **qualitative methodologies**. These involve summarizing feedback from students or teachers in a narrative fashion. These anecdotes or observations can provide detailed insight into how the program is affecting participants. These methods seek to capture *how* a program is affecting student and teacher outcomes, rather than simply tracking numerical differences in those outcomes.

Given the wide array of methodologies available for assessing the outcomes of a 1:1 program, districts may find it helpful to employ multiple methodologies concurrently, depending on available resources and the questions of interest. The evaluation plan for

⁵⁰ “1:1 Evaluation Toolkit.” Op. Cit., p. 7. Items 2 and 3 are taken verbatim.

Waltham Public Schools' 1:1 initiative — a pilot program distributing iPads to approximately 90 students at each of several district middle schools — highlights the use of multiple methodologies, including surveys, focus groups, classroom observations, and monitoring of achievement and disciplinary measures:

We will use **technology integration surveys** to assess entry points for teacher skills and to evaluate ongoing technology integration into instruction. **Classroom observations and focus groups** will concentrate on the levels of use and integration of the iPads in our pilot programs... **School and student data will be reviewed to target any trends** in assessment scores, attendance, and discipline data.⁵¹

EVALUATING STUDENT OUTCOMES

In this subsection we review best practices for evaluating the impact of 1:1 programs on students. Figure 2.1 summarizes the content in this section by matching common student-centered goals for 1:1 computing programs with evaluation methods for measuring progress towards those goals.

Figure 2.1: Methods for Evaluating Student-Centered Goals

GOAL	EVALUATION METHODS
Engagement/Motivation	
Increased student interest in learning	• Student surveys/focus groups • Classroom observation
Increase in students' sense of ownership of learning process	• Student surveys/focus groups • Classroom observation
Deemphasize traditional, lecture-style instruction; give students more control	• Student surveys/focus groups • Teacher surveys/interviews • Classroom observation
Academic Achievement	
Improved writing skills	• Pre-post or quasi-experimental analysis of standardized test scores (ELA) • Assessment of student work according to a rubric
Higher standardized test scores: math and science	• Pre-post or quasi-experimental analysis of standardized test scores

As noted in Section I, some effects of 1:1 programs on students may be observable shortly after the implementation of the program, while others may take several years to appear.⁵²

Thus, districts should conduct evaluations in multiple phases or at least devise partially distinct evaluation procedures for short-term and long-term goals. For instance, Maine's statewide 1:1 computing program has been ongoing since 2002, and has conducted evaluations in multiple stages, including a "preliminary" evaluation in 2004 and a follow-up evaluation in 2007.⁵³

⁵¹ "Waltham Public Schools 1:1 Learning Initiative." Op. Cit.

⁵² Zucker, Op. Cit.

⁵³ [1] Silvernail and Gritter, Op. Cit.

EVALUATING SHORT-TERM GOALS

Evaluators can use each of the following methods to determine progress towards desired short-term goals, such as increased student engagement and improved 21st Century skills. For each of these methods, Intel's 1:1 evaluation toolkit provides sample evaluation tools (e.g., classroom observation worksheets, survey/focus group questions, etc.).

- **Classroom Observation:** Can be used to track how often 1:1 devices are incorporated into classroom activities, as well as the sorts of activities for which teachers rely on 1:1 devices the most. Intel's 1:1 evaluation toolkit recommends providing classroom observers with a worksheet that can be used to frame and organize their observations.⁵⁴
- **Focus Groups:** Provides a moderator-guided forum for groups of students to share their experiences with a 1:1 computing program.⁵⁵
- **Student Survey:** Can be used to gather information on students' background characteristics, as well as attitudes towards and experiences with the 1:1 computing program.⁵⁶
- **Assessments of Student Work:** Provides a more qualitative look at students' engagement and performance than looking at standardized test scores (discussed in the next section). This method involves collecting student work and scoring or coding it according to a rubric. This method can be used to identify common themes in students' use of technology in completing school assignments, as well as areas of improvement or lack of improvement.⁵⁷

