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Science, Play and Research Kit (SPARK) Competition
Winner Summary

Honorable Mention – Prototype Category

Margaret Richards and Peter Friedman
"Hexpods"

Margaret Richards (Pittsburgh, PA) and Peter Friedman (Chicago) have won an honorable mention in the prototype category of the Science, Play and Research Kit (SPARK) Competition, for their "Hexpods." The competition, sponsored by the Gordon and Betty Moore Foundation and Society for Science & the Public, challenged entrants to create the equivalent of a new chemistry set for the 21st century. Winners were selected in two categories: prototypes – projects that are operational and demonstrable - and ideations – fleshed out project ideas that have not yet been developed into prototypes, but have a strong potential for development.

"Hexpods is a kit-based, technology-enhanced learning framework designed to foster curiosity and passion for the sciences in children of all ages," say Friedman and Richards.

Each Hexpod is a set of themed experiments with an interactive digital assistant to guide science learning and discovery. A dynamic tablet application hosts the assistant while serving as a virtual laboratory, lab notebook, and entertainment center. A child can easily add new kits from the home screen by scanning the "KitCode" featured on each package. The app uses the child's kit inventory and progress to customize material.

A separate app for parents keeps them updated on their child's progress and provides additional resources for continuing education. Kits can be ordered individually or as part of a sequence. New kits are recommended to parents based on the educational goals for their child and the child's performance in other kits.

"Hexpods is a framework for science education, not a limited set of experiments in a box," say Richards and Friedman. "The core app is extensible and content agnostic, allowing it to easily support different subjects. The kit design is modular and highly scalable. Every piece in a Hexpod, down to the box it comes in, is engineered to be both useful and interesting."

"The interactive nature of Hexpods makes it an excellent platform to encourage curiosity and scientific learning," they say. "It can dynamically illustrate abstract concepts, provide instant feedback to reinforce key information, and simulate experiments too dangerous or impractical to be included in a kit."

Hexpods make science learning game-like by adding quests to complete and achievements to unlock. Activities and video games supplement the experiments: They help the child review important concepts, offer insight into their knowledge retention, and keep the learning experience

exciting.

Activities can take advantage of the tablet's cameras and sensors, so children can observe and document the world around them. Integrated tools like the lab notebook promote the use of scientific methods.

The app for parents keeps them directly involved in the learning process. They can receive notifications about their child's new achievements and monitor progress within each kit. The app also includes science briefings and supplemental activities for each kit, so parents can reinforce scientific concepts with their children and foster an environment in the home that reinforces learning.

The Hexpods platform is designed to be flexible; material can accommodate any skill level. While prototyped kits focus on ages 8-12, content difficulty can be easily scaled to advanced topics for older children.

"We firmly believe that a quality science education should be made available to all children," say Richards and Friedman. "To realize this goal, we intend to make the app, complete details of each kit, and even package blueprints available for free."

Sale of the assembled kits would subsidize development of the app as well as new kits, sustainably allowing them to offer learning opportunities to a wide and diverse audience.

They believe that, by documenting and releasing the technical details of the platform, they will foster an open kit developer community. "Our framework would provide an easier path to production, create a wider variety of available science kits, and give children a way to learn new concepts in a familiar environment," they say. "As children mature we would encourage them to transition from consumer to creator, giving them the opportunity to develop new skills, contribute back to the community, and continue the learning process in a new and exciting way."

"It was our goal to create a product that encourages children to not only ask 'why' and 'how,' but to be actively involved in finding the answers," they say. "Our focus when creating the prototype was to ensure that every aspect, from the packaging to the tablet application, was unique and engaging while staying true to our mission of fostering growth through creativity and exploration."

Both trained in computer science at Carnegie Mellon University, Richards is a senior software engineer at the Elberly Center for Teaching Excellence at Carnegie Mellon and a graduate student in the university's Human-Computer Interaction program, while Friedman is a distributed-systems engineer at Argonne National Laboratory.