Collaboration and Research in International Schools

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Introduction

“It is hard to think about computers of the future without projecting onto them the properties and the limitations of those we think we know today. And nowhere is this more true than in imagining how computers can enter the world of education.”

- Seymour Papert, Mindstorms, 1980

Like all human endeavor, technology provides the limit of our capabilities in education. The invention and subsequent proliferation of new technologies across informal and formal educational systems dates back thousands of years. With the introduction and widespread use of each new technology, educational opportunities and affordances have advanced accordingly. Cuneiforms, abacuses, writing slates, paper, books, chalkboards, and even transparency projectors all represent technologies that were adapted for advancing schooling and education. In just the last few decades, computer-based technologies have transformed the personal and professional lives for large segments of the world’s population. Many parents, educators, and policy makers see great potential in leveraging tools like laptops, tablets, and smartphones in the classrooms of the world.

After working with Jean Piaget, mathematician and AI pioneer Seymour Papert was perhaps the first to imagine the potential of providing children individual computers for learning math, and ultimately about learning itself. Seymour’s experiments and wide-eyed observations are evident in our opening quote and further documented in his appropriately titled classic: Mindstorms. In 1989, Ladies Methodist College in Australia became the world’s first school to provide each of their grade 5-12 students their own laptop computers. Since then, 1-to-1 student computing programs (whereby each student has their own Internet-connected computing device in school) have captured the attention of educators and policy makers worldwide. To many, 1-to-1 student computing offers a new opportunity for evolving and redefining traditional teaching and learning practices in an age-old profession. Despite this, only a few institutions have made the necessary investments in resources, infrastructure, and ideologies to provide sustained opportunities for 1-to-1 computing. As computer-based technology grows more pervasive in the world population and costs of devices and ownership lower, the number of schools and classrooms with 1-to-1 programs will undoubtedly grow. Moreover, how can schools that have already made such investments document and understand the impact of technology in an ever-changing school landscape?
As an industry traditionally defined by the No. 2 pencil and bubble-scan technology of the 1930s, computer-based technologies have also transformed educational assessment and measurement in recent years. Online surveys, computer-adaptive assessments, learner analytics, and dynamic data visualizations allow for more efficient and accurate collection, analyses, and reporting of data than ever before. From the researchers’ perspective, technology-rich school environments like 1-to-1 programs afford numerous technical and practical advantages (Bebell, O’Dwyer, Russell, & Hoffman; 2010). For example, recent studies have leveraged online data collection and reporting tools to provide quicker and more detailed program results to school leadership and policy makers. Computer adaptive surveys take less time to complete and provide richer and more detailed information. This resulting data can be shared efficiently through dynamic web-based visualization tools that provide educators and school leaders real-time access to analytic tools for exploring their own data and viewing results.

These advantages are especially noteworthy given the growing demand of school leaders and policy makers to make use of research-based evidence and data in school policies and decision-making.

A short history of the International Research Collaborative

The American School of Bombay first launched a student 1-to-1 program in 2001 across all fifth through twelfth grade classrooms. During the 2009-2010 school year, the American School of Bombay partnered with an educational researcher to collaboratively design data collection instruments to measure ASB teachers’ and students’ access, use, and beliefs around educational technology. The goal was to provide the school’s leaders and IT decision-makers with the tools, techniques, and data for assessing the impact of the 1-to-1 program. Focused on the use of technology in and outside of the classroom, these customized web-based teacher and student surveys have provided the school with valuable empirical data on the frequency and variety of technology integration practices amongst staff and students across the school. The data collected and analyzed annually has helped the school to continue to maximize their technology investments, better plan and strategize to evolve their 1-to-1 program, and evaluate the efficacy and impact of 1-to-1 access on student learning and achievement.

