The Exhibit Development Process

The development of interactive STEM exhibits follows a process which mirrors the scientific process and engineering design process, both of which are important foundations in the Massachusetts Curriculum Frameworks.

A. Front-End Evaluation and Planning

Exhibit development planning begins with research – learning the science (and or the engineering and math) of a particular topic. Museum staff reach out to scientists and researchers in the field who can serve as content advisors and whose research might be showcased in the exhibit.

Brainstorming produces a short list of possible exhibit themes & storylines and a rough list of potential interactives for those themes.

Front-end evaluation entails multiple meetings with museum visitors, staff, volunteers, Board members and community groups for their feedback on the possible themes, storylines and interactives. This includes: paper and verbal polls, brainstorming exercises and/or focus groups, and “talk back” displays. Done well, this process produces yet more themes storylines and possible interactives to be evaluated until a single theme and storyline emerges, with a list of possible interactives.

B. Formative Evaluation and Iterative Prototyping

Typically this stage of exhibit development takes a year and costs between 10% to 20% of the total project budget. However experience shows that this early investment is more than recouped in cost savings at later stages. Engineering questions can be worked out early on. Controls or concepts that are confusing visitors can be adjusted. Since the final design and fabrication of final museum exhibits is expensive -- avoiding expensive mistakes is key. It is essential to prototype more interactives than there will be space for in the final exhibit, as some ideas can be expected not to survive this stage of evaluation. Indeed the motto for prototyping might be: fail early, fail cheaply, and learn quickly.

Iterative prototyping is driven by evaluation, which looks for markers of a variety of learning outcomes. Learning outcomes can include: evidence of visitors using science practices, evidence of family learning, open-ended exploration, etc. Evaluation tools include behavioral observation, conversational analysis, visitor interviews and asking visitors to “think out loud”.

Stage 1 Prototypes generally resemble programs. They are often table-top objects, often hand-made from foam core, paper and re-worked off-the-shelf items. A staff member is always next to the interactive, actively engaging visitors in conversation. Changes made to the interactive at this stage are rapid and numerous, easily a dozen or more changes to the size, shape, color, layout, text, diagrams, etc. in the course of 2-3 days' prototyping. As the prototype is more refined, is for the staff member to step away from the interactive, stepping in only when the visitors get “stuck”. Iterative changes address each sticking point until most visitors can work with the interactive most of the time.

A Stage 2 Prototype is still staffed, but they are safe enough, sturdy enough and understandable enough to allow that staff to stand away for the duration of the visitors’ interaction with it. Evaluation consists of observation, watching for specific markers of engagement and learning. At the end of the interaction, the staff member may approach the visitor to interview them to help clarify the observations. Iterative changes continue driven by the evaluation results, so the prototype is still made of relatively cheap materials (excepting specialized exhibit-specific equipment and computers) and is not left on the museum floor unstaffed.

At Stage 3, a prototype can be left on the museum floor without constant supervision. Thus, expensive technology is housed for security and the remaining parts of the interactive are made to be safe for visitors (e.g. no temporary extension cords or easily broken moving parts). However, evaluation and iterative changes continue. At this stage, other related prototypes and temporary text panels are put in the vicinity, to see if this alters visitor behavior or conversation.

Stage 4 prototyping requires full-sized, full-powered internal technology (fans, sensors, touch screens, pumps and filters, etc.) for longevity testing. This stage identifies engineering flaws and maintenance issues that do not arise in early stage prototypes. Additionally, the final ergonomics of the prototype are refined at this stage. In most cases the inner workings of the interactive will be incorporated into the final interactive, recouping that investment.

The overall exhibit space plan is brought through a similar and simultaneous process, to ensure that all the interactives, exhibit furnishings and visitor amenities will fit into the space as a cohesive, logical whole. Similarly, all exhibit texts are developed and vetted at the same time.

C. Final Exhibit Design & Fabrication

While this stage is time-consuming and costly, conceptually it is the process of “dressing up” all of the interactives. A back-and-forth between all 3D design of exhibits and 2D design of all graphics and signs is constant. Fabrication and installation generally involves multiple specialized builders, artisans and fabricators.

D. Remedial Evaluation

Once the exhibit is installed and open, unforeseen issues will arise, often around maintenance, but also around learning outcomes. Thus it is wise to retain a small percent of the budget for further evaluation and the modifications suggested by that evaluation.