BYRAM HILLS CENTRAL SCHOOL DISTRICT
ARMONK, NEW YORK

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Title of Project: *An implementation study: The impact of a wireless network on curriculum, instruction, student learning, and professional development.*

Year: 2013-2014

School/Grade: District-wide/K-12

SUMMARY OF *INVESTIGATORS OF PRACTICE* ACTION RESEARCH PROJECT

Context

The fast evolution of technology requires constant evaluation and reflection on the impact of technology resources and tools in classrooms and on student learning. Educators recognize that students entering our schools today are *digital natives*; that is, current students do not know what life was like before desktop computers, cell phones, and the internet. For example, 71% of students in grades 3-5 have access to the Internet at home and use it for help with school work and 41% have personal tablets (Green & Evans, 2013); 80% of high school students report having smart phones (Project Tomorrow, 2013.) Growing up in the 21st Century technology environment creates a new kind of learner. As educators, we must address "the new needs of modern learners in entirely new ways" (Richardson, 2013, p. 12.) As we seek to advance high quality teaching and learning at Byram Hills in order to develop *lifelong learners* "to become productive and responsible citizens of the twenty-first century" (Byram Hills Mission Statement), we must study and plan for new approaches that support the current state of technology, specifically, the role of wireless technology and mobile learning devices. Since "mobile devices are gateways to endless learning, collaboration, and productivity fostered by the Internet" (Johnson, et al., 2013, p. 3), we are positioned to reflect upon past uses of technology as we assess current needs and develop future plans.

Our 2012 Technology Study identified many current projects that the technology department manages, including: 28 initiatives and activities from instructional technology; 13 from network/infrastructure/equipment; 26 that involve database management and reporting; and 19 from within the administrative/business operations support category. Furthermore, we identified

21 future or pending initiatives and activities; wireless network and mobile learning devices comprised two of the 21 future projects. The importance of mobile learning with today's digital natives moved this initiative to the top of our priorities.

As a district leader, I recognize the many competing demands placed upon the technology department and the faculty. At the same time, the digital natives demand new ways of learning. As educators, "we must start long-term, broad, inclusive conversations about what teaching, learning, and being educated mean in light of the new technologies" (Richardson, 2013, p. 14.) To better understand the needs, the benefits, and the challenges of using wireless network devices in Byram Hills, the District funded a pilot study in anticipation of expanding the wireless network districtwide beyond 2014. Thus, the research question that drove this study was: *In what ways can a wireless network enhance instructional practices and student learning?*

Action Plan

During the 2013-2014 school year the Byram Hills Central School District conducted a wireless pilot project following a yearlong infrastructure upgrade that strengthened the stability and speed of the network. A committee consisting of administrators and teachers developed an application process with three priorities for the wireless projects:

1. Focus on important district, building, or department initiatives or goals;
2. Enhance teacher learning and improvement in student learning; and
3. Integrate into routine classroom practices.

The application process was open to any teacher in the district. The applications were reviewed and evaluated by the committee. As the District considered future wireless network applications districtwide, the committee was charged to determine the effectiveness of the pilot wireless projects to gain a deeper understanding in the following areas:

1. The impact on curriculum and instructional practices;
2. The impact on student learning in the target area of the project;
3. The professional development needs of the teachers; and
4. The stability of the wireless network and the functionality of the technology hardware and software.

Furthermore, the committee used the SAMR model to evaluate the applications. SAMR includes four levels of technology integration: *Substitute, Augment, Modify, Redefine*. We evaluated the projects to determine the extent to which they addressed the "transformational" components of SAMR, which include the *Modify* and *Redefine* components. (See Appendix A for the full SAMR model.) The application process required teachers to address ways in which the project would meet the qualities of transformational technology learning.

The District accepted four wireless pilot projects out of six applications for implementation during the 2013-2014 school year. The approved projects included:

1. Two kindergarten classrooms (one general education and one special education.)
2. Three first grade classrooms.
3. Middle school physical education teachers in grades 6 - 8.
4. The Authentic Science Research program in grades 10 - 12.

The Director of Technology reviewed the plans, met with teachers, purchased the devices and equipment, and installed the necessary wireless routers. He provided ongoing support early in the implementation process as teachers began working with the new devices. The Director of Technology reviewed various technology resources to gather information on two key areas: the infrastructure of the wireless network and the devices. We chose iPads for three of the projects, kindergarten, first grade and middle school physical education. The high school project used Dell laptop computers and included a Bring Your Own Technology (BYOT) component. These devices were chosen based on the degree to which they met the needs of the projects and the potential for long term use.

