TEXAS STATE
LBJ INSTITUTE FOR
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STEM Research
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NASA STEM Engagement

Research-based School to Home Science Programming for Students and Families

The NASA FAMA Backpack Program

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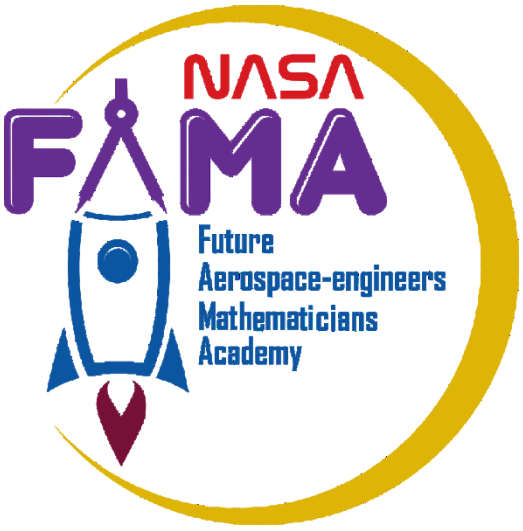

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The NASA Family Backpack Initiative was designed as part of a collaborative agreement between NASA's Minority University Research and Education Project (MUREP) and Texas State University. The MUREP Aerospace Academy developed by Texas State University was branded 'Future Aerospace Engineering and Mathematics Academies (FAMA)' to target the Spanish speaking communities it serves.

This program is more generally referred to as the NASA Family Backpack Initiative, but examples and some documentation will include references to FAMA.

The NASA Family Backpack program is a curricular program designed for use by educators as an inclusive tool to assist in connecting students' science and engineering learning experiences between school and home. Sometimes, educators face a challenge in finding effective and novel approaches for bridging student's learning between school and home in a culturally relevant way. With this program, educators continuously engage with families by sharing student experiences from the classroom, while simultaneously valuing family's ideas and expertise, also known as their cultural wealth.

The program utilizes NASA educational interactive activities that focus on students' use of the engineering design process. The activities are designed for students to work in teams of 3-4. Educators begin the activity in the classroom during the instructional day. This process engages students in the classroom then their families are encouraged to join in the learning process as the activity is extended to the home, by drawing families and students to make revisions and improvements. Students are provided inexpensive, recyclable materials to carry out their investigations, but they are not limited to these. Students then return with an improved model or extended experience and report back to classmates emphasizing their family's contribution.

The engineering design process used in this initiative is one that NASA has used in educational materials for K-8 students for several years. It includes a series of steps like that which engineers use in problem solving and engineering design. Engineers identify the problem, brainstorm solutions, select a design, build a model or prototype, test and evaluate, and optimize the design, these steps are then repeated with the goal of optimizing prior to sharing their solutions and designs. NASA activities encourage students to design, by providing a list of materials, questions to help the student brainstorm solutions and basic building steps that allow for student creativity and opportunities for original designs. The concepts showcased in these activities are connected to actual NASA missions. The NASA Backpack activities are not limited to the activities shared in this guide. The concept of taking NASA Family Engineering Design Challenges and adapting them for home extensions can continue to be applied by teachers to different NASA activities. Three activities showcased in this guide are ones that have been piloted for home and school use with 4th and 5th grade students and their teachers and families.

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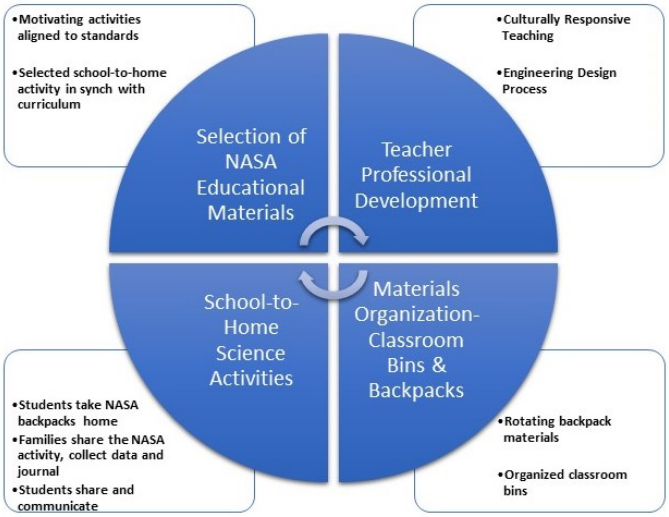
The NASA Family Backpack Initiative incorporates enriching NASA STEM hands-on activities into the classroom experience, guided by the participating teacher with additional activities traveling to each student's home as a shared family learning experience.



