

Launch It Design Challenge Reflection

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The Launch It Design Challenge was implemented in a fourth grade classroom for a period of four days. When introducing the challenge most of the students showed a lot of excitement to complete the challenge. In the class discussion students were knowledgeable about engineers, what they do, and how they improve people's lives. I surveyed the class and 9 out of 12 students have heard of the engineering design process and have had experiences using it. I discussed the seven step design process: ask, imagine, plan, create, test, improve and share that were used for the design challenge. I chose to use seven steps because it helped break down the design process for the students to be successful. For this grade level I think if there were fewer steps I would have needed to scaffold each step for understanding and clarity. If there were more steps, I think students would have possibly lost interest and become overwhelmed. During the discussion about how NASA uses rockets, students on their own began calculating how far the moon is from the earth by using the given information: how many miles per hour the rocket travels and how many days it takes to reach the moon. I was impressed how this group of students wanted to learn as much as they could during this challenge activity. Throughout the engineering design challenge there were obstacles and successes.

The first obstacle was that the students were not clearly explaining their thoughts and ideas. I noticed this after the first day of the lesson when I reviewed groups' responses for ask, imagine, and plan steps in the engineering design notebook which was called STEM JOURNAL for this activity. Most groups did not define the problem, the design criteria and the constraints thoroughly. All but one group brainstormed only one possible design and all groups rushed through the diagram without following all of the directions. Even though many students said they had been through the design process before, I think students were new to documenting the engineering design process in this much detail, therefore, they needed to be taught how to do it.

To help address these challenges, I first wrote some comments next to students' google slides on what they explained well and then proposed some questions for them to think about that would help them explain and clarify their responses. This gave individualized guidance to areas that each group needed. The following day, day 2 of the lesson, I began discussing the importance of the three beginning steps of the design process. I knew the students wanted to jump right in and create and test the rockets but they needed to understand the reason of why and how to brainstorm and plan. Next, I modeled the design process with the simple challenge of throwing an ice cream party for the school of 250 students in 30 minutes. I showed them how to clearly define the challenge, criteria and constraints. As a class we brainstormed different ways that we could get the ice cream and distribute the ice cream for the party, noting that there is not just one way, but many ways to solve this challenge showing that it's critical to write all ideas down. We chose the best way and then made the plan. After this example, I had students look at

the comments I made in their STEM Journals and as a class students volunteered responses to the questions for the ask, imagine, and plan steps. During this conversation it was evident that students better understood the challenge and the importance of the first three steps of the engineering design process. Before groups could move onto the creating step, they needed to check in with me to make sure their first three steps were completed correctly. The class discussion and modeled design process challenge was needed for this group of fourth graders, but it took time that wasn't scheduled in the initial lesson plan which then took away from the time the students needed to create, test and improve their rockets.

Time was the next challenge encountered. On the second day most groups did not have enough time to finish creating and testing their rockets. To fix this problem I was able to add another class period for the lesson so on day 3 students had the entire period to create, test and revise their rockets. To help the groups collect their data and organize their testing results and improvements in an efficient way, I created a table (see examples attached below). This made it easy for students to keep track of their rocket changes, reasons for rocket changes, launch angle, and if the rocket hit the target. Students continued with the engineering design process and cycling through the creating, testing, and revising during half of the class period on the fourth day leaving the last half of the class period to document their final steps of the design process and complete the share questions to present. Five out of six groups were able to complete their STEM Journals, but unfortunately we ran out of time in the school year and students were not able to present their rockets and reflections to the class. Even though the presentations were not able to occur, students were noticing similarities and differences amongst their rockets and varying launching strategies as they were involved in the design process.

Many successes were observed when the fourth graders used the design process in the Launch It Challenge. One success was that the students had a high interest level in this particular activity. They were determined to hit the target (moon) so they persevered through many failures and made several revisions to their rockets. If there was more time allowed, there are groups that would continue to improve their rocket so they could solve the challenge. Another positive was that the students took the feedback and the model engineer design challenge (ice cream event) and were able to apply that process to their Launch It Challenge. During the design process I listened to students make remarks such as "a lot of our rockets have the same parts", "some groups are using a different way to push the air out of the balloon," and "I notice there is science in launching the rocket. There is potential and kinetic energy." Even though we were not able to reflect as a class at the end, I saw and heard many students observing and reflecting as they were involved in the design process.