The first year of survey data collection provided ASB with a descriptive analyses of where and how ASB teachers and students used technology across grade levels and subject areas. Subsequent data from the following years provided longitudinal results showing how and where practices and beliefs were evolving across the ASB community. With ASB’s increased interest and capacity for using research and data, the technology survey results were found to be complementary to the school’s other inquiry methods (observations, journals, etc.) and valuable for reflection.

Over the past decade of 1-to-1 student computing, ASB has learned several valuable lessons and have shared these with other schools to avoid pitfalls as they embark on their own 1-to-1 implementations. Indeed, one of ASB’s goals is to guide other international schools as they navigate the 1-to-1 journey. While researching their own program, the school’s Research and Development (R&D) department realized that there wasn’t any data available for international schools to compare progress with each other or understand the unique issues and cultures of international schools. Most of the 1-to-1 research data and comparative analysis had been based in US public schools which highlighted the need for a research partnership among international schools. The R&D department at ASB launched the International Research Collaborative in Spring 2012 with Dr. Damian Bebell as the 1-to-1 educational research partner. In a few years we see the scope of the Research Collaborative expanding to focus on specific areas of technology and non-technology practices – e.g. studying online and blended learning approaches and their impact on teaching and learning, or studying project-based learning.
Five international schools with mature 1-to-1 student computing programs were invited to join the Collaborative in 2012. Each participating school was given full access, instructions, and support to customized research and measurement tools to systematically collect, quantify, and interpret the perspectives of students, teaching staff, and parents through a series of fully customizable state-of-the-art surveys. For participating schools, such results provide a general audit of teacher and student access, beliefs, and practices (with and without technology) that support learning. To provide a broader perspective and lens, schools are also able to compare their own results to other international schools in the Collaborative.

The Collaborative is designed to foster reflection and increase the quality of discourse in each school’s unique context and setting. As such, each school brings its own unique agenda, questions, and perspective to the IRC. Common to each partner school is a goal to use their data to address and answer a broad range of potential questions:

- How do you show the efficacy of your school’s educational technology investments?
- How do you quantify the use and value of your school’s resources?
- How do you determine if your implementation model for student computing is benefiting all classes and students equally?
- How do you determine if your investments in educational technology are helping to evolve teaching and learning practices in your classrooms?
- How do you know if your school is meeting student and parent expectations for the use of educational technology in school?
- How do the practices of your teachers and students compare to teachers and students at other International schools?

Today, there are 20 schools participating in the IRC Technology Use and Beliefs study:

| Cohort 1 Schools (From Fall 2012) | American School of Bombay  
Cairo American College  
Frankfurt International School  
Graded School of Sao Paulo  
Singapore American School  
Zurich International School |
|---|---|
| Cohort 2 Schools (From Fall 2013) | American Community School of Abu Dhabi  
American Community School, Amman Jordan  
American International School of Budapest  
American International School, Chennai  
French American International School  
Lakefield College School, Canada  
The Avenues School- New York, NY  
United Nations International School (UNIS) Hanoi |
| Cohort 3 Schools (From Fall 2014) | American Embassy School, New Delhi  
International School Manila  
Knox Grammar School of Australia  
Nexus International School, Putrajaya  
Qatar Academy of Doha  
Robert College of Istanbul |
Annual online student and teacher surveys are the primary data source of the IRC’s Technology Use and Belief Study. As such, both the teacher and student surveys were carefully developed to empirically measure:

- access (and perceived access) to technology at school,
- use of technology in school,
- frequency of different teaching and learning practices in school,
- attitudes and beliefs toward technology and learning, and
- access and use of technology outside of school

Building on over a decade of research and development, much of the IRC survey content employs dynamic and innovative item types and represents the state-of-the-art in practices in quantitative data collection (Bebell, O’Dwyer, Russell, & Hoffman; 2010). Since Cohort 2 and 3 schools have not collected data yet, the remainder of this report provides some example snapshots of results and interpretations from the six Cohort 1 schools in Spring 2013. Using this available data, we can begin to reflect on how these results can be used to address research questions. Although provided here primarily for illustrative purposes, the following research questions were informed using this first year IRC data:

- Which subjects are more closely integrated with student technology use?
- How does student technology use differ across Elementary, Middle and High School?
- How often do students use technology for different tasks in school?
- Are there grade level differences within schools and subjects in how students and teachers use technology?
- Is there a relationship between students’ Facebook use and their distractibility in class?

