

My child just built a radio and we hear music!

Viranga Perera^{1*}, George Che², Kristina Davis³, Steven Semken², Christopher Groppi², and Christopher Walker⁴

¹Johns Hopkins University Applied Physics Laboratory, ²School of Earth and Space Exploration, Arizona State University, ³Department of Physics, University of California, Santa Barbara, ⁴Department of Astronomy and Steward Observatory, University of Arizona.

* viranga.perera@jhuapl.edu

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Parents take their children to informal science education venues due to their own interests and/or the interests of their children. In doing so parents, regardless of their own educational backgrounds, maybe unintentionally learning.

What is this study about?

We interviewed 41 adult participants who completed an informal learning activity. As part of this activity they built a simple AM radio. The goal of this study was to assess the effectiveness of the AM radio activity. This activity was developed and tested for use by a broad audience at both formal and informal education settings [1]. For this particular study, interviews were conducted during three public events that took place at Arizona State University, which were hosted by the School of Earth and Space Exploration (SESE). The events, dates, and the total number of attendees to the Interdisciplinary Science and Technology IV building for each event are shown below.



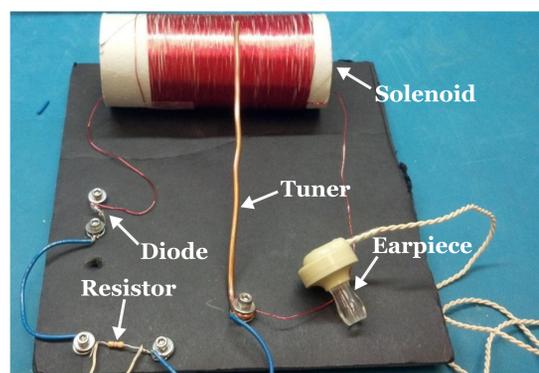
Why is this important?

People generally only spend a small fraction of their lives in formal education settings [2]. Informal education is more widely available to supplement knowledge and to help people pursue interest-driven learning [e.g., 3]. Thus, it is important to study the effectiveness of informal education activities, such as the one discussed in this work.

How do you build an AM radio?



First, create a solenoid by winding wire around a toilet paper tube (shown below). Next, connect a diode to one end of the solenoid followed by a resistor in series. To the open end of the resistor, connect a stiff piece of wire or metal that will serve as the tuner to select a specific radio frequency. Complete the circuit by connecting the tuner to the open end of the solenoid. Then connect the two terminals of an earpiece to the two terminals of the resistor. Lastly, connect a long wire (the antenna) to a lead of the diode and connect a ground wire to a lead of the resistor.



Example setup of an AM radio with individual components identified

What did the participants do during the activity?

Pre-construction

Instructors gave participants a brief (5 to 10 minute) interactive lecture. The following topics were discussed: electromagnetic waves, alternating current (AC) circuits, voltage rectification, impedance matching, and energy conversion. The lecture introduced the four major components of a simple AM radio (i.e., solenoid inductor, diode, resistor, and earpiece).

Construction

Participants were provided all components unassembled and they were given step-by-step instructions on constructing their own AM radio. Instructors assisted participants and answered questions. After successfully assembling an AM radio, participants connected them to an antenna and listened to a local AM broadcast.

Post-construction

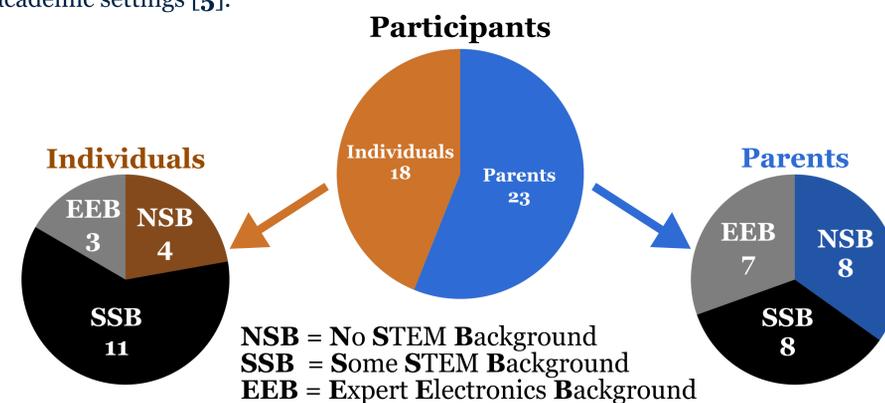
Participants were asked to discuss how they could improve their radio (e.g., design, reliability, and ease of construction). They were also asked to think of new applications for radios. Some participants were asked to volunteer to be interviewed after this step.