Wissahickon School District, a district of around 4,500 students spread among four elementary schools, a middle school, and a high school in suburban Pennsylvania,⁵⁸ provides an example of **student work assessment as a component of an evaluation plan** for its 1:1 program: "The 21st Century Teaching & Learning Steering Committee will review reports from the Technology Department staff that summarize data on the assessed proficiency of students with regard to meeting the established technology standards for identified grade levels, as measured by the specific assessments conducted for each targeted grade."⁵⁹

[2] Silvernail, D., and D. Lane. "The Impact of Maine's One-To-One Laptop Program on Middle School Teachers and Students." University of Southern Maine, 2004.
<https://wiki.rockwallisd.org/sandbox/groups/technologysptools/wiki/fb328/attachments/c39b3/Maine%20Research.pdf>

⁵⁴ "1:1 Evaluation Toolkit." Op. Cit., pp. 184-197. See also the coding scheme in Banks, Op. Cit., p. 36-37.

⁵⁵ Ibid., pp. 198-201.

⁵⁶ Ibid., pp. 202-208.

⁵⁷ Ibid., pp. 209-214.

⁵⁸ "District Information." Wissahickon School District. <http://www.wsdweb.org/page.cfm?p=1644>

⁵⁹ "WSD Technology Department 21st Century Teaching & Learning Initiative Implementation Plan." Wissahickon School District.
https://www.wsdweb.org/uploaded/schools/District/Administration/Technology/1_1_Initiative/21st_Century_Teaching_and_Learning_Implementation_Plan.pdf

EVALUATING LONG-TERM GOALS

While improvements to academic performance are common goals for 1:1 programs, a program may take several years to have a demonstrable impact. One challenge for evaluating progress towards these long-term goals is the difficulty of controlling variables that may affect the impact of the program, such as differences in how teachers integrate technology into the classroom. As Zucker notes, “One likely possibility is that because choices about how to use technology are often left to individual students and teachers... impacts on student achievement are weak and scattered.”⁶⁰ However, if districts take steps to ensure consistency of implementation across teachers and classrooms, then program evaluations can make meaningful assessments of progress towards academic achievement goals.

As noted in Section I, program evaluations that investigate impacts on student achievement typically use standardized test scores (and occasionally GPA) as measures of academic achievement. Methodologies used to evaluate progress on these measures can include pre-post assessments or quasi-experimental comparisons with other groups.⁶¹

EVALUATING TEACHER OUTCOMES

When evaluating the impact of a 1:1 program on teacher practices, evaluators use many of the same principles and methods used to evaluate student outcomes. Evaluators use **classroom observations, surveys, and interviews/focus groups with teachers** to track progress towards effective implementation of 1:1 computing at the classroom level. In addition, evaluators can use interviews with administrators or surveys of students about teachers’ practices to gain a greater perspective on implementation practices.⁶²

Intel’s Evaluation Toolkit provides a number of questions that can be used to guide the evaluation of teachers’ implementation of a 1:1 program. These questions are divided into six areas of focus:

- Relationship of implementing 1:1 computing and changes in teachers’ knowledge of pedagogy and technology integration
- Relationship of implementing 1:1 computing teachers’ skill in lesson planning
- Relationship of implementing 1:1 computing strategies and teachers’ use of effective instructional strategies
- Relationship of implementing 1:1 computing strategies with changes in teachers’ attitudes toward technology
- Relationship of implementing 1:1 computing strategies with changes in teachers’ technology skills and competence

⁶⁰ Zucker, Op. Cit. p. 378.

⁶¹ “1:1 Evaluation Toolkit.” Op. Cit.

⁶² Ibid.

- Relationship of implementing 1:1 computing strategies and technology-supported classroom practices and pedagogy⁶³

For the full set of evaluation questions see Appendix B.

EVALUATING KNOWLEDGE-BASED GOALS

Education strategist Barbara Bray produced a model of stages of teachers' level of comfort and facility with educational technology (based on Hall and Rutherford's Concerns Based Adoption Model),⁶⁴ shown in Figure 2.2. **This model can help teachers assess their preparedness for integrating computer-based activities into the classroom, by giving them (and administrators) a framework for classifying their current knowledge and comfort level and by highlighting areas for further development.** Survey tools such as the Teaching with Technology Instrument⁶⁵ and the Technological Pedagogical Content Knowledge (TPACK) Assessment⁶⁶ can help teachers determine which stage best captures their current knowledge.

