

# Career Readiness Challenge

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Frog Bots





Most likely everyone has eaten fruits and vegetables before. Well, what if I told you that according to the United States Department of Agriculture (USDA), honeybees pollinate 15 billion dollars worth of crops in the US and honeybees also pollinate more than 130 types of fruits, nuts and vegetables. At the same time, honeybees face many threats such as American Foulbrood Disease. We all need food to survive and honeybees are crucial to agriculture. We chose to interview Annette Kleiser, founder of Dalan Animal Health because they are helping to save the world by providing vaccines for honeybees.

My brother and I created a VEX IQ team named Frog Bots. Ever since we were little we loved science and technology, for example, Walter loved garbage trucks and I loved electric fans as toddlers. We both have dreams of becoming business owners and would like to help the world. We thought that this was the perfect opportunity to learn more about what we love.



# Engineering Design Process

What else can be improved? Once the vaccine works and is approved by the USDA, use the EDP to solve how to market it. Use the EDP to solve any other problems.

## Repeat Design Process:



## Test Solution:



## Identify the Problem:



## Build and Program:



## Brainstorm Solutions:



## Select Best Solution:



Bees are sick and dying. Bees are crucial to agriculture and humans. What can be done to help?

What will save the bees and not hurt them? A vaccine? If so, by injection, by putting it on the bees or into the food? Which bees do we give the vaccine to?

Which solution is simpler? Which solution will be most effective and safe?

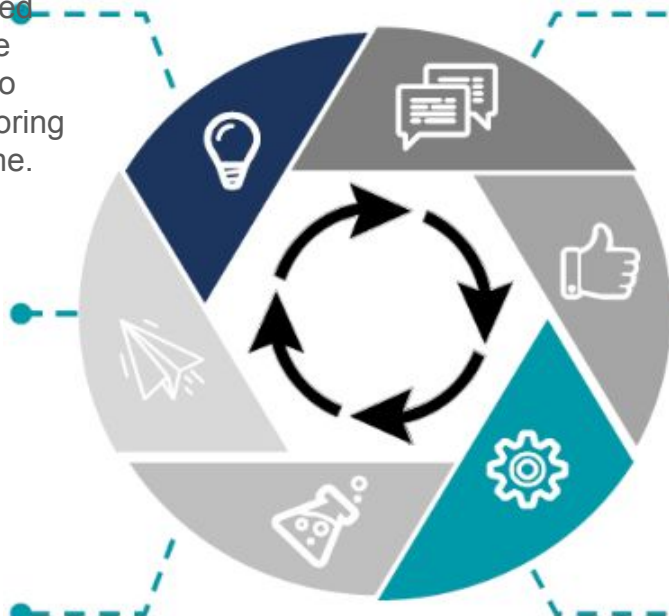
Work with scientists to create vaccine and scale with Good Manufacturing Practices

# Frog Bots' Engineering Design Process

**Identify the Problem:** First we read the game manual and watched the game reveal to understand the game so we know what problem to solve. We also played with the scoring app to further understand the game. In subsequent cycles, we asked "What is wrong?"

**Repeat Design Process:** Each part of our robot that moves has been rebuilt over five times before it worked. Once we had a working robot, we rebuilt different ones that were even better too.

**Test Solution:** We test the individual mechanisms after we build each one. If it does not work, we try to figure out what is wrong and we may try different mechanisms too. After, we do lots of test drives to make sure everything works together.



**Brainstorm Solutions:** For our first cycle, we decided to not look at any other robot and we just researched mechanisms that we thought were relevant. We came up with our own ideas. After we attended our first competition, we saw other robots and we also started to watch videos on other robots to learn from them.

**Select Best Solution:** We used decision matrixes to rank our team's brainstormed solutions and chose the best ones.

**Build and Program:** We started by building the drivetrain, then the intake, and then the storage and output. We then started work on auton using the EDP process.

# Comparison of the EDP for Dalan & Frog Bots: steps 1-3



Honeybees are very important as they are crucial in agriculture and all humans need food. Honeybees are dying from diseases such as the American Foulbrood Disease. Dalan's goal was to make a vaccine that can help bees. Dalan first read the existing research on bee immunity and learned more about bees. They also learned more about the vaccines currently used on other animals. They then brainstormed solutions and selected the best one to try. Annette and Dalan did not set out to use the EDP in developing the vaccine that they developed, but when she thought back on their journey, she feels that they used a problem solving method that is the same as the EDP. Dalan also uses the EDP to make business decisions too, such as how to market the vaccine once they created one that works, and it was approved for sale by the USDA. The team at Dalan sits down and goes through the EDP whenever they have a problem.