During the year, the Director of Technology and the Assistant Superintendent visited pilot classrooms to observe implementation of the wireless devices. Also, the Assistant Superintendent interviewed students and teachers, conducted a survey of all participating teachers, and held a focus group with each pilot team. (See Appendix B and Appendix C for focus group and survey questions.) The pilot wireless projects were evaluated using various data sources, including: a) classroom observations, b) conversations with teachers, c) conversations with students, d) survey of all pilot teachers, e) focus groups with teacher teams, and f) interactions with the Director of Technology and building administration.

Literature Review

The assistant superintendent reviewed various sources of literature from the point of view of student learning, teacher learning, and the district perspective. A brief summary of the literature includes the following important notes:

Student learning

The current model of technology integration is not concerned with "layering expensive technology on top of the traditional curriculum. Instead, it's about addressing the new needs of modern learners in entirely new ways." (Richardson, 2013, p. 12)

"Using computers for their own sake adds nothing to the learning environment. But weaving technology into the culture of your classroom ensures that the technology does not become a distraction." (Dappolone, 2013, p. 72)

"If we want students to think critically and independently, then it's important to give them opportunities to solve challenging problems in new situations." (Green & Evans, 2013, p. 13)

"While widespread improvements in technology and communications have modernized some aspects of the education system, mobile learning has the capacity to accelerate and compound technology's impact by joining massive amounts of information with a student's imagination. Wireless technology... enables, empowers, and engages learning in ways that transform the learning environment for students inside and outside of school." (West, 2013, pp. 1-7)

Teacher learning

Because the internet and technology have created new ways for educators to collaborate, communicate, and learn, "teachers must be colearners with kids, expert at asking great, open-ended questions and modeling the learning process required to answer those questions. Teachers should be master learners in the classroom." (Richardson, 2013, p. 13)

"Teachers are crucial to the success of any school reform or learning innovation… Like any other profession, teachers need training opportunities that demonstrate best practices and ways to take full advantage of educational innovations. They require instruction on how to use mobile technology and how it can make their lives easier while also engaging students." (West, 2013, p. 8)

"Using technology will place new, unfamiliar, and often substantial demands on your prep time, but in many cases, after an initial investment of time, the resources are available to you forever and require little time to maintain." (Dappolone, 2013, p. 69)

"Digital technology helps teachers think about new classroom models. Students can take more responsibility for their own learning, while teachers can focus on more advanced problem-solving and building critical skills for those in their classrooms. The result will be an

educational collaboration that is more satisfying for students and teachers." (West, 2013, p. 8)

District perspective

"All too often, when schools mandate the use of a specific technology, teachers are left without the tools (and often skills) to effectively integrate the new capabilities into their teaching methods. The results are that the new investments are underutilized, not used at all, or used in a way that mimics an old process rather than innovating new processes that may be more engaging for students." (Johnson, et al., 2013, p. 9)

"We must help teachers learn how to use technology to improve productivity and student outcomes… Unless they believe technology improves instruction, teachers are not likely to adopt the new approach and deploy it in ways that will be effective." (West, 2013, p. 13)

Results

From the collected information throughout the year, I reviewed the data several times to look for common themes and patterns. I organized the data by category and summarized the results below:

A. *Impact on curriculum and instruction.* As a result of the technology, 60% of the pilot teachers reported that they made positive changes to curriculum; 70% reported positive changes to instruction.

   a. Differentiation. Three fo the four groups explicitly stated that the technology provided opportunities to differentiate instruction for students. Some details include:

      i. vary the depth of learning based on student readiness, such as writing readiness.

      ii. students could use voice and text during the writing process, which allowed struggling writers an opportunity to "tell" stories as they developed writing skills.

      iii. instruction could vary for different learners during a given lesson because of the flexible use of the technology tools.

   b. Curriculum enhancement. The two elementary groups noted that the curriculum was enriched because of the technology. Specific comments include:

      i. more depth of content was taught, specifically with problem solving and critical thinking.

      ii. content beyond the grade level expectations were taught because some apps allowed students to accelerate independently and the apps introduced

the information in an accessible way for young learners. (Specific content noted included 3D shapes and introduction to algebraic thinking in the first grade, and writing in kindergarten.)

iii. Two groups observed that students demonstrated the transfer of learning to new situations. This was noted in both math and writing.