Figure 2.2: Stages of Adaptation to 1:1 Computing Techniques

STAGE	DESCRIPTION
Awareness	May know or not know about the technology, but is not ready, even if has access to it
Informational	Aware of the technology, wants to learn more, and may ask lots of questions before jumping in
Personal	Uses technology for personal use and may ask WIFM (What's In It For Me?). May have general anxiety about using technology beyond personal use.
Management	Uses technology regularly but has trouble finding and organizing files, folders, and programs
Consequence	Looking for ways that technology will impact student learning
Collaboration	Interested in using technology as a collaborative tool with students and other teachers
Refocusing	Willing to share and teach other teachers how to use technology with students

Source: Bray, B. "Stages of Concern"⁶⁷

Once this initial assessment has been conducted, teachers and administrators can perform periodic re-assessments to track changes in teachers' knowledge and comfort over time.

⁶³ "1:1 Evaluation Toolkit." Op. Cit., pp. 121-122.

⁶⁴ Hall, G., A. George, and W. Rutherford. "Measuring Stages of Concerns about the Innovation: A Manual for Use Of the Soc Questionnaire." The University of Texas at Austin, The Research and Development Center for Teacher Education. <http://files.eric.ed.gov/fulltext/ED187716.pdf>

⁶⁵ Atkins, N. and E. Vasu. "Teaching with Technology Instrument." September 15, 1999. <http://www.ncsu.edu/project/middletech/staffdev/tti.pdf>

⁶⁶ Schmidt, D. et al. "Technological Pedagogical Content Knowledge (TPACK): The Development and Validation of an Assessment Instrument for Preservice Teachers." *Journal of Research on Technology in Education*, 42:2, 2009. <http://punya.educ.msu.edu/publications/schmidt-et.al.2010.pdf>

⁶⁷ Bray, B. "Stages of Concern." Tech & Learning. <http://www.techlearning.com/pdq/0054/stages-of-concern/42264>

EVALUATING PRACTICE-BASED GOALS

Given the opportunities that computing devices offer beyond traditional classroom teaching methods, evaluation of progress towards practice-based goals for teachers should seek to gauge the extent to which teachers are using 1:1 computing devices to their full potential.

Evaluators can conduct **classroom observations and teacher interviews, and administer surveys to both students and teachers** in order to establish how often computers are being used for classroom activities and homework assignments. In addition, these methods can also determine whether the activities employed are “meaningful” uses of the technology and whether they take advantage of the unique benefits of computing devices.⁶⁸

Teacher logs or diaries can also be helpful in keeping track of technology-assisted classroom practices. In a study of three high schools in the early implementation phases of 1:1 programs, a team of researchers at the Technical Education Research Centers collected biweekly teacher logs “documenting what types of technology they and their students used in their case-study analysis.”⁶⁹

⁶⁸ See scale developed by Dawson et al., Op. Cit., reviewed in “Practice-Based Goals” in Section I above.

⁶⁹ Drayton et al., Op. Cit., p. 13

SECTION III: PROFILES

In this section, Hanover Research provides detailed profiles of evaluation programs implemented by K-12 school districts in order to assess their 1:1 computing programs. Exemplary evaluation programs have been implemented by a diverse array of school districts, and most evaluation measures reported (e.g., surveys and classroom observations) should translate well to different contexts with appropriate modifications (e.g., employing a sampling method where surveying all students or teachers would be impractical).

ST. HELENA UNIFIED SCHOOL DISTRICT, CALIFORNIA

St. Helena Unified School District (SHUSD) is a small district in Napa County, CA consisting of a primary school (Kindergarten through Grade 2), an elementary school (Grades 3 through 5), a middle school, and a high school, with 573 students enrolled in Grades 3 through 8. The district has a staff of 190 and a yearly budget of \$22 million.⁷⁰ In 2013, SHUSD began piloting a 1:1 program in its Fifth, Sixth, and Ninth Grade classrooms (one classroom each at the elementary, middle, and high schools) as a component of its Strategic Initiatives for Technology program.⁷¹ Students in Fifth and Sixth Grade were provided with Google Chromebooks.

