Description of Artifact

In this engineering design challenge, students used LEGO SPIKE Prime kits to design, build, program, and refine a robot or vehicle capable of capturing a ball and transporting it 20 feet while maintaining continuous contact with the ball. Students followed the Engineering Design Process by asking questions, researching mechanisms, brainstorming multiple solutions, planning a design under clear constraints, creating and testing prototypes, and iterating based on performance data and failures. The engineering notebook documents student thinking at each stage, including design decisions, coding attempts, mechanical challenges, testing results, and reflections on improvements. Students were required to integrate both mechanical design and programming, troubleshoot real-world issues such as stability, motor control, sensors, and power management, and make informed decisions to improve their solutions over time .

Reflection of Artifact

This assignment provides students with sustained opportunities to engage in higher-level thinking at DOK levels 3 and 4. Students analyzed constraints, evaluated multiple design options, synthesized mechanical and coding knowledge, and made iterative decisions based on testing data and observed failures. The engineering notebook provides clear evidence of conceptual understanding and cognitive processing, as students documented problem-solving strategies, debugging processes, design revisions, and reflective reasoning about what worked, what did not, and why. Rather than following a single set of instructions, students were required to adapt designs, revise code, and justify improvements, demonstrating applied reasoning, persistence, and decision-making. The completed student work samples show authentic engineering thinking and complex problem-solving.

ENGINEERING Notebook
LEGO SPIKE PRIME

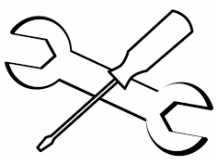
YOUR MISSION Your mission, which you must accept, is to design a super grabber then design a more advanced robot or car. The main test for the activity is to see if you can design an advanced car or ROBOT and program it to CAPTURE a ball and MOVE it 20 feet.

For the design challenge, the following restrictions apply to your designs.

The car should have tires or wheels
The car needs to be able to capture or harness or grab the ball
The ball can touch the ground while it moves
The ball must always stay in contact with the car while it moves
You can NOT touch the ball or pick up and place it in the car

The permitted materials are LEGO Spike Prime kits.

 ASK & RESEARCH	*Engineers ask critical questions about what they want to create, whether it be a skyscraper, amusement park ride, bicycle or smartphone. These questions include: What is the problem to solve? What do we want to design? Who is it for? What do we want to accomplish? What are the project requirements? What are the limitations? What is our goal?* *This includes talking to people from many different backgrounds and specialties to assist with researching what products or solutions already exist, or what technologies might be adaptable to your needs.*
 IMAGINE	*You work with a team to brainstorm ideas and develop as many solutions as possible. This is the time to encourage wild ideas and defer judgment! Build on the ideas of others! Stay focused on topic*
	Revisit the needs, constraints and research from the earlier steps, compare your best ideas, select one solution and make a plan to move forward with it. Why did you decide on this solution?

 PLAN	
 CREATE & TEST	*These early versions of the design solution help your team verify whether the design meets the original challenge objectives. Push yourself for creativity, imagination and excellence in design. Does it work? Does it solve the need? Communicate the results and get feedback. Analyze and talk about what works, what doesn't and what could be improved.*
 IMPROVE	*Discuss how you could improve your solution. Make revisions. Draw new designs. Iterate your design to make your product the best it can be. And now, REPEAT!*

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What mechanism should I use to grab the ball?

What are the limits with what I can build with LEGOS?

What size is the ball?

How do I build a LEGO car???

How am I supposed to take the LEGO pieces apart?

What do any of these pieces do?

How do I make the wheels turn?

How do I insert code?

How do I drive the car?

How can I fix the battery to make it flat on the bottom?



