



Museum of Science.



Families
and STEM Events



Engineering at Home:

Turn It Up!

Activity Book



Try engineering as a family!

Bia and Cris have a problem. Their grandfather Tiago wants to play music, but his phone speakers are not loud enough. **Engineers are people who figure out how to make things that solve problems.** Try this activity as a family and you'll be thinking like engineers, too!

Turn It Up! challenges you to design a way to make the music coming from a speaker louder. What will you design? A horn? A sound reflector? A box? Here's what you'll need to get started.

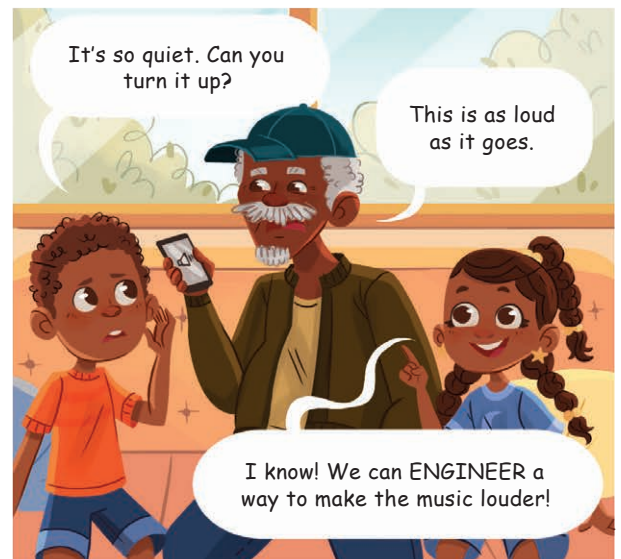
- **Device** – You need a cell phone or some other device that can play music, such as a radio, an mp3 player, or a home speaker.
- **Materials** – You will need to gather some materials that your family can use to make the music louder. Try inexpensive, non-breakable items, such as recyclables. The more materials you gather, the more creative you can be!
- **Music** – You will need to choose music to play from the device. You can choose a type of music you really like or that has special meaning for your family.



Engineers use many skills when they design solutions to problems. This activity supports the development of critical thinking, communication, creativity, and persistence among children. Best of all, it's a fun way to connect as a family!

Children as young as four can participate, though they may need a bit more support. You can read this activity book with your child, or, if they're ready, let them read it to you!

For more engineering resources, visit www.eie.org/families.



Turn the page to help Bia and Cris make the music louder!

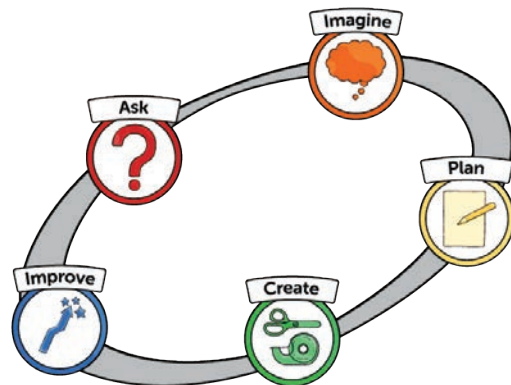


Engineers are people who figure out how to make things that solve problems.

They break the problem down into steps that are easy to follow. First, they **ask** questions about the problem . . .



. . . then, they **imagine** possible solutions.



Next, engineers make a **plan** . . .



. . . then, they **create** and **test** their solution.
Finally, they **improve** it to make it better!



Let's think like engineers! We'll follow these steps to make something that makes the music louder!