A team of 20 SHUSD employees conducted an evaluation of the 1:1 program after an 11-week pilot. The team was composed of four teachers at each of the three participating schools, along with a “Leadership and Professional Development Team” that included senior administrators and media and technology specialists. This 10-member team comprised of the following personnel:

- Library-media specialist/Google Domain Administrator
- Teacher on Special Assignment
- Library-Media Specialist
- Counselor
- Principal (x3)
- Interim Technology Integration Specialist
- Assistant Superintendent
- Assistant Principal⁷²

⁷⁰ “About the District.” St. Helena Unified School District. <http://shusd.schoolwires.com/domain/24>

⁷¹ “SHUSD 1:1 Chromebook Pilot Evaluation Fall 2013.” Op. Cit.

⁷² Ibid., p. 2.

GOALS OF SHUSD'S 1:1 PROGRAM

SHUSD's program assessment centered primarily on students' and teachers' attitudes towards the program and its impact on the learning process. While SHUSD did not include test scores or other metrics of academic achievement in its evaluation of the pilot program, the program assessment does list "enhance student learning and achievement" among the program's overarching goals.⁷³

In addition, SHUSD identified three central learning practices to the 1:1 computing program, and consistent use of these practices in the classroom was a key goal of the pilot initiative. Though not explicitly referenced as such by SHUSD, **these goals align with both the "21st Century skills" and "student engagement" goals that are common among 1:1 computing programs.** The three key learning practices are:

- **Blended Learning:** Creating a "digital space" for classrooms that promote "efficiency, anytime learning, and resource access."
- **The Google Experience:** Utilizing software (e.g., Google Apps for Education) and internet tools (e.g., YouTube) to facilitate collaboration and student-directed learning.
- **Student Involvement:** Using technology (e.g., blogs and portfolios) to promote participation, critical thinking, and student-produced learning.⁷⁴

EVALUATION METHODS USED

SHUSD employed a variety of qualitative methodologies to evaluate student and teacher experiences with the 1:1 program, as well as the effectiveness of the devices as tools for teaching and learning. Specifically, SHUSD used the following three methodologies:

- Experience sampling
- Surveys of students and teachers
- Anecdotal feedback from teachers

The **experience sampling** method, developed by psychologist Russell Hurlburt⁷⁵ provides students with a randomly timed prompt to "freeze" their experience and complete a survey on their current thoughts and feelings. Each student completed one experience sampling survey in the final week of the pilot program. The questions used in these surveys are provided in Appendix C.

SHUSD administered **surveys** to both students and teachers during the final week of the 1:1 pilot program. These surveys (reproduced in Appendix D) used a five-point rating scale to

⁷³ Ibid., p. 4.

⁷⁴ Ibid.

⁷⁵ For a concise description of the method and its uses, see Hurlburt, R. and S. Ahkter. "The Descriptive Experience Sampling Method." *Phenomenology and the Cognitive Sciences*, 5:3-4, 2006.
<https://faculty.unlv.edu/hurlburt/hurlburt-1997.pdf>

gauge student and teacher attitudes towards topics such as the impact of 1:1 computing on the learning experience and the extent to which the devices improved access to resources and content.⁷⁶ The surveys also included open-ended questions to allow students and teachers to report additional experiences and suggestions. Teachers' responses to these open-ended questions, and to informal email requests for comments on the program, formed the **anecdotal feedback** component of the evaluation.

Figure 3.1: Outcomes and Assessment Methods of SHUSD's 1:1 Program Evaluation

LEARNING OUTCOME	ASSESSMENT METHOD
Engagement	Experience Sampling
Literacy	Experience Sampling
Critical Thinking and Inquiry	Experience Sampling
Information and Resource Access	Survey

Source: St. Helena Unified School District⁷⁷

SHUSD received extremely positive feedback about the program from both students and teachers. Based on the results of the evaluation, SHUSD has decided to expand its 1:1 program to Grades 4, 7, and 8, and has, based on student and teacher feedback, identified devices and software programs that will be explored in future iterations of the program.⁷⁸