c. Collaboration. Two of the four groups noted positive improvements in student collaboration through increased opportunities and new ways for collaboration.

d. Feedback. The technology allowed new ways for teachers to provide feedback to students. Some teachers were able to use iPad apps to see more student work and provide feedback. Students were able to record themselves, so the teacher could give feedback on these "live" presentations. In the kindergarten project, the students were able to "publish" their written work frequently, which allowed opportunities for peer review as well as teacher feedback. The PE teachers noted the use of video recording of skills to provide feedback to students on performance.

e. Self-assessment. Two of the four groups noted an increase in student self-assessment. For example, students could voice record a story first, then write the story, and then listen and read at the same time to self correct and edit the written story. Also, students would record themselves during "readers theater," then self assess their performance afterwards. One teacher noted, "The students were able to see themselves and evaluate their reading skills."

f. Usage. Three of the four groups reported using the mobile learning devices on a daily basis, thus, the technology became integrated into classroom instructional routines.

B. *Impact on student learning*. 80% of the teachers reported an increase in student knowledge knowledge and skills as a result of the technology.

a. Motivating. Overwhelmingly, the teachers noted a direct increase in student motivation as a result of this technology. One teacher noted that "...their creativity was sparked…" as the students worked together to solve problems.

b. Feedback. The technology increased student feedback in two ways. First, teachers could provide more feedback to students on assignments, and thus, improved learning as a result. Second, teachers were able to obtain useful feedback from students about their learning due to the use of the technology applications. We know that feedback is the singularly most important method to improve student achievement (Hattie, 2009.)

c. Improved their phonetic spelling. The kindergarten teachers noted specifically that they saw an increase in students' phonetic spelling as well as improved keyboarding skills.

d. Ownership of learning. Two groups noted that students took ownership of learning, and this was observed during classroom visits as well. One teacher stated, "The fact that kindergarten students are able to independently publish their work digitally still amazes me!" Another teacher noted that a particular app on the iPad taught "persistence" as students wanted to improve performance.

C. *Professional development needs*. 80% of the pilot teachers reported that they wanted more professional development.

a. Training. Two of the four groups noted that they had sufficient professional development, where one of these group said they used their Learning Communities time to collaborate, research, learn and try new apps for use in the classroom. Overall, the groups wanted more training in: using the devices; evaluating apps; and in seeing examples of this technology in classrooms. One teacher noted, "I would love to learn about how other schools are implementing this technology and what apps they have found most meaningful."

b. Management. One group wanted to know ways to manage the data collected from certain applications, particularly large video files. Another group noted that they used a lot of time searching for apps and determining ways to manage the use of devices in the classroom.

c. Expectations. A teacher showed optimism by stating, "As we become more proficient users and are able to share with others who are using iPads we will become more confident and competent."

D. *Stability of wireless network and appropriateness of hardware and software*. 40% of the teachers agreed that the network was stable; 80% agreed that the hardware and software functioned properly.

a. Authentication using the network. All four groups noted that using the wireless network was cumbersome due to authentication issues. This occurred when the network idled, which caused the user to have to login repeatedly. This resulted in loss of information or time on task. One teacher noted, "We had to authenticate repeatedly, and sometimes a teacher had to authenticate, which interrupted instruction."

b. Software and apps. All groups utilized software and apps that enhance the curriculum or instruction. And each group noted that they wanted more examples of effective software and apps from other teachers. One group noted that they could use a rubric or evaluation tool for apps. Two of the four groups noted that

the management of apps needed to be streamlined. Two groups said that the inability to print or sometimes email from apps was a downside. Some of the successful apps used include: StoryKit; Tunetasktic; Popplet; Dragon Box; Slate Math; iMuscle; Coach's Eye.

c. Hardware. The three groups that used iPads noted the ease in which students used the hardware and the software associated with the tablet. The PE group noted that the large tablet with a heavy case was cumbersome for the physical education classroom; smaller devices would better meet their needs.
One teacher noted that her classroom would benefit by having more devices, so all students in the classroom could work in pairs at the same time.

Implications

Several key implications on the District's roll-out of a wireless network with mobile learning emerged from this yearlong study and from the literature. They are:

1. Train teachers. The success of any new initiative lies in the skills of those implementing it. Teacher training must center on these areas: a) developing the skills and knowledge of the new technology, including managing apps and using new devices. Teachers would benefit from using an evaluation tool for apps and software; b) connecting the new skills to innovative classroom practices. Teachers need to know the "vision" for technology use in the classroom. Also, they need to see examples of how a wireless environment can transform student learning through new instructional approaches; and c) managing the student information acquired from new technologies. Large amounts of data can be collected from some technology tools, including information from formative tools, from video, audio, and photos. Teachers need ways to manage and use this data.