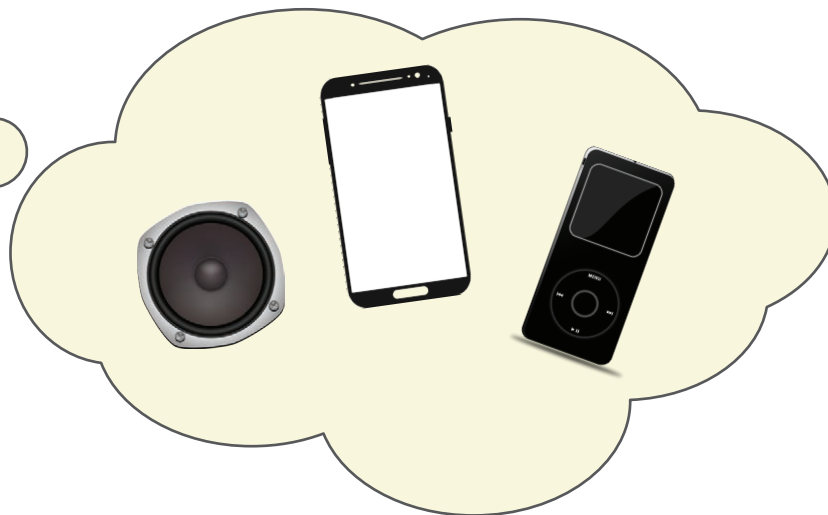


We can work together! Let's start by **asking** questions.



Hmm . . . what do we need to get started?

How loud is the music now?
How loud do we want it to be?



What should we use to test our idea?
We could use a cell phone, an mp3 player,
a speaker, or something else!



What will you be testing?

Decide what device will play the music and how much louder you want it to be.



I know what's next! Engineers **imagine** many creative ideas to solve the problem before they pick one.



Hmmm . . . what are some ways to make sounds louder?



What ideas do you have? Write or draw them above.

Talk as a family about what you want to try.
Find some materials you can use to build it.



What will your design look like?
Draw a picture of your plan!

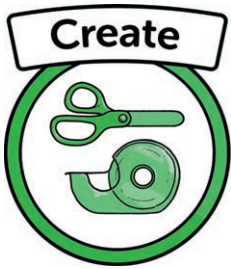
We're almost ready
to build, but first we
need a **plan**.



Drawing a picture of our design helps us
remember how all the parts fit together.

List your materials here.

_____	_____
_____	_____
_____	_____



Create



It's time to **create** our design!

We're so excited
to see if it works!



Create and test your design! Did it work?
Talk as a family about how your design worked.
What worked well?
What didn't work well?



Improve



If it doesn't work, that's okay.
We can always **improve**!



Engineers LOVE to **improve**.
They learn from their mistakes and
make their designs even better!



How can you make your design even better?

Talk about it together or
draw a picture of your new idea.
Then create and test it again!

It can take many tries to make a
design work. We've got to keep at it!



Congratulations!

You followed the steps of
the engineering design process
and solved a problem!

We did it! We used
engineering to make the
music louder.



Engineering activities like *Turn It Up!* are a great way to develop useful skills like critical thinking, communication, creativity, and persistence. They're also a lot of fun! Here are a few ways that you can extend the activity and continue the fun as a family.

- 1. Do you like to share your ideas?** Tell friends or other family members about your design. You can take photos or videos to show them how it works, or you can draw your own comic to show how you solved the problem.
- 2. Do you like to experiment?** Test different materials, shapes, and setups to find out which makes the music loudest. (You can use a decibel meter app to measure how loud it is.) Research how sound travels and try to figure out why some designs work better than others.
- 3. Do you want a challenge?** Make the activity harder by
 - using a larger device, such as a tablet,
 - getting the music to travel around a corner or some other obstacle, or
 - designing a way to make the music louder for one person but quieter for everyone else.
- 4. Do you like to listen to music?** Find out if any of your family members play a type of music. Listen to examples of that type of music on the internet or have them play some for you!
- 5. Do you like solving problems?** Think about a new problem you can solve using engineering.
 - What's the problem?
 - What could you create to solve it?
 - What materials will you need?
 - How will you test your design?

What engineering problem will we solve next!?

Keep engineering together!

Visit www.eie.org/families for more free engineering activities from the Museum of Science, Boston.

Families: Share your designs with us!
Tag us on social media.

Twitter & Instagram: @eie_org #eiefamilies
Facebook: @eie-mos #eiefamilies



Illustrations by Rayanne Vieira, Brazil