KENT SCHOOL DISTRICT, WASHINGTON

Kent School District in Washington consists of 28 elementary schools, six middle schools, four high schools, and three academy schools, with a total enrollment of 27,539 students in 2012-2013.⁷⁹ The district's 1:1 program has been steadily expanding since its initiation in 2005, and has earned national recognition, including designations as a "Signature District" by Project RED and a "Showcase Site" by the One-to-One Institute.⁸⁰ Kent's pilot 1:1 program distributed 90 laptops to seventh-grade students at one district middle school in 2005. After a 2007 external review of this pilot program showed positive results, Kent administrators decided to expand 1:1 computing to all secondary students, and the program now includes approximately 12,000 students in Grades 7 through 11.⁸¹

In 2007, Kent sought an external evaluation of the district's pilot 1:1 program by education consultant Dr. Karen Banks. While Kent School District relied on an external review, the principles applied in Dr. Banks' evaluation can serve as a useful template for a district conducting an in-house review. **The evaluation of Kent's 1:1 program is particularly instructive because of its use of formal, quantitative methodologies.**

⁷⁶ "SHUSD 1:1 Chromebook Pilot Evaluation Fall 2013." Op. Cit., pp. 30-31.

⁷⁷ Ibid.

⁷⁸ Ibid., p.28

⁷⁹ "Our District." Kent School District. <http://www.kent.k12.wa.us/domain/37>

⁸⁰ "Our District." Kent School District. <http://www.kent.k12.wa.us/domain/37>

⁸¹ "One-to-One: Past, Present, Future." Kent School District. <http://www.kent.k12.wa.us/Page/3556>

GOALS OF KENT'S 1:1 PROGRAM

The goals for Kent's 1:1 initiative are integrated with those of the district as a whole: "the One-to-One planning team carefully considers the Kent School District Board's strategic plan as the foundation of this program,"⁸² and as overarching goals, the program seeks to "increase student achievement, provide a way for effective communication with students and families, and help maximize resources."⁸³

More specifically, the program aims to meet the following instructional goals:

- Increased use of collaborative or cooperative approaches to learning
- Emphasis on project-based instruction
- Use of technology to individualize the instruction for students
- Differentiated instruction to support different learning styles
- Improved student technology skills
- Sustained opportunities for writing
- Greater integration of subject matter
- High expectations for every student⁸⁴

Further goals of the pilot program included providing a "proof of concept" for more wide-scale implementation of 1:1 computing and to increase equity by closing the "digital divide."⁸⁵

EVALUATION METHODS USED

The assessment of Kent's 1:1 program employed several methods and focused on several evaluation questions, including:

- What achievement outcomes have resulted from the [1:1] program?
- How were these outcomes obtained? What background, training, and other attributes did... teachers bring to the project? What were the staffing levels?
- What impact has the program had on teaching and learning?
- Could the program be expanded on a much larger basis?⁸⁶

The data used in measuring progress towards these goals was collected using the following methods:

- Interviews with teachers and the 1:1 program director

⁸² "One-to-One: Vision and Purpose." Kent School District. <http://www.kent.k12.wa.us/Page/3380>

⁸³ Ibid.

⁸⁴ Bulleted text taken verbatim from Banks, Op. Cit., p. 8.

⁸⁵ Ibid.

⁸⁶ Abridged version of bulleted text found in: Ibid., p. 9

- Classroom observations
- Focus groups of seventh and eighth grade students
- Standardized test scores (Washington Assessment of Student Learning)
- Observation of an informational session for parents
- Student surveys (measuring technology skills and attitudes about school)⁸⁷

Dr. Banks conducted **an analysis of standardized test scores** for students in the 1:1 program, comparing these scores both to these same students' scores prior to beginning the program and to the scores of students in the school district at large. Consistent with other research on 1:1 programs, students in the 1:1 program demonstrated substantial improvements in writing scores, along with significant but more modest improvements in math and science.

Dr. Banks's evaluation of Kent's 1:1 program also included a **direct, formal assessment of students' technology literacy**. Washington State administers a technology literacy survey to eighth grade students, which queries students on their comfort level with technology (e.g., use of keyboard and mouse, software usage, and internet skills); responses are used to sort students into three tiers of technology literacy.⁸⁸ Dr. Banks used this survey to construct a **pre-post assessment of technology literacy**: students in Kent's 1:1 program completed this survey upon beginning the program in seventh grade and again the next year. Using this pre-post method, Dr. Banks was able to establish that high levels of technology literacy among Kent eighth graders were attributable to the effects of the 1:1 program.