## Frog Bots

One of the first things we did as a team this season is to learn more about the EDP so that we can use it. We also read the game manual and thought about how we can score the most points within one minute. We tried to learn about general mechanical systems that people have used before to see if any of them would be relevant to the robot we would build. We used decision matrixes to rank every idea we had while brainstorming, we then chose the highest ranked ideas to build on the robot.



# Comparison of the EDP for Dalan & Frog Bots: steps 1-3



## Research articles

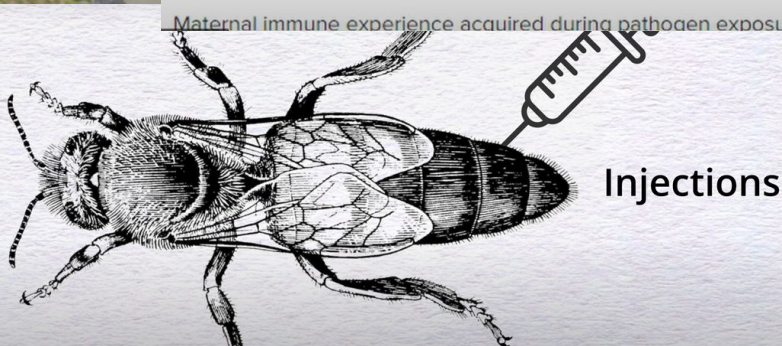
## Trans-generational immune priming in honeybees

Javier Hernández López✉, Wolfgang Schuehly, Karl Crailsheim and Ulrike Riessberger-Gallé

Published: 22 June 2014 | <https://doi.org/10.1098/rspb.2014.0454>

## Abstract

Maternal immune experience acquired during pathogen exposure and passed on to



Injections

## IDENTIFY THE PROBLEM

At the start of the design cycle, identify the problem in detail, challenges IN DETAIL, and constraints. Use pictures, and diagrams. State goals for accomplishing the challenge.

## BRAINSTORM SOLUTIONS

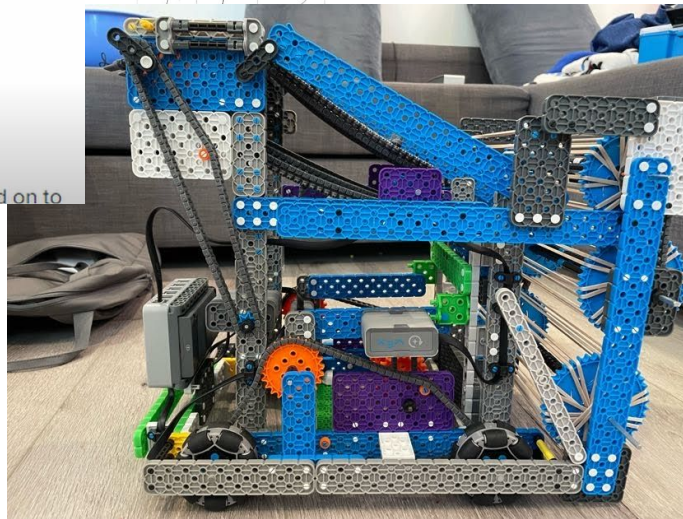
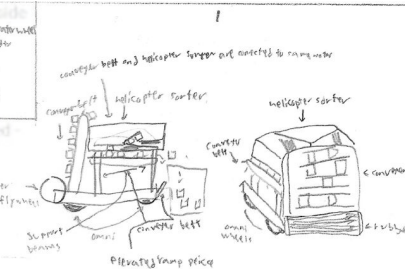
List three or more possible solutions to the game or robot design challenge with labeled diagrams IN DETAIL.

Robot Version

	Robot 1 (7,1)	Robot 2 (7,2)	Robot 3 (7,3)	Robot 4 (7,4)	Robot 5 (7,5)
Reliability	3.5	3	4	3.5	3
Cost	2	1.5	3	3.5	2.5
2.5	3	3	2.5	3	3
2.5	3	3	3	3	3
2.5	3	3	2.5	2.5	2.5

## SELECT BEST SOLUTION

How do you know the solution was selected? How do you describe IN DETAIL the plan to build the chosen solution?



Frog Bots

# Comparison of the EDP for Dalan & Frog Bots: steps 4-6



Scientist put dead American Foulbrood bacteria in the queen bee's food and see if after, the next generation produced by the queen are immune to the disease or not. Many tests and results had to be collected and submitted to the USDA in order to get the vaccine approved. It took three years. Dalan's team has fifteen people on it currently working together. Dalan is now working on making vaccines to protect bees from other deadly diseases too.

