21-Tech: Engaging Visitors Using Open-Source Apps

by Cecilia Garibay and Keith Ostfeld

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A recent survey of AAM member organizations found that despite the growth of mobile technology in museums, approximately four in ten museums do not offer mobile experiences due to lack of financial and staff resources and limited knowledge about mobile platforms (Fusion Research + Analytics, 2012). The time and cost of developing apps, for example, can be a barrier to the integration of mobile technology in museums.

21-Tech is a multi-museum initiative funded by IMLS that takes an innovative approach to integrating personal mobile technology (PMTs) into the museum. The project uses open-source applications (i.e., already-developed and readily available low-cost apps) as tools for floor staff to facilitate and deepen visitors' experiences with science content at multiple existing exhibits. The project is led by the Children's Museum of Houston in partnership with Lawrence Hall of Science, University of California Berkeley; New York Hall of Science, Queens; Oregon Museum of Science and Industry, Portland; and Sciencenter, Ithaca, with Garibay Group leading testing and evaluation.

Key Features of 21-Tech
This initiative explores the use of PMTs as part of facilitated visitor experiences intended to enhance and advance hands-on learning. Rather than developing mobile applications or resources such as cell phone tours for smartphones or mobile maps for a museum visit, 21-Tech gathers learning and experience scaffolds for use with specific exhibits. Each focal exhibit has several associated apps and resources that allow facilitators to customize the experience for visitors. (For the sake of brevity, we use the term "apps" to refer to both applications and resources such as photos and video throughout this article.)

Testing and Development Process
In the spirit of inquiry, museum partners adopted a development approach heavily guided by evaluation and prototyping of apps, resources, and the development of staff training. Three phases of testing, each building on the other, were included. The early testing phase (Phase I), exploratory in nature, focused on investigating a broad range of questions about how facilitators might use PMTs to positively engage visitors in various exhibits. For example, the team explored such questions as: What kinds of exhibit interactions work best: observing, hands-on, etc.? How can we use the PMT in ways that are different from other extension activities? What about the PMT makes for a special or unique kind of interaction?

Whereas Phase I was intentionally broad and exploratory, Phase II aimed to narrow the focus and built on what we had learned from early investigations. For this phase, the team focused on testing the same apps across partner sites at exhibits commonly found at many science centers and museums (e.g. colored shadows, structures, microscopy, pitch). This allowed us to test whether earlier findings were replicated at other sites and also ensured that the apps worked at different types and sizes of museums. In this phase, we also focused on understanding how PMT-based facilitation affected visitor interactions and experiences at the exhibit. Phase III centered on assessing the

Four categories influenced the interaction between the visitor and facilitator: the device, the app, facilitation skills and the exhibit. Each element needs to be carefully considered since the interplay among these four elements ultimately determines the impact of the experience on both the visitor and the facilitator. Courtesy of Garibay Group.

training curriculum developed by partners and the extent to which it successfully prepared staff to facilitate PMT-based experiences with visitors.

Since 21-Tech uses PMTs as facilitation tools, all interactions with visitors are staff-facilitated and were tested as facilitated experiences. To date, we have tested more than 100 apps and resources (e.g., video, images) at targeted exhibits. We have also observed interactions with 195 casual visitor groups, surveyed more than 100 visitors, and interviewed facilitation staff at all partner sites.
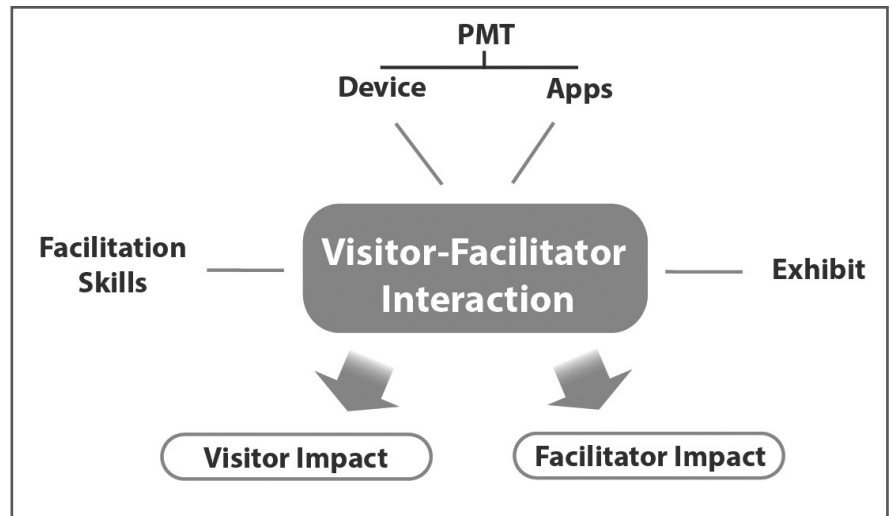
What We're Learning
Based on the phased testing approach, Garibay Group identified four components that influenced the interaction between a visitor and facilitator. Although these categories may overlap, separating them allowed us to systematically organize findings and to discuss them more easily.