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IMAGINE	I can attach wheels directly to the grabber mechanism. I can make a net to carry the ball. I can make a truck to put the ball into a trunk. I can grab the ball behind the truck and drag it. I can create a forklift to lift the ball.
 PLAN	*Revisit the needs, constraints and research from the earlier steps, compare your best ideas, select one solution and make a plan to move forward with it. Why did you decide on this solution?* I will make a grabber, and attach it onto the delivery cart. The cart will move forward, pick up the ball, move again, and then drop it. I can make it so the cart only needs two of those blue motors so I can use the third one for the grabber. This will be hard.
 CREATE & TEST	*These early versions of the design solution help your team verify whether the design meets the original challenge objectives. Push yourself for creativity, imagination and excellence in design. Does it work? Does it solve the need? Communicate the results and get feedback. Analyze and talk about what works, what doesn't and what could be improved.* My car wants to drive off into the void. Not happening. Reworked the code again, still did not work. My car got attacked by another car and lost a wheel. Whoops. I made my own code from scratch, this seems to work better. Time to attach the claw. Accidentally deleted my whole code before copying it. My car ran out of battery today. Going to charge it and build the grabber again. I hope that this will work, I have not tested the car yet. I am not using the correct blue piece for the grabber, so I need to kind of modify the original instructions. The item I am using for the grabber is spinning around in a circle, going to have to figure out how to get that to stop. I have attached eyes to the grabber. Why? It's because it looks goofy, and it makes me happy. The test grabber is extremely flimsy, definitely will not work. I am starting to want to give up on this project. Got to keep going, I think I can make it work. The grabber is still flimsy, I am going to put rubber bands on it and hope that it works. The battery finished charging! It's not working though…. Maybe charge it for longer?

	Everything is in place, time to start coding. I need to move the grabber up a bit, it is blocking the sensor. The class ended, and I could not finish. That's okay, I had a lot of fun!
 IMPROVE	*Discuss how you could improve your solution. Make revisions. Draw new designs. Iterate your design to make your product the best it can be. And now, REPEAT!*
	Overall, I think the only way I could improve is by fixing the grabber. The car worked just fine, and the code (should) have worked, so I just need to improve on the grabber. I had a lot of fun on this project, thanks Mrs Hamilton! I hope we get to do more projects like these in the future, as I enjoyed building and coding a lot.

Side notes:

CODE FOR GRABBER:

E when pressed
A start motor at -100% power

E when released
A run clockwise for 0.5 seconds

Grabber A works best for grabbing a ball, but grabber B is a lot stronger. Try a different grabber?

Blue lego mover thingies are good for moving wheels

The battery was put in incorrectly. I might have done that, so sorry Mrs Hamilton!!!

CODE FOR CAR:

When right button pressed

Set movement to A+E

Set movement speed to 50%

Start moving [arrow facing up]

Wait until B is closer than 5%

Stop moving

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Should we build a baseball bat or a car with a claw?



IMAGINE

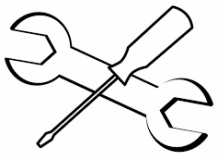
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1.build a baseball bat to hit the ball 20 feet

2.(second round) Build a car that can use a claw to move a ball 20 feet. Then use the claw and build pongs so that we can battle other cars.



Revisit the needs, constraints and research from the earlier steps, compare your best ideas, select one solution and make a plan to move forward with it. Why did you decide on this solution?

PLAN	1. Build a baseball bat using a strong motor. 2.Build a strong car car and claw, taking advantage of all the motors and two sensors/buttons.
 CREATE & TEST	*These early versions of the design solution help your team verify whether the design meets the original challenge objectives. Push yourself for creativity, imagination and excellence in design. Does it work? Does it solve the need? Communicate the results and get feedback. Analyze and talk about what works, what doesn't and what could be improved.* We tried to build a baseball bat but it didn't hit the ball far enough Built the claw Wrecked the claw Built the car Built a new, more effective claw that connected to the car well Coded buttons and sensors in
 IMPROVE	*Discuss how you could improve your solution. Make revisions. Draw new designs. Iterate your design to make your product the best it can be. And now, REPEAT!* Armored the car so it could be a better battle bo Made "Mr. Clampy" mechanism, alternate program for battling meant to clamp on to rival battle bots. Starts when program begins Upgraded with prongs for battle bot