SUNNYSIDE UNIFIED SCHOOL DISTRICT, ARIZONA

Sunnyside Unified School District (SUSD) is situated near Tucson, AZ and serves over 17,000 students at 22 schools, including 13 elementary schools and five middle schools.⁸⁹ SUSD's 1:1 program provides netbooks and laptops to all students in grades 4 – 12. SUSD rolled out its 1:1 program in multiple phases, beginning with fifth grade students in 2010 and expanding to seventh through tenth grade students over the next two years.⁹⁰

GOALS OF SUSD'S 1:1 PROGRAM

Sunnyside's 1:1 program includes a comprehensive set of goals, organized into six categories. These goals extend beyond outcomes for students and teachers to impacts on the community at large, as shown in Figure 3.2.

⁸⁷ Adapted from: Ibid.

⁸⁸ Ibid., pp. 23-24.

⁸⁹ "About Us." Sunnyside Unified School District. <http://www.susd12.org/about-us>

⁹⁰ "One-to-One 2.0." Op. Cit., p. 7.

Figure 3.2: Program Goals, SUSD 1:1 Initiative

GOAL CATEGORY	GOALS
Student Achievement	• Increase student engagement across all content areas • Improve student proficiency on state standardized tests • Empower students with anytime, anywhere learning
Graduation and Career	• Continue to reduce the dropout rates and improve promotion and graduation rates • Enhance the college readiness program
21 st Century Readiness for Every Student	• Increase student's technology skills • Develop and promote 21st Century skills and global awareness in our students • Triple students access to technology within three years • Increase student proficiency on the Arizona and National Educational Technology Standards
21 st Century Skills for Teachers	• Enhance teacher proficiency in the National Education Technology Standards (NETS) • Transform how teachers use technology to teach, manage resources, and collaborate with colleagues • Increase the integration of technology in daily lessons and how we conduct business • Promote and increase Project Based Learning opportunities for all students • Increase opportunities for professional development that are self-directed and measurable • Increase teacher proficiency in the use of assessment data as it relates to technology and instruction
Community Transformation and Economic Development	• Continue our district transformation efforts: from dropout factory to tech-savvy district • Transform Sunnyside's image into a 21st Century Ready community of learners • Align our One-to-One Computing Initiative with our new marketing efforts to enhance the districts image in our community, the state and the nation. • Continue to align our One-to-One Computing Initiative with our Economic Development Plan
Community and Family Engagement	• Bridge the digital divide in our community with respect to Internet access and technology • Increase Internet access and use in our community • Increase and enhance our schools community's and business community's support to ensure sustainability of the One-to-One Computing Program over the next 10 years • Improve parent / teacher communication through a more structured use of Parent Connect • Provide enhanced opportunities for parental engagement through technology

Source: "Program Goals" Sunnyside Unified School District.⁹¹

As professional development for teachers is a central goal of SUSD's 1:1 program, the district has established both procedures for providing professional development and

⁹¹ "Program Goals." Op. Cit.

benchmarks for assessing teachers' proficiency with 1:1 computing in the classroom. Professional development goals for teachers have progressed "from [their] initial focus on how to operate digital technology to treating the technology as a means to enhancing instruction;"⁹² that is, **SUSD has moved from knowledge-based to practice-based goals for teachers as the 1:1 program has evolved.** The district now uses the WayFind Teacher Assessment⁹³ to assess teachers' technology proficiency and knowledge of 21st Century teaching skills, and monitors trends in these scores across schools.⁹⁴

EVALUATION METHODS USED

SUSD employs multiple techniques to evaluate its 1:1 program, which have been further developed along with the 1:1 program itself. Initial stages of the evaluation were informal and qualitative in nature, consisting mainly of classroom observations conducted by 1:1 program's director Pam Betten. These observations sought to establish whether teachers are using 1:1 devices to encourage "student-driven use of technology;" in short, Betten's site visits are designed to determine "which teachers 'get it,' and which are still adapting—to giving up control of the classroom, to letting the students take charge of their learning, and to digital technology itself."⁹⁵

In order to monitor more long-term, quantitative impacts of the program, such as those concerning student achievement, SUSD has secured funding for an external evaluation. This evaluation will focus on large-scale trends in the effects of the 1:1 program on student outcomes, and will use "such measures as statewide tests, grade-level mastery, Advanced Placement test scores, and college credits accumulated during high school. The [evaluation] will also look at what happens to students after they graduate, taking stock of college enrollment, college graduation, and professional careers."⁹⁶

⁹² Pratt, Op. Cit.