The accompanying text highlights selected first year study results. It also shares how schools are beginning to use this information for reflection and ultimately to evolve teaching, learning, and educational technology practices. Before exploring this data, Figure 1 first details the maturity of each school’s 1-to-1 program across individual grade levels.

Figure 1: Maturity of 1-to-1 student computing programs across IRC Tech Study Cohort 1 schools
Before going any further, even this summary data provides some opportunity for reflection. First, it is apparent that a wide range of 1-to-1 experience exists across the IRC schools with ASB in their eleventh year of implementation and other schools across a range of years. Second, most schools typically focused their 1-to-1 programs on their upper grades, with ASB as the only Cohort 1 school with a school-wide 1-to-1 initiative. Third, looking at the relative maturity of the 1-to-1 programs across grade levels, two implementation patterns are apparent. ASB, SAS, and ZIS launched their 1-to-1 program across multiple grade levels simultaneously while CAC, FIS, and Graded, launched their programs with just one (or two) grade levels and expanded annually. As the IRC tech study grows to include a wider range of school programs, device types, and implementation approaches, the resulting data may yield new insights about the particular challenges or benefits associated with different approaches.

What We Are Learning

In the remaining pages we highlight a tiny fraction of the range of first-year results that have been generated for formal IRC reports, presented at professional conferences, and explored formally and informally with each partner school. Space limitations prevent much more than a cursory summary of such myriad results. Although we hope the examples shared here are interesting and illuminative to a general audience, our purpose in sharing them is as much to demonstrate their potential and capacity for schools.

In short, the results presented here were culled from the 802 K-12 classroom teachers and the 5,127 grade 4-12 students who completed the Spring 2013 surveys across the six Cohort 1 schools. The overall teacher survey response rate was 80% while the student response rate was 77%. Given these response rates, we can be reasonably sure that the practices and sentiments reported represents the majority population of our partner schools.

In the following figures and tables, we report the frequency of different technology practices using a 0 to 180 point scale. This scale estimates the number of instructional school days in a typical school year, so that teachers’ and students’ survey responses were coded as Never = 0; A couple times a year = 2; Once every couple weeks = 18; At least every week = 36; A couple times a week = 72; Every day = 180. When examining individual survey respondents, such a scale conversion should be interpreted cautiously, but for quantifying use across large numbers of survey respondents, such an approach provides a more realistic representation of frequency.

In Figure 2 we introduce the Year 1 results by summarizing how frequently students from upper elementary (grade 4-5), middle school (grade 6-8), and high school (grades 9-12) reported using computer-based technology (i.e. tablets, laptops) in their different classes. Also presented in Figure 2 is students’ estimate of their teachers’ use of technology in these same classes.
Figure 2: Average number of days that student estimated teachers’ and students’ technology use across classes

Figure 2 summarizes a great deal of information from the perspective of over 5,100 students regarding how often they saw their teachers using technology in class and how often they themselves used technology in class. Figure 2 addresses which subjects are comparatively more closely integrated with student technology use. Specifically, Figure 2 shows the average number of days in the 2012/2013 school year that elementary, middle, and high school students reported their teachers and themselves using technology in class (0-180). Overall, the figure shows that teacher use of technology was more frequent than student use in each surveyed school level, with the majority of students reporting that their teachers used technology everyday or nearly everyday in most subjects. Looking across all of the school settings, middle school teachers and Social Studies/History/Geography teachers were the most frequent users of technology in class.

