

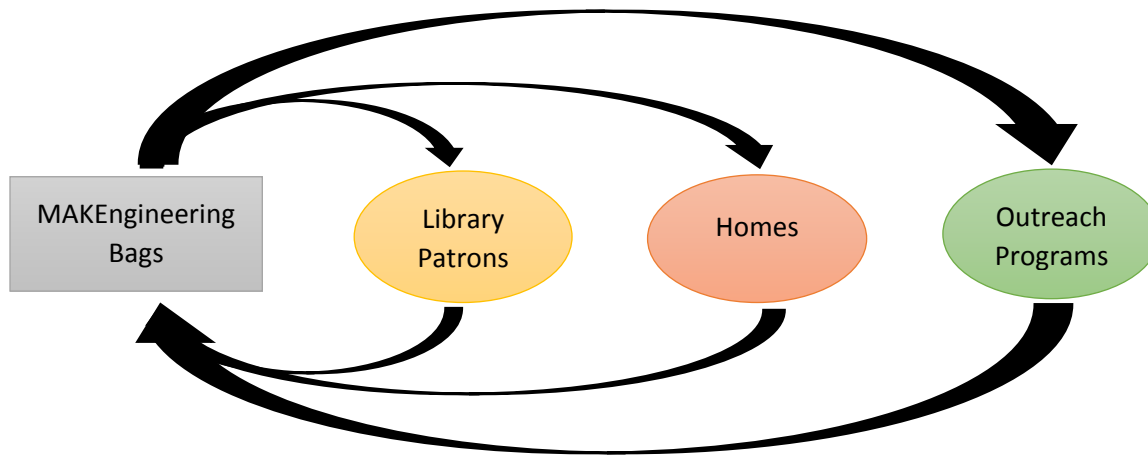
Indiana University

### **MAKEngineering Bags: A library program to engage families in making activities**

This *Sparks* project proposes to design, develop and refine “MAKEngineer” take-home bags that provide learning experiences for patrons across the lifespan. Our focus is on developing bags that will engage children and their families/caregivers in local underserved communities, as well as considering the logistics of circulation and sustainability of the bags. The Center for Research on Learning and Technology (CRLT) at Indiana University (lead organization), in partnership with Monroe County Public Library and WonderLab Museum are requesting \$24,966 to address the following IMLS goals: promote museums and libraries as strong **community anchors** that enhance civic engagement, cultural opportunities, and economic vitality while promoting the use of emerging technologies (i.e., making, DIY electronics) to facilitate discovery of knowledge. We expect this project to have a national impact in that schools and public libraries, as well as museums, will be able to adapt and build upon our research-based bags and materials within various contexts.

In recent years, there has been an emphasis placed on inclusion of engineering design practices and engineering curriculum within K-12 schooling (e.g., Engineering is Elementary (EiE); Museum of Science, 2016). While engineering-related programs are spreading across K-12 schooling, they are often available in well-resourced communities or limited to students with strong academic backgrounds (Brophy et al., 2008). Additionally, there are opportunities for youth to engage as engineers in after-school programs and summer camps (e.g., Varney et al., 2012). As research suggests, engineering curricula and after-school programs afford youth opportunities for learning STEM content, problem solving skills, and the ability to communicate ideas and results (Brophy et al., 2008). However, we do not know how engaging in engineering design practices with parents/caregivers and other family members in home environments may impact the engineering interests of youth, as well as their self-concept, preparation, and experiences. Considering the fact that women and minorities are underrepresented in STEM fields (NSF, 2015) and the projected employment rate in STEM occupations is expected to grow 23% in the next decade (US Department of Labor, 2015), we argue there is a critical need to include families as stakeholders in meeting this demand through implementation of engineering design practices with an emphasis on emerging technologies in the home environment. This project will address this need through developing and researching the impact of MAKEngineer take-home bags for library patrons, particularly youth and parents/caregivers in under-resourced communities. As an example, a MAKEngineering bag may contain construction materials (e.g., popsicle sticks, felt, tape), guidance and open-ended questions for making a submarine, and a related book (e.g., *Papa's Mechanical Fish* (Fleming, 2013)). As the bags become more refined through an iterative research design process, we expect the bags to be delivered to under-served patrons through the library's book mobile, and through community organizations (e.g., Boys and Girls Club), school-related outreach programs (e.g., Afterschool Edventures), and local school libraries.

This study will span a year from June 2017 to May 2018. It is expected that the research will inform further development and refinement of the MAKEngineering bags (see Figure).



Research collected during this project will include reflections, video and/or photographs, family observation-interviews, and logs, with each data source being utilized to make informed changes to the bags and to how they are circulated through the library. Family members will be asked to complete reflections after engaging with the bags. This will be a set of questions asking what they liked and disliked; what they would change; what they learned; and what they would like included in other MAKEngineering bags. Digital cameras will be provided so that families can video record or take photographs to document their process and product. During family observation-interviews, families will be observed as they engage with the activity. They will be asked to think-a-loud and researchers will ask questions throughout the process based on in-the-moment observations. Lastly, the library will maintain logs regarding logistics such as the check in/check out process, what material are missing, what material need to be continuously replaced (e.g., batteries), what bag are being checked out the most, and so forth.

The purpose of this project will address the *Community Anchors* project category in several ways. First, the “MAKEngineer” bags will be a local pilot program that addresses a national need and will have the potential to be scaled and implemented in a variety of local and national settings, including formal and informal learning environments. Second, the bags will provide interdisciplinary learning experiences for youth and their families/caregivers with a focus on underserved communities. Third, progress with the development, refinement, and use of the bags will be shared broadly and in a variety of formats by the research team throughout the one-year grant period.

The total anticipated cost of this project is \$24,966. These funds will be used for salaries, wages and fringe benefits for the project PIs, Adam Maltese and Amber Simpson, who will coordinate the development and evaluation of the bags. Costs for the bags include the costs of materials for sets of making projects, costs for cameras. We also included costs for testing out a variety of approaches to facilitate circulation, including vacuum formed packaging for the materials, RFID tagging of equipment and similar technologies. Funds will be used to cover costs of outreach events where along with our partners, we will engage youth and their families in making activities and publicize the MAKEngineering bags. Finally, the budget includes indirect costs collected by Indiana University.