⁹³ See "WayFind Teacher Assessment." Learning.com. <http://www.learning.com/wayfind-teacher-assessment/>

⁹⁴ Isquierdo, M. "Every Student a Success." p. 46. http://www.susd12.org/sites/default/files/One-to-One_032212.pdf

⁹⁵ Pratt, Op. Cit.

⁹⁶ Ibid.

APPENDIX A: EVALUATION PRINCIPLES FOR EDUCATIONAL TECHNOLOGY PROGRAMS

These descriptions of guiding principles for evaluating educational technology programs are based on the framework developed by Barbara Means and Geneva Haertel,⁹⁷ and are taken from a 2004 article by Alejandra Bonifaz and Andrew Zucker of the Education Development Center, Inc.⁹⁸

Look for critical influences at multiple levels of the education system: There are many influences on teachers' and students' uses of technology. Study those influences that are most important in your context (state or district policies, school leadership, demographics of schools, teachers' training and expertise, etc.). Don't try to do it all.

Figure out what you're especially trying to teach, and measure that: If you study student achievement, focus on areas that are high priorities in the laptop program. Even then, the evaluation field is likely to require the development of more good assessments of student learning—for example, to measure students' higher order thinking, problem solving, and technology proficiency.

Look for ways to evaluate the long-term costs and benefits of the technology infrastructure: Both costs and benefits are difficult to quantify, but understanding them is important. Little has been written about the costs of laptop programs, and about the relationship of those costs to the benefits.

Let the research question drive the choice of method: There are too many interesting questions to ask about laptop programs for you to study them all. Depending on the research questions you choose, surveys, case studies, experiments, or other methods may be appropriate. No one methodology is best for answering all questions.

⁹⁷ Means and Haertel, Op. Cit.

⁹⁸ Bonifaz and Zucker, Op. Cit., p. 12.

APPENDIX B: EVALUATION QUESTIONS: TEACHER-CENTERED GOALS

The Intel Corporation's 1:1 evaluation toolkit provides the following set of questions that can be used to guide teachers' progress towards knowledge and practice goals for implementing 1:1 computing.⁹⁹

1. Relationship of implementing 1:1 computing and changes in teachers' knowledge of pedagogy and technology integration
a. How has the introduction of 1:1 computing changed/influenced teachers' knowledge of technology and pedagogy related to technology integration.
2. Relationship of implementing 1:1 computing and teachers' skill in lesson planning
a. Are teachers using technology resources for lesson planning?
b. In what ways have teachers integrated online and web-based resources into lesson plans?
c. How have teachers used technology resources to develop project-based and inquiry-based learning activities?
3. Relationship of implementing 1:1 computing strategies and teachers' use of effective instructional strategies
a. How have teachers integrated 1:1 computing strategies into lesson delivery?
b. In what ways have teachers used 1:1 computing strategies to support project-based and inquiry-based learning activities?
c. How have teachers used online and web-based resources in classroom activities?
d. How have teachers used technology-supported assessment and communication/feedback strategies with students?
4. Relationship of implementing 1:1 computing strategies with changes in teachers' attitudes towards technology
a. How do teachers' experiences with 1:1 computing strategies change their values/perceptions toward technology?
b. How do teachers' experiences with 1:1 computing strategies influence comfort and competence in using technology in the classroom?
5. Relationship of implementing 1:1 computing with changes in teachers' technology skill and competence
a. What is the relationship between teachers' technology skills and their implementation of 1:1 computing strategies?
b. How has the quality of classroom instruction changed as a function of using 1:1 computing programs in the classroom?
6. Relationship of implementing 1:1 computing strategies and technology-supported classroom practices and pedagogy
a. Are students and teachers engaged in technology-supported learning activities?
b. Are students and teachers engaged in technology-supported assessment, feedback, and communication practices?
c. How does the implementation of 1:1 computing strategies influence the quality of instructional interactions in the classroom and support real-world applications, opportunities for problem-solving and critical thinking, collaboration and communication, and the development of digital literacy?
d. How is the development of classroom community supported by 1:1 computing programs?