PMTs
We found that interactions with visitors using tablets such as the iPad tended to work better than interactions involving smaller devices such as the iTouch. iPad displays were large enough to be shared easily and were clearer to see. The larger screen allowed all members in a visitor group to gather around the device and engage. Additionally, the speed, efficiency, functionality, and app depth were ideal. Based on these findings, the team decided to use tablets as the mobile device for the project.

One significant finding from formative testing was the importance of the right "fit" between app and exhibit. Some

apps were too enticing and drew visitors away from the exhibit; in other cases, the connection between the app and the exhibit was unclear and left visitors confused. Sometimes, the technology got in the way if an app was too involved or complex. We also had to consider group dynamics to ensure that experiences worked for everyone in the visitor group. Apps that worked well during facilitated interactions had the following characteristics: 1) they had a tight relationship to the physical exhibit that was easy for the visitor to understand; 2) they were simple enough for visitors to quickly figure out how to use them; 3) they were not so compelling as standalone apps to take away visitor attention from the exhibit; and 4) they worked for multi-aged social groups (i.e, were "juicy" enough for both adults and children).

Exhibits
Not all exhibits necessarily benefit from PMT-based facilitation. Those exhibits that already deeply engaged visitors, for example, were not the best candidates. The most successful interactions occurred at exhibits: 1) where apps could show visitors something they could not readily see in the exhibition; 2) where adding a challenge helped make the exhibit more engaging; and 3) that provoked visitor questions that could be answered by the apps.

Rather than developing mobile applications or resources such as cell phone tours for smartphones or mobile maps for a museum visit, 21-Tech gathers learning and experience scaffolds for use with specific exhibits.

Visitors try out an app at the Ricochet Table *exhibit (facilitator is on the left). Courtesy of Children's Museum of Houston.*

For phase 2 the team focused on testing the same apps across partner sites at exhibits commonly found at many science centers and museums (e.g. colored shadows, structures, microscopy, pitch).

For example, one app in which a ball can be bounced off the sides of the screen (users touch the "ball" to grab it, then swipe a finger to bounce it) was used at the "Ricochet" table exhibit. The exhibit is similar to a mini-golf course, with three holes and several obstacles to help visitors explore the concept: angle of incidence equals angle of reflection. Facilitators used the app to engage visitors in exploring the angle in = angle out principle. We found that when visitors explored the concept via the app, they were then able to apply their learning to create their own challenges at the exhibit.

At one partner site's popular "Honey Bee" colony, photos and videos of swarms, queen bees, larvae, and royal jelly were loaded on the iPad to show a range of bee behavior (e.g., workers keeping the hive warm, bees collecting pollen in slow motion, bee dances) and museum staff used these apps as part of facilitation tools with visitors. Evaluation data found that visitors moved seamlessly back and forth between exhibit and tablet, often looking more closely at the physical bee hive. Overall, the videos and photos of bees and bee behavior deepened visitors' engagement and observations at the exhibit.