In addition to the success of the engineering design challenge process, fourth grade mathematics and science concepts were naturally integrated in the challenge. For math, students made sense of problems and persevered in solving them, used appropriate tools (protractors and rulers) to measure the length of their rocket parts and launch angles, and some students calculated the distance from earth to the moon using the distance formula. Students also applied

scientific ideas to design, test, and refine a device, in this case a rocket. Students thought about aerodynamics when deciding on the material of the nose cone, how many fins did their rocket need, and what shape the fins should be. When testing the rocket, students observe the conversion of energy from one form (potential energy) to another (kinetic energy). Besides math and science, students used technology to document their ideas, results and reflections, draw diagrams, and downloaded pictures in a STEM Journal on Google slides. These math, science and technology concepts were applied to a simulation of a real life challenge showing how these subjects naturally relate to each other.

As the class encountered difficulties in the engineering design challenge each day, improvements and adjustments were made to help students learn the design process and provide students with more time to go through the design process for the challenge. In the future, I would make sure the students are knowledgeable and have used the engineering design process before solving a challenge, so that I would use as much lesson time to teach the process. I also would increase the time for the design challenge to around 2 hours instead of 1.5 hours because I found that the students who did not solve the challenge wanted to keep revising their rockets to hit the target but they did not have enough time. Lastly, I would add another target station of the moon to make a total of three instead of two, so that groups would have a shortened wait time to test their rockets. Overall, the Launch It Design Challenge was an enjoyable STEM learning experience for the students.

Sample Testing Tables

Name Caden Band Ethan C.

Test, Evaluate, and Improve

Test Trials	Rocket Improvements	Reason for Improvement	Launch Angle	Hit the Moon(Target)
1	Original rocket design	-----	50°	Yes <input type="radio"/> No <input checked="" type="radio"/>
2	Paper Nosecone	clay was too heavy	50°	Yes <input type="radio"/> No <input checked="" type="radio"/>
3	Less air	goes farther	80°	Yes <input type="radio"/> No <input checked="" type="radio"/>
4			80°	Yes <input type="radio"/> No <input checked="" type="radio"/>
5			55°	Yes <input type="radio"/> No <input checked="" type="radio"/>
6			60°	Yes <input type="radio"/> No <input checked="" type="radio"/>
7			55°	Yes <input type="radio"/> No <input checked="" type="radio"/>
8			58°	Yes <input type="radio"/> No <input checked="" type="radio"/>
9			56°	Yes <input type="radio"/> No <input checked="" type="radio"/>
10			57°	Yes <input type="radio"/> No <input checked="" type="radio"/>
11			57°	Yes <input type="radio"/> No <input checked="" type="radio"/>
12			58°	Yes <input type="radio"/> No <input checked="" type="radio"/>
13	Short launcher	goes farther	58°	Yes <input type="radio"/> No <input checked="" type="radio"/>

Fraction of times your rocket hit the moon

$$\frac{2}{21}$$

Test Trials	Rocket Improvements	Reason for Improvement	Launch Angle	Hit the Moon(Target)
14			70°	Yes <input type="radio"/> No <input checked="" type="radio"/>
15			0	Yes <input type="radio"/> No <input checked="" type="radio"/>
16			200	Yes <input type="radio"/> No <input checked="" type="radio"/>
17		3 1/2 in. up	0°	<input checked="" type="radio"/> Yes <input type="radio"/> No
18			60°	Yes <input type="radio"/> No <input checked="" type="radio"/>
19			60°	Yes <input type="radio"/> No <input checked="" type="radio"/>
20			55°	Yes <input type="radio"/> No <input checked="" type="radio"/>
21			53°	Yes <input type="radio"/> No <input checked="" type="radio"/>
22				Yes <input type="radio"/> No <input checked="" type="radio"/>
23				Yes <input type="radio"/> No <input checked="" type="radio"/>
24				Yes <input type="radio"/> No <input checked="" type="radio"/>
25				Yes <input type="radio"/> No <input checked="" type="radio"/>
26				Yes <input type="radio"/> No <input checked="" type="radio"/>