2. Model success. Teachers found many uses that deepened the curriculum and provided ways to differentiate instruction. When considering uses of a wireless network and mobile devices, frameworks and examples must be provided to teachers so they can see the various ways in which these tools can be used in the instructional design process to enhance student learning. Provide opportunities for ongoing teacher collaboration, such as, through cross grade level and interdisciplinary teams, and through collaboration with administrators. Furthermore, the administrators and technology teachers can model successful practices, and thus, must be included in the training as noted in #1 above.

3. Emphasize student learning. Technology should be used to deepen student learning of the content and expose them to more practice with skills. Some examples of technology use include: differentiating the content, processes, and product; providing feedback to students and getting feedback from students; and providing ways to create and share knowledge. To this end, a framework for using technology may help teachers, such as the SAMR or other relevant models and software evaluation tools. In the end, what

matters is how well students learn, so all technology tools must be evaluated through the lens of student learning.

4. Provide easy network access. To maximize the effectiveness and efficiency of mobile devices, the network must be easy to access and be stable. Classtime is a precious commodity for teachers, so the technology must be easy to access on demand by teachers and students to maximize time on task. The "authentication" issue described above is being addressed, for example.

5. Seek feedback. As teachers implement new software, hardware, and instructional activities using mobile learning and a wireless network, they benefit by seeking student feedback on the effectiveness of such tasks and devices. Teachers can make adjustments along the way to be certain the new tasks and technology benefit student learning. Furthermore, district and building administrators also benefit by seeking feedback from teachers and students on the use of new technologies in order to make adjustments in "real time." Such adjustments could involve professional development, network access, and additional resources.

Many benefits exist to the implementation of mobile learning devices and a wireless network. Maximizing the benefits will involve ongoing evaluation and communication between administrators, teachers and students. This new technology in classrooms has the potential to broaden and deepen the curriculum, motivate students, and create more opportunities to deepen student learning. The District is committed to making this happen.

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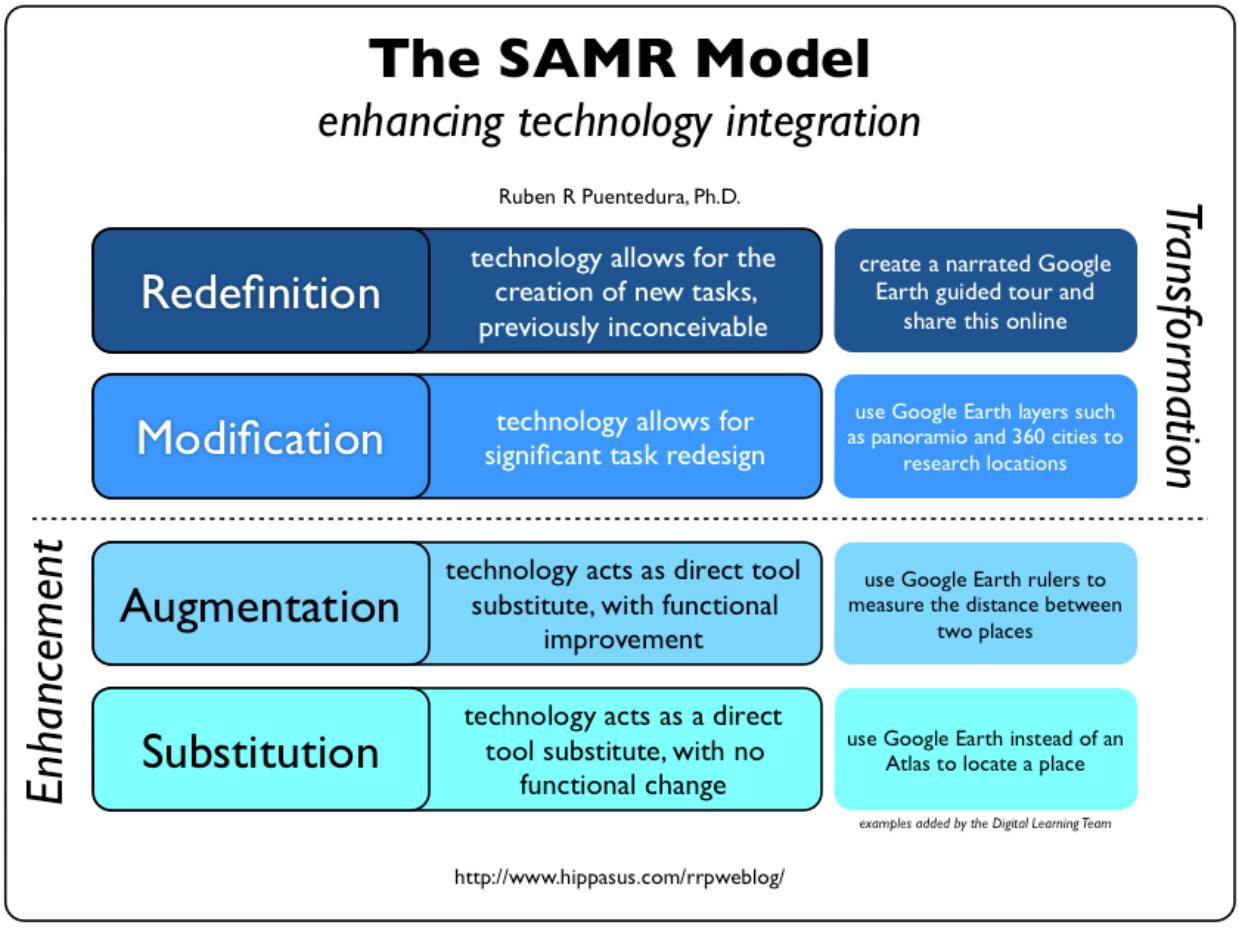
Appendix A