Across all of the schools, students’ use of technology varied by subject area and by school level. Overall, Social Studies and English Language Arts classes had the most frequent student technology use while Math and Fine, Performing and Media Arts saw the least. Differences across school levels further illuminates
student experience, with patterns emerging across school levels and subject areas. For example, students in the upper elementary classes generally used technology less frequently than their middle school and high school peers. Within different subject areas, different patterns emerge. For example, students’ average technology use in Math class was fairly consistent across school levels (around once per three days). Conversely, Cohort 1 students’ average use of technology in science class increased three-fold between upper elementary grades and middle school. School administrators and educators can imagine the increased poignancy and value for results representing their own school for formative and summative reflection. As shown above, even results from a single data collection period provide a richer understanding of a school’s educational technology implementation, while longitudinal data provides opportunities for sustained formative reflection within a school.

In addition to simply measuring where and how often teachers and students used technology in school, the data provides school partners a much deeper investigation of what students are doing in class. Although a variety of teaching and learning practices are measured across the teacher and student surveys, the following example provides a further estimate of what students were doing with technology in their classes. Specifically, Figure 3 summarizes the average number of days in the 2012/2013 school year that students used technology resources in class for different purposes.

Fig. 3: Average number of days students used technology for a variety of purposes

<table>
<thead>
<tr>
<th>Activity</th>
<th>Elem</th>
<th>Mid</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Play computer games related to class</td>
<td>23</td>
<td>31</td>
<td>51</td>
</tr>
<tr>
<td>Take a test or quiz on a computer</td>
<td>22</td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>Record audio or video using a computer</td>
<td>27</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>Create or capture digital images for using/sharing</td>
<td>42</td>
<td>50</td>
<td>51</td>
</tr>
<tr>
<td>Download or watch streaming video</td>
<td>32</td>
<td>53</td>
<td>74</td>
</tr>
<tr>
<td>Analyze web content for bias/trustworthiness</td>
<td>36</td>
<td>53</td>
<td>59</td>
</tr>
<tr>
<td>Take notes in class with a computer or iPad</td>
<td>42</td>
<td>60</td>
<td>96</td>
</tr>
<tr>
<td>Learn on your own (self-paced learning)</td>
<td>57</td>
<td>64</td>
<td>72</td>
</tr>
<tr>
<td>Publish or upload your work online</td>
<td>49</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>Maintain an electronic organizer/calendar</td>
<td>28</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>Collect, process, and/or analyze data using a computer</td>
<td>43</td>
<td>72</td>
<td>78</td>
</tr>
<tr>
<td>Collaborate with other students/schools using technology (blogs, emails, wikis, Skype, etc.)</td>
<td>49</td>
<td>64</td>
<td>79</td>
</tr>
<tr>
<td>Submit assignments electronically</td>
<td>49</td>
<td>65</td>
<td>85</td>
</tr>
<tr>
<td>Access a teacher’s web based resources</td>
<td>55</td>
<td>55</td>
<td>96</td>
</tr>
<tr>
<td>Use Google Apps in class</td>
<td>77</td>
<td>77</td>
<td>96</td>
</tr>
<tr>
<td>Research or study a topic using the Internet</td>
<td>76</td>
<td>76</td>
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<td>66</td>
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<td>114</td>
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</tbody>
</table>
As shown above in Figure 3, students reported using technology for a wide variety of applications in their classes (sorted from most frequent to least frequent use). The most frequently reported uses of technology in the classroom included “research or study a topic using the Internet”, “using Google Apps”, “collaborating with other students”, and “accessing a teacher’s web-based resources”. In addition to these daily or near-daily practices, students also reported using technology in class for a host of applications such as “taking notes in class”, “publishing or uploading work”, “watching videos”, and engaging in “self-paced learning”.

Looking across the three school levels (elementary, middle, and high), noteworthy patterns of student technology use emerged. Elementary students generally reported the least frequent use of many technology practices in class, although patterns differed across the different uses. For example, upper elementary students reported the most frequent use of technology use for “playing educational games”, and approximated the rates of older students use of “Google Apps in class”, “publishing or uploading work”, and “self-paced learning”.