## Frog Bots

While building, we had to check that each mechanism we built worked, when they did not work, we had to make changes and improve the design or try a whole new mechanism. Whenever we add on another mechanism, we conducted tests to make sure that our robot still worked because when we change one thing, it usually causes another thing to stop working. We also did a lot of test drives once we had a working robot to see how else we could improve the robot and driving routes. We recorded our results on the engineering notebook too. After each competition, we thought about how we could improve to score higher in the next competition. For our auton, we also used the EDP process. We brainstormed possible routes and how to score efficiently. We also tried using the brain inertia but that did not improve accuracy so we did not continue to pursue that. We have two people on our team working together and the robot season is about one year long.



# Comparison of the EDP for Dalan & Frog Bots: steps 4-6

## REPEAT DESIGN PROCESS

Show that the design process is repeated **MULTIPLE TIMES** to improve performance on a design goal, robot, or game performance

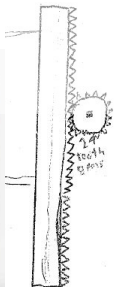
## TEST SOLUTION

Record **ALL STEPS** IN DETAIL to test the solution

Record the **results** of testing  
Record notes and observations from competition performance



elevator mechanism



What we did, why I mainly drove and

Driver No.	Goal I	Goal II	Goal I	Goal II
18	39	2P	39	2P
19	69	3P	59	6P
20	69	2P	29	7P
21	59	2P	59	7P
22	89	3P	49	7P
23	79	3P	49	7P

## Frog Bots



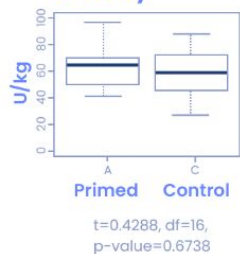
## BUILD AND PROGRAM

Record IN DETAIL the steps to build and program the solution

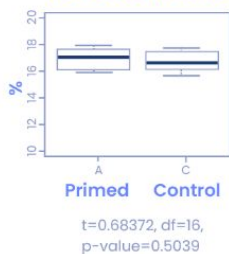
Include enough detail for reader to follow the logic and recreate the design



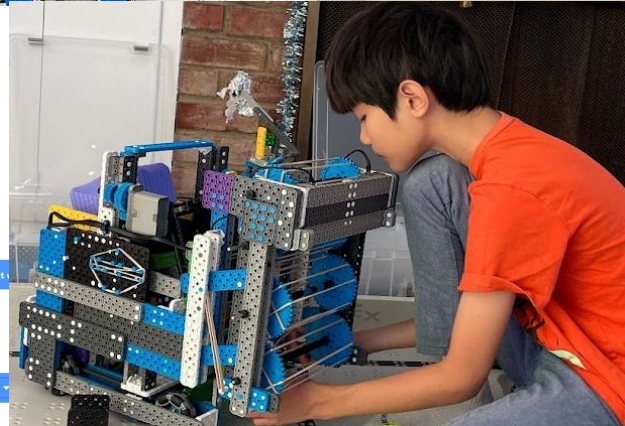
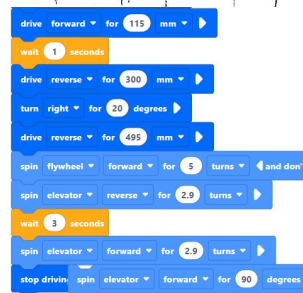
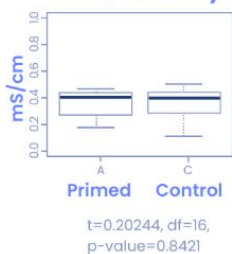
## Invertase activity



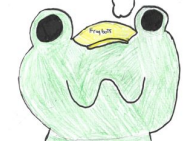
## Humidity refractometer



## Electrical Conductivity







# Participating in VEX prepares us for future careers

- Robots and technology will be increasingly important in the future. By being in a VEX team we learned engineering, coding and how to build robots.
- This robotics competition is the biggest project we have ever done. In our future careers we will encounter really big undertakings too.
- In VEX IQ, we learned the Engineering Design Process and also how to manage time and resources, both skills are going to be very important for our future careers.
- Learning how to work as a team is very useful.
- Building a working robot was endlessly frustrating. This taught us how to be persistent and how to deal with our emotions.
- We got to communicate with different people such as different teams, be interviewed by judges and to conduct an interview too.