

Chain Reaction STEM Activities with Simple Machines:

Practicing Innovation Through Chain Reactions (STEM)

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Innovation is the creation of something new. It takes creativity, interest in learning and discovering new things, and strong reasoning skills to create innovative inventions, projects, or products. Introducing children to tasks that require innovation allows them not only to apply skills to innovative tasks but also to practice and improve their creativity, critical thinking, and reasoning skills through the activity itself.

Our students are exposed to a great deal of instruction via technology, and as online instruction and activities, regular internet access, and artificial intelligence become increasingly integrated into our daily lives, students may experience less and less time to practice innovative tasks without the aid of technology. However, hands-on activities are a crucial component of children's growth and development. Allowing students to practice innovation through creative hands-on tasks can actually equip them to develop the logical and critical thinking required for success in a technology-based world.

Providing your students with chain reaction & Rube Goldberg tasks that practice innovation has many benefits:

- Students benefit from open-ended tasks with no single solution. These promote deeper thinking, build creativity and critical thinking, and foster ownership and confidence.
- Innovation activities enhance engagement, teamwork, and real-world problem-solving. As students collaborate, they naturally ask questions, share ideas, and refine their work.
- These kinds of activities and projects also build pride and ownership. Through challenges and revisions, students develop resilience, confidence, and a sense of satisfaction in creating their own solutions.
- Finally, practicing innovation strengthens critical thinking skills by encouraging creativity, experimentation, and problem-solving.

Chain-Reaction Inventions: A Great STEM Activity for Students

One way of allowing your students to practice innovation is through chain-reaction inventions, or Rube Goldberg inventions. The American inventor and cartoonist Rube Goldberg, born in 1883 and died in 1970, popularized over-engineering in his cartoons, which he published between 1929 and 1931. In those cartoons, he depicted detailed contraptions that resulted in a simple outcome. For example, in one of his cartoons, the simple outcome is a napkin that wipes the man's face. However, for the napkin to wipe his face, a spoon moves a string that pulls another spoon, which pops toast into the air. This action causes a bird to leap from its perch and a tiny bowl to hit a bucket, and on and on, until a swinging clock pendulum finally moves the napkin. In that example of an overengineered contraption, every crazy step interacted with the next step, causing a chain reaction that ended in the final task of using a napkin to wipe a man's face. Rube Goldberg popularized this over-engineered process and made a seemingly mundane end task fun and interesting through the contraptions that he drew. You can find all of Rube Goldberg's cartoons featuring over-engineered chain reactions, or Rube Goldberg Machines, at the Rube Goldberg Institute for Creation and Innovation on the official website at:

<https://www.rubegoldberg.org/all-about-rube/cartoongallery/>

Since the popularization of Rube Goldberg's cartoons nearly 100 years ago, the idea of over-engineering a chain reaction to produce a simple outcome has been adapted and integrated across inventor challenges, in K-12 classrooms, and in homes across the world. It's an engaging and fun way to practice divergent and convergent thinking in order to produce an interesting result that concludes with a simple outcome, fostering innovation. Every year, competitions across the country allow individuals to showcase interesting chain reaction designs, like this one:

<https://www.youtube.com/watch?v=dNsLSrbT4Gg&t=1s>

You can find a list of all the host locations for the official 2026 Rube Goldberg Machine Contest here:

<https://www.rubegoldberg.org/rube-goldberg-contests/the-rube-goldberg-machine-contest/>

While incredibly impressive and complex inventions win big awards in Rube Goldberg-style competitions, these activities, which require chain reactions and a bit of innovation and creativity, can be utilized on a smaller scale for all age groups.

Take a look at this example of a 3rd-grade classroom and how they are exploring chain reactions:

<https://www.facebook.com/watch/?v=867904723896243>

To integrate chain reaction inventions with your own students, consider a few things in your planning:

Plan the time

How long do you expect the activity to take? Make sure you decide how much classroom or extracurricular time you can devote to your studies, exploring a chain reaction on a small scale, or building a larger-scale invention.

Plan the Space

How much space can you allocate to each student group? This will dictate how complex their chain reactions can become.

Plan the Simple Task

Every chain reaction results in a final, simple task that is completed.

For example, the yearly Rube Goldberg Machine Contest (https://en.wikipedia.org/wiki/Rube_Goldberg_Machine_Contest) has included simple tasks like putting toothpaste on a toothbrush, turning off a light, or watering a plant. Once you determine your simple task, you expect students to start getting creative about how a chain reaction will cause the task to happen!

Plan the Materials

Now you'll need to plan for all the materials that students will be able to use when completing a chain reaction invention. Materials are typically everyday items and include things like: A table and chair, A step stool, Wood boards, Cardboard, PVC pipes, Wooden blocks, Dominoes, Playing cards, Boxes and storage bins, Paper towel tubes, Toy cars, Marbles, Tennis Balls, Ping Pong Balls, Small fans, Sandbags, Pulleys, Funnels, Magnets, Books, Paper towel rolls, Plastic soup ladles, etc. You're allowing students to use "random" items to build interesting chain reactions.

Plan Your Expectations

You'll think, too, about your expectations for student inventions. You might require them to complete four "steps", for example, in a short 4-6 hour total time frame. For example, when providing your students the requirements of completing four "steps" their final chain reaction invention might look something like:

1. A ball rolls down a ramp and knocks over dominoes
2. A domino falls into a cup
3. The cup falls onto a toy car, which moves it off a table
4. The toy car falls onto a pressure pad that turns on a small light (the task)

The results of your planning and then allowing your students to complete chain-reaction inventions can be as complex as something like this video, which shows an individual making a complex chain reaction using toys:

<https://www.youtube.com/watch?v=ilrRtNBGYHY&t=1s>

Or it can be something as simple as this contraption that could be suitable for younger elementary students:

<https://www.youtube.com/watch?v=yrEH8AootkM>

To learn more about how to plan for these kinds of chain-reaction inventions in your classroom, to know about the materials you can provide to your students, and to understand methods for supporting your students and stretching their creativity, enroll in the Model Teaching course, *Inventing with Chain Reactions*



Inventing with Chain Reactions: Fostering Innovation & Creativity

Learn how chain-reaction projects enrich instruction and strengthen students' creativity and reasoning. Follow a clear, step-by-step design process for your class and utilize a ready-to-use checklist to implement it in your own classroom.

[View The Course →](#)

For Further Reading:

The official Rube Goldberg website provides you with official contest information, ideas, and the original cartoons:

<https://www.rubegoldberg.org>

This is an example of a Rube Goldberg team that competes at the college level:

<https://boilermakerrubegoldberg.com>

Tinkerlab gives ideas and a materials list for designing a Rube Goldberg machine:

<https://tinkerlab.com/engineering-kids-rube-goldberg-machine>

Peer Reviewed Articles:

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Khalil, R., Godde, B., & Karim, A. A. (2019). The link between creativity, cognition, and creative drives and underlying neural mechanisms. *Frontiers in Neural Circuits*, 13, 18

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Model Teaching is not affiliated with the Rube Goldberg Institute for Innovation & Creativity.

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