The complete NASA FAMA Backpack teacher's guide is available at no cost to any interested educator.

Download it and see how the authors incorporate NASA STEM lessons for students from 3rd- 8th grades.

Visit:

http://lbj-stem.education.txstate.edu/Publications.html

The Backpack initiative is a coordinated, grade-wide, classroom-to-home enrichment STEM activity that includes the teacher, each student in the class, and the students' respective families. Specific planned learning objectives in science and math should be selected to guide the overall learning intent for each grade-level participating.

NASA offers a vast resource base of learning activities that are content rich, motivating, and aligned to science and math standards. These resources are freely available at various NASA websites described in the appendix, some science content/discipline areas that might be enhanced with this approach for elementary and middle school grades are:

- Physical Sciences
- Life Sciences
- Earth & Space Sciences
- Engineering, Technology, and Applications of Science

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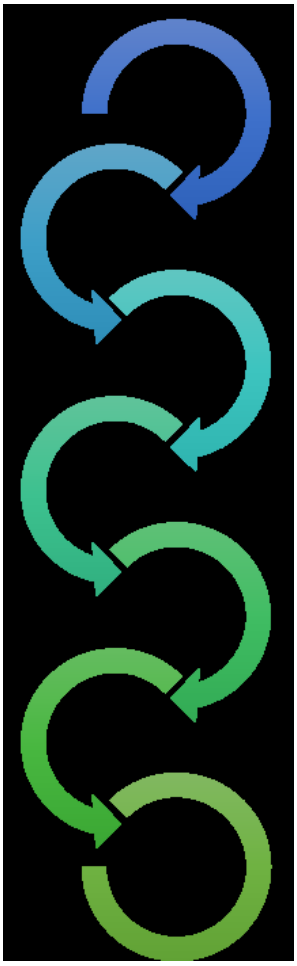
Scheduling & Organization



For more information about NASA EPDC visit https://www.txstate-epdc.net/. For additional information contact: Dr. Araceli Martinez Ortiz, LBJ Institute Executive Director: araceli@txstate.edu

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It is important to organize the rotation of the student backpacks so that all students have an opportunity to take the backpack home and enough time is allowed during class for sharing.

In our implementation, students took the NASA activity home for three days, the first group from a) Monday through Wednesday and the next group b) from Wednesday through Friday.

We communicated with the families informing them that the journals were a class tool and that it would be used as a place to document findings and design improvements. Students were asked to return the backpack at the end of their assigned period and present their family's improved design to the class.

Teachers then give students time to test their designs in front of the class. This usually takes place at the beginning or end of each day. Below is a more detailed overview of the Backpack initiative implementation steps and timeline (Table 1).

Table 1 : Backpack Initiative Implementation Timeline

Step	Description	Time Period (sample)
1. Creating buy-in	Begin a conversation with school district administration and campus administration on benefits of incorporating Engineering Design Process using NASA activities.	Spring Semester
1. Communication	Work with your school district administration to organize and plan the best timeline for implementation of the NASA activities selected.	Spring/Summer Semester
1. Classroom bin	Collect materials for the NASA activity, activity design and instructions and teacher support materials then organize into a bin. Two backpacks complete with materials should be also included in the bin.	Summer/ Early Fall Semester
1. Profession Development	The PD should be delivered before the teacher introduces the NASA activities. Teachers should take time to go through the NASA activity before engaging students in the classroom.	Fall or Early Spring Semester
1. Distribution of materials	The Backpack bins will need to be distributed to all campuses participating.	Early Spring Semester
1. Implementation	An identified person will be needed to work closely with each campus to provide professional development.	Spring Semester

Scaling it Up and Making it Sustainable

We have found the Backpack program to be most effective when a teacher has at least one other collaborating teacher who is also participating with his/her classroom. Once teachers have experience with this program, it can easily be scaled to include an entire grade level and can also be carried out at various schools in the school district. The good news is that this program can be kept fresh since there is a tremendous supply of exciting and challenging NASA activities.