⁹⁹ "1:1 Evaluation Toolkit." Op. Cit., pp. 121-122.

APPENDIX C: EXPERIENCE SAMPLING PROTOCOL

Here Hanover Research provides the protocol and survey questions for the experience sampling method used in St. Helena Unified School District's 1:1 program evaluation (reviewed above).¹⁰⁰

All students were asked to “freeze” their activities and to take a quick Google Form “snapshot” of their current experience. Students were asked:

What are you working on right now?

- Browsing the Internet
- Researching the web
- Writing an email
- Writing a document
- Using a spreadsheet
- Creating an image
- Creating a video or animation
- Working collaboratively
- Other

What are you thinking about?

In addition, students were then asked to score the 10 questions below using a five-point Likert scale.

Questions:

- How engaged were you in the activity?
 - Rate your engagement on a scale of 1 to 5 (5 = extremely engaged, 1= not engaged at all).
- Did you enjoy the activity?
 - Rate your enjoyment on a scale of 1 to 5 (5 = extremely enjoyed, 1= did not enjoy at all).
- How challenging was the class activity?
 - Rate the level of challenge on a scale of 1 to 5 (5 = extremely challenging, 1= not challenging at all).

¹⁰⁰ “SHUSD 1:1 Chromebook Pilot Evaluation Fall 2013.” p. 29.

- How skilled were you at the class activity?
 - Rate your ability to do the activity on a scale of 1 to 5 (5 = extremely skilled, 1= not skilled at all).
- Was the activity meaningful to you?
 - Rate the level of meaningfulness on a scale of 1 to 5 (5 = extremely meaningful, 1= not meaningful at all).
- How much were you concentrating?
 - Rate your level of concentration on a scale of 1 to 5 (5 = extremely high, 1= not concentrating at all).
- Were you learning anything or getting better at something?
 - Yes or no
- Did you feel nervous?
 - Rate your level of nervousness on a scale of 1 to 5 (5 = extremely nervous, 1= not nervous at all).
- Did you have a choice in picking this activity?
 - Yes or no

APPENDIX D: SAMPLE TEACHER AND STUDENT SURVEY QUESTIONS

Below are the survey questions distributed to teachers and students in St. Helena Unified School District's 1:1 program evaluation (profiled above).¹⁰¹

1. How much did having 1:1 Chromebooks benefit learning?
 - A great deal
 - Quite a bit
 - Somewhat
 - Very little
 - Not at all
2. How did having 1:1 Chromebooks allow you to connect to more resources and content?
 - A great deal
 - Quite a bit
 - Somewhat
 - Very little
 - Not at al
3. How much did having 1:1 Chromebooks change your learning experience?
 - A great deal
 - Quite a bit
 - Somewhat
 - Very little
 - Not at al
4. What is your position about going 1:1?
 - Strongly favor
 - Somewhat favor
 - Neutral
 - Somewhat oppose
 - Strongly oppose

¹⁰¹ "SHUSD 1:1 Chromebook Pilot Evaluation Fall 2013." pp. 30-31.

5. Did 1:1 Chromebooks meet your expectations (compare your feelings about 1:1 Chromebooks before and after the pilot)?

- Far exceeds my expectations
- Exceeds my expectations
- Meets my expectations
- Meets some of my expectations
- Does not meet my expectations

6. Did 1:1 Chromebooks create a distraction?

- Not at all
- Very little
- Somewhat
- Quite a bit
- A Great deal

7. Do you think Chromebooks are easy to use?

- Very easy to use
- Easy to use
- Same as other devices
- Hard to use
- Very hard to use

8. Which device do you prefer to help you learn?

- Chromebook
- Regular laptop
- Desktop computer
- Smart Phone or iPod
- No preference
- Other _____

9. If you were to Tweet about your Chromebook experience, what would you say?

10. Suggestions for making the Chromebook experience better for students

11. I am a...

- Student
- Teacher

PROJECT EVALUATION FORM

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