Name Terriann Weisenberg

Test, Evaluate, and Improve

Test Trials	Rocket Improvements	Reason for Improvement	Launch Angle	Hit the Moon(Target)
1	Original rocket design	-----	60°	Yes <input type="radio"/> No <input checked="" type="radio"/>
2	more air in balloon	same distance	60°	Yes <input type="radio"/> No <input checked="" type="radio"/>
3		same distance	70°	Yes <input type="radio"/> No <input checked="" type="radio"/>
4		went further	50°	Yes <input type="radio"/> No <input checked="" type="radio"/>
5		same as 50° angle	45°	Yes <input type="radio"/> No <input checked="" type="radio"/>
6	take off clay / fold nose + taped down	nose cone too heavy	50°	Yes <input type="radio"/> No <input checked="" type="radio"/>
7		hit board.	60°	Yes <input type="radio"/> No <input checked="" type="radio"/>
8		didn't go as far	70°	Yes <input type="radio"/> No <input checked="" type="radio"/>
9	change balloon - hole in balloon, air leaking		60°	Yes <input type="radio"/> No <input checked="" type="radio"/>
10	1 breath of air in balloon	hit board	65°	Yes <input type="radio"/> No <input checked="" type="radio"/>
11	1 breath of air	hit moon	70°	Yes <input checked="" type="radio"/> No <input type="radio"/>
12	"	hit board	70°	Yes <input type="radio"/> No <input checked="" type="radio"/>
13	can't wait to release air.	doesn't get enough power/force	70°	Yes <input type="radio"/> No <input checked="" type="radio"/>

Fraction of times your rocket hit the moon

1/25

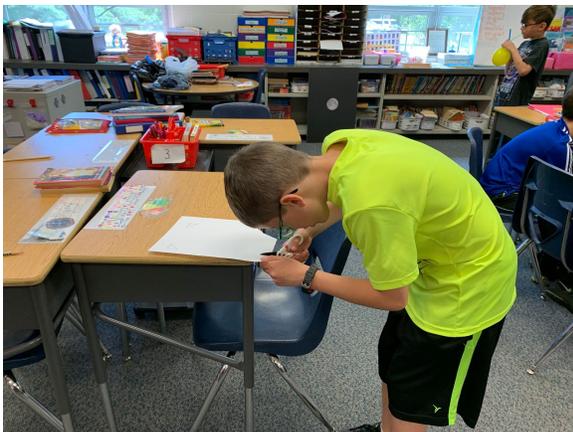
Test Trials	Rocket Improvements	Reason for Improvement	Launch Angle	Hit the Moon(Target)
14	add 1 more fin - now 3 fins	help with direction	70°	Yes <input type="radio"/> No <input checked="" type="radio"/>
15	took extra fin off + made	help with direction	70°	Yes <input type="radio"/> No <input checked="" type="radio"/>
16	right angle with fins (changed position)	help with direction	45°	Yes <input checked="" type="radio"/> No <input type="radio"/>
17	"	"	"	Yes <input checked="" type="radio"/> No <input type="radio"/>
18	"	didn't aim correctly	"	Yes <input type="radio"/> No <input checked="" type="radio"/>
19	"	"	"	Yes <input checked="" type="radio"/> No <input type="radio"/>
20	"	"	"	Yes <input checked="" type="radio"/> No <input type="radio"/>
21				Yes <input type="radio"/> No <input checked="" type="radio"/>
22				Yes <input type="radio"/> No <input checked="" type="radio"/>
23				Yes <input type="radio"/> No <input checked="" type="radio"/>
24				Yes <input type="radio"/> No <input checked="" type="radio"/>
25				Yes <input type="radio"/> No <input checked="" type="radio"/>
26				Yes <input type="radio"/> No <input checked="" type="radio"/>

Launch It Engineering Design Challenge Pictures

Plan



Create



Create



Test



Test