IRC schools have examined the range and frequency of student and teacher technology use across subject areas and across grade levels within their own school communities. Again, the individual patterns reported to each partner school provide a rich opportunity to assess and reflect on how students and teachers are using their available educational technology resources. Schools have explored differences across student gender, students’ home language, and even teachers’ experience level (see Fig. 5) using this data. Some schools have focused on differences between grade levels participating in 1-to-1 programs to their other grade levels that are not. Other schools are examining the fidelity of their implementation across different campuses. Given the nature of the collaborative study, schools can also easily compare their own results to similar settings. Beginning in Spring 2014, multiple years of survey data will allow for the longitudinal examination of teaching and learning practices over time. We advocate that examining the range of student and teacher practices within a school can illuminate those areas of best practice or areas that may be struggling with components of the implementation.

Traditionally, educational research and evaluations have shared results or findings through formal papers or presentations. Schools access and interpret the reports to inform their decisions and policies. However, with such a large spectrum of data and so many potential comparison opportunities, the IRC has been actively promoting a new generation of web-based data visualization and analysis tools. Through a password-protected webpage, schools can access and manipulate their own survey results however they wish by building interactive graphs and tables (see Fig. 4 and Fig. 5). For example, a school may be interested in exploring student attitude towards using technology in class. More specifically, schools could explore how their students’ home technology access and experiences may be impacting their use and perception of technology in school. To demonstrate the potential value of such an approach, Figure 4 examines the relationship between students’ distractibility in class, their gender, and their Facebook membership (0=No, 1=Yes).
Figure 4: Example of an IRC web-based visualization examining the relationship between Facebook access, gender, and students’ distractibility in class.

Figure 4 provides an example of one of the IRC web-based data visualization tools by showing three related analyses generated using the tool. The Spring 2013 survey asked students to rate their personal agreement with the statement: “using a computer in school makes me more distracted”. It is challenging to convey the dynamic nature of the visualization tools here, but Figure 4 shows three sets of analyses presented vertically to illustrate the relationship of IRC students’ distractibility in class (presented in the bottom of figure), their gender (top-represented as donut), and their Facebook membership (middle).

The leftmost column shows the survey responses for the three surveyed items (gender, Facebook, and distractibility) across all of the surveyed IRC students (n=5,127). The middle column shows the same data, but only for the 493 students who responded they “strongly disagreed” that using a computer made them more distracted in class while the rightmost column shows only those 531 students who responded “strongly agreed”.


So, using the data visualization tool schools can explore if student gender or Facebook status may be related to students’ feeling of distraction in class.

Deceptively simple, the analyses of three survey variables actually encompasses a lot of data. The leftmost column shows the data from all survey respondents. This leftmost bottom distribution shows that most students generally reported neutral feelings towards being distracted by technology in class. Similarly, the center of the leftmost column shows that across all of the participating IRC students, the majority of students (60%) reported having a Facebook account while the top figure shows that an nearly even number of boys and girls completed the survey.

The middle column shows only those students who reported “strongly disagree” to being distracted by technology in their classes. The middle column in Figure 4 shows that the students who reported no distractibility in class were somewhat more likely to be boys than the general surveyed population. Similarly, those students who reported that technology was not a distraction in class had a lower percentage of Facebook membership (48%) than the total student population.

The rightmost column in Figure 4 presents the results from only those students who reported they “strongly agreed” that technology was a distraction in class. So, presented in this right column are those students who were most distracted by technology in class. Again, boys report a somewhat more extreme sentiment than girls, but what is really interesting is the Facebook variable. Of these students who reported the greatest distractibility in class, 81% also reported having a Facebook account. Clearly, this data suggests a relationship between students’ out-of-school technology practices and their in-school experiences with technology.