How were participants interviewed?

Some participants were asked if they would like to volunteer to be interviewed after they had completed the activity. Participants were not offered any incentives and were interviewed by the first and second authors of this work. Interviews were structured and normally consisted of asking participants 12 questions pertaining to their background (occupation, education, experience with electronics), reason(s) for interacting with the activity, and their experience with the activity (e.g., what they did, what they liked, and what they learned). The range of interview durations were from about 2 minutes (Interview #21) to about 11 minutes (Interview #33), with mean and median durations being about 3 and a half minutes. Recorded interviews were transcribed by a third-party transcription service and the transcripts were individually checked against the original audio recordings for accuracy by the authors.

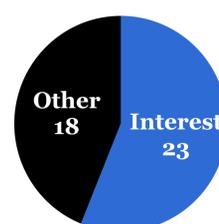
Who were the participants?

We did not collect any demographical information of participants. However, a number of them (56%) mentioned being a parent during their interviews without being inquired by the interviewer. For our analysis, we categorized participants as either a parent or an "individual." Some "individuals" may have children who were either not present or were not mentioned during interviews. We further categorized participants into three subgroups based on their stated science, technology, engineering, and math (STEM) and electronics backgrounds. Analyzing interviews in this manner is important since parents play a vital role in the education of their children [e.g., 4]. Further, more educated parents may provide academic advantages to their children. Previous work found that more educated parents have more causal explanations with their children in informal education settings, which may give them an advantage in formal academic settings [5].

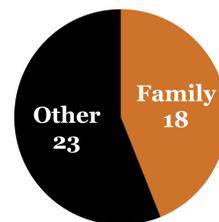


What did the participants say?

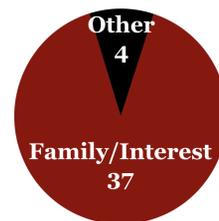
Participants came because of... (What attracted you to the AM radio activity?)



"I really wanted to understand how the light waves and everything because she explained me the project and like she said there is no electricity, so I was really curious to understand how the light waves getting converted through the magnet to into a sound and all."
--Transcript #11 (SSB Individual)



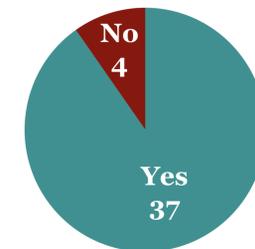
"My daughter saw the table with all the cool stuff on it and she, it's like a bug going to a light bulb or something, if there is an activity she will do it and she loves it."
--Transcript #37 (SSB Parent)



"There was a nice person standing there that had a display open. So I thought, ok great, I will go to it."
--Transcript #1 (NSB Parent)

Learned Something From the Activity (What did you learn from the AM radio activity?)

"Nothing because I already knew this stuff. My daughter, I was here for my daughter."
--Transcript #27 (SSB Parent)



"I learned about radio waves being light waves, and I honestly didn't know that before, and that was pretty cool."
--Transcript #16 (SSB Parent)

"Even though it's my major but I have learned today something from somebody who is demonstrating something for the public...It will not just help public people, but it will help people even doing a Ph.D."
--Transcript #17 (EEB Individual)

What conclusions can be drawn?

Participants largely interacted with this activity due to a family member and/or their own interests in electronics. The vast majority of participants reported that they learned something from this activity. Interestingly, fewer individuals with no STEM experience or with an expert knowledge in electronics interacted with this activity. As such they maybe missing out on a learning opportunity. To improve public understanding of science, informal learning centers should continue to consider ways to make events more accessible and more enticing for people who may not be experiencing these valuable learning opportunities.

References

[1] Davis, K. (2015) AAS Meeting #225, ID 436.03. [2] National Research Council. (2009) *Natl. Aca. Pr.* [3] van der Hoeven Kraft, K. J. (2017) *J. Geosci. Educ.*, 65(4), 594-603. [4] Zimmerman, H. T., et al. (2010) *Sci. Educ.*, 94(3), 478-505. [5] Tenenbaum, H. R., & Callanan, M. A. (2008) *Int. J. Behav. Dev.*, 32(1), 1-12.

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