In practical terms, we have learned that selecting the "right" apps and pairing them with specific exhibits takes careful consideration. When the criteria for selecting apps and exhibits were met, we observed visitors move fluidly between the app and exhibit: visitor groups engaged highly with the physical exhibit, the PMT, and the facilitator during their interactions.

Overall, children took a more active role in the visitor-facilitator interactions than adults. This included both engaging with the exhibit and interacting with the PMT. When it came to listening during facilitated interactions, however, children and adults took part fairly equally. Interactions were also almost evenly divided among those led by adult visitors, those led by children, and those led by facilitators.

Facilitation Skills

We also learned that integrating PMTs into a facilitator's repertoire of tools was no simple process. Even highly experienced facilitators needed training to develop comfort, knowledge, and confidence using PMTs. First, facilitators needed to familiarize themselves with the PMT device, learning tips and tricks and

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getting comfortable with it. Second, front-line staff needed time to explore the apps and understand how they related to the concepts at a particular exhibit. Third, facilitators needed to develop the skills to become adept at integrating the PMTs into their interactions with visitors (e.g., when and how to approach visitors; how to move back and forth easily between apps and the exhibit). Facilitator training for 21-Tech focuses on these areas and uses reflective practice; staff pair up (one facilitating, one observing) to discuss visitor interactions, what worked, and ideas for improvement. Still, it takes time for facilitators to feel confident with the related apps. One critical issue, for example, involved ensuring that each

component of the training was long enough (particularly role-playing practice time and spending time on the floor with visitors).

Overall response from front-line staff has been positive; they see value in using these PMT tools. As one facilitator noted,

Using the applications made explaining certain things much easier, since some ideas are easily understandable with visual aids provided by 21-Tech. I was also more likely to engage visitors of more diverse age groups with different levels of understanding, since the applications worked with the majority of visitors.

A facilitator and visitor build paper airplanes using a plane builder app and then head to the Launch *exhibit to test how far their creations will fly. Courtesy of Garibay Group.*

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Reference:
Fusion Research + Analytics (2012). Mobile in Museums Study 2012. Retrieved June 2, 2013 from: https://aam-us.org/docs/research/mobilemuseums2012-(aam).pdf

> The major challenges that visitors identified in their experiences occurred when they did not see a clear connection between the app and the exhibit, or if they felt the app did not add anything new or different to what they could do at the exhibit.

Visitor Perspectives

Visitor data from testing and development has been promising. Observational data indicated that PMT-based interactions facilitated connections between the content at hand and visitors' prior experiences. For instance, in nearly half of the interactions, at least one visitor was seen making a connection between the exhibit and PMT. In nearly one-third of interactions, at least one visitor was observed connecting the exhibit to his or her previous experiences.

We found from survey data that more than 90% of visitors agreed that the PMT enhanced their experience; 80% said they would look for facilitators with PMTs at other exhibits. When asked more specifically about their reasons for these ratings, visitors cited either that their experiences helped them better understand the exhibit or that they had learned something new; in both cases visitors really enjoyed the PMT-facilitated interactions. Here are some representative comments from visitors:

> Seeing the explanation on an app gave a better understanding of what I was experiencing. Very excited about you guys using the iPad!

> They really seemed to enhance the knowledge imparted to my kids! Thanks!

It made viewing the image very easy to zoom in and out and it focused easily. I think my children benefited from spending time both with an educator and with the technology.

The major challenges that visitors identified in their experiences occurred when they did not see a clear connection between the app and the exhibit, or if they felt the app did not add anything new or different to what they could do at the exhibit. Visitor feedback has continued to inform the development process and has helped the team to further refine the PMT tools. All evaluation findings to date are available on the project website at http://www.21-tech.org.

Conclusions

When the project launched in 2011, the team had somewhat naïve notions about the ease of integrating PMTs as tools for facilitation: Purchase a device, load it with quality apps, and give it to staff to use with visitors. While it certainly is not that straightforward, the iterative testing process and the ability to use open source apps and resources has allowed us to experiment with ways to integrate PMTs as facilitation tools that can enhance and deepen visitors' experiences. We have recently begun summative evaluation, which will be completed at the end of 2013. ✳