Individual schools have further examined relationships in their data between attitudes towards technology and the frequency of different practices across different cohorts of their teacher and student populations. For example, are some groups of teachers or students using technology in a markedly different way than the rest of the school? Such data can provide school leadership with empirical evidence of their program’s success. In other cases, the data provides greater information and insight providing leadership the opportunity to fine-tune professional development, infrastructure, and other resources.

Discussion

It has been suggested that educational technology programs can function like a Trojan horse ushering in more constructivist pedagogies and student-centric practices into the classroom. Similarly, the IRC seeks to develop relationships with partner schools to demonstrate how data can be systematically collected and used to inform and support school leadership, teachers, and the entire school community. This is by no means a short-term goal and we recognize the many challenges, and obstacles in implementing any major school reform or improvement effort. Although the technology use and attitudinal data we collect here provides valuable information for each school working to sustain and evolve their educational technology programs, the long-term value of the IRC is in helping schools evolve their culture and capacity to take advantage of the data that is becoming increasingly available (Wurman, 1997).

Thus, the examples presented here can be looked upon as signposts in the long journey of evolving teaching and learning. This Spring 2013 IRC data is noteworthy in that it provides partner schools their most ambitious opportunity to document and explore such a wide range of student and teacher practices and beliefs across their entire school community. Moreover, this inaugural data provided most schools
their first formal opportunity to contextualize educational technology practices as well as teacher and student sentiments in the context of other international schools.

Clearly, as the availability and scope of educational data grows, how schools leverage such data will play an increasing role in their ultimate success. Through our work at ASB and other IRC schools, we witness many benefits from such inquiry, reflection, and collaboration. Recognizing that individual schools have their own unique history, culture, and decision-making procedures, each IRC school leverages their own data and results in their own context. Collectively, our partners have reported a variety of benefits in leveraging data, research, and reflection including:

- Organizing school constituents around project goals,
- Determining if school investments in instructional technologies are “paying off”,
- Better understanding how teaching and learning is evolving in your school (and where),
- Measuring progress towards meeting specific project or strategic goals,
- Supporting action planning with data,
- Providing your school community evidence of success,
- Providing the greater educational community evidence and examples of what works (and what doesn’t), and
- Building and sustaining a culture and community for leveraging data in your school.

Before web-based surveys and widespread student access to computing devices in school, the costs of good quality research was beyond most schools. Advances in computer-based technology have transformed how we collect, analyze, and share educational data in ways that were almost unimaginable just a decade ago. In the coming years, a predicted “tsunami” of data and information is headed for all levels of the educational system (Wurman, 1997). Whether it will be known as “big data” or “learner analytics”, educational leaders and practitioners will soon witness a substantial increase in student, teacher, and system data available to them. How will school leadership use this information? How can educators use this information? Through this collaborative research partnership, we seek to build and sustain a global network of schools that can proactively begin to address such questions through their practice and collaboration together.

This paper summarizes the history, objectives, and first-year results of a very unique partnership between school leaders, educational researchers, and data scientists. One year after our initial Spring 2013 data collection, the IRC continues to evolve with 14 engaged and enthusiastic 1-to-1 partner schools. Each partner school is brave enough to ask some tough questions of their programs and investments. Similarly, each partner school is working on how to best leverage their own results and data to improve and evolve their programs and ultimately their school. In its short history, we are delighted that the IRC is providing a valuable service and connection for schools. Furthermore, the IRC has provided a rich setting for evolving best practices in educational research and our research team has broken new ground in the dynamic online presentation of study results to schools (see examples as www.asbunplugged.org/collaborative). As the IRC grows and evolves, our foundation for all future work will remain based on the unique partnership between visionary school leaders, educational researchers, and data scientists. Thus, the IRC will continue to be a model whereby the collaborative experience provides each constituent (school leader, research, data scientist) with greater resources, a more valuable perspective, and an increased capacity for improvement than otherwise possible.
References