The SAMR Model
enhancing technology integration
Ruben R Puentedura, Ph.D.
Redefinition
technology allows for the creation of new tasks, previously inconceivable
create a narrated Google Earth guided tour and share this online
Modification
technology allows for significant task redesign
use Google Earth layers such as panoramio and 360 cities to research locations
Augmentation
technology acts as direct tool substitute, with functional improvement
use Google Earth rulers to measure the distance between two places
Substitution
technology acts as a direct tool substitute, with no functional change
use Google Earth instead of an Atlas to locate a place
examples added by the Digital Learning Team
Transformation
Enhancement
http://www.hippasus.com/rrpweblog/

Appendix B

Interview questions

1) Impact on curriculum and instructional practices.
    a) What are the objectives of this project?
    b) What are the outcomes of this project?
    c) To what degree were the outcomes met?
    d) What curricular changes occurred as a result of this project?
    e) What instructional changes occurred as a result of this project?
    f) What could you do now that you could not do without the technology?

2) Impact on student learning.
    a) What are the student learning goals of this project?
    b) How are the student learning goals measured?
    c) To what extent did students increase their knowledge and skills?

3) Professional development needs.
    a) What professional development was provided to teachers?
    b) Was the training appropriate and sufficient?
    c) What additional training, if any, would be necessary to ensure high implementation?
    d) How would you like this training delivered?

4) Implementation.
    a) To what extent was the project implemented as designed?
    b) In what ways was the plan appropriate or not appropriate?
    c) How would the plan be revised for future implementation?

5) Stability of the wireless network and technology.
    a) To what degree was the wireless network reliable?
    b) To what extent did the hardware and software serve the plan's purpose?
    c) Was the hardware and software reliable?

Appendix C

Survey questions

Responses on statements below were recorded on a 1 (strongly disagree) to 5 strongly agree) scale. Other questions allowed for free response.

A. Curriculum & Instruction

1. The objectives of my project were met? (responses from 0% to 100%)
2. I made positive changes to the curriculum as a result of what the technology provided.
3. I made positive changes to instructional methods as a result of what the technology provided.
4. Describe curricular or instructional changes you made, if any.
5. What were you able to do or accomplish that you were unable to do without the technology?

B. Impact on students

1. The student learning goals I set with this project were met by the students.
2. Students' knowledge and skills increased more with this technology available than it has in the past without it.
3. In what ways did the technology enhance student learning?

C. Teacher PD

1. I received adequate professional development to implement this technology.
2. The professional development I received was high quality.
3. Describe additional professional development you need to be successful with implementing wireless technology.

D. Stability of Network and Technology

1. The wireless network was reliable and stable.
2. The hardware devices functioned properly and reliably.
3. Describe any concerns or issue you had with the network or the devices.

E. Additional Information

1. Feel free to provide any additional information about the implementation of the wireless project.