TECH AND TINKER

Presented by FRC Robotics Team 1389

EXECUTIVE SUMMARY

Team 1389 will be hosting day camps for 3rd to 5th graders. The camps will focus on hands-on, engaging STEM activities, ensuring a balance of fun and learning, while also generating income to support our team.

PURPOSE

Our goals are to: 1) fundraise money; 2) serve as outreach for the team; and, 3) get the next generation interested in STEM.

AUDIENCE

We are marketing to find 30-40 kids in 3rd to 5th grade. Anyone younger and they would not easily be managed by a bunch of high schoolers. Anyone older and they will not be as enthused by simple stem projects and would be distracted by phones. Due to their age, we are not expecting any of the kids to show up with laptops, phones, or other electronic devices.

LOGISTICS

Date: We are looking to book an elementary school all purpose room for December 14th.

Time: We will rent the space from 8am-2pm and host the camp from 9am-1pm (Extra time would be buffer time for setting up and cleaning up).

Food: We will provide a quick, easy, non peanut snack for kids to eat around 11:30 pm with some outdoor time.

Our camper to team member ratio will be 5 to 1. For our goal of 40 kids, that means 8 team members minimum plus at least 2 adult volunteers.

Rough Schedule of Activities:
8 am: Volunteers arrive and set up
9 am: Campers start to arrive and are sorted into teams of 4
9:15 am: Activities start
11:30 am: Snacks are given, activities are taken outside
12:30 pm: Students come back inside with choice of another activity or driving the robot
1 pm: Campers all leave, volunteers stay to clean up
2 pm: Volunteers leave

PRICING

We will charge $85 per person for the 4 hour camp.

MARKETING

In order to market this camp, we will use listservs and flyers placed in local libraries. We will be sure to be on the listserv for all of the elementary schools in the Whitman cluster, for outreach to our future members, in addition to other elementary school listservs.

SIGN-UP LOGISTICS

We will create a web page dedicated to camp information and registration. On that page, we will have forms for the parents to fill out and then email to the Team 1389 email account. There will be a form and a waiver to fill out. Included on that waiver will be a photo release form, and in the future we will include photos from the camp on our website. We will use Givebutter.com to process payments.

PREP TIMELINE

- Week 1
    - Book The Space
    - Have All Forms Created
- Week 2
    - Recruit Volunteers
    - Web Site Live
    - Start Listservs
- Week 3
    - Train Volunteers
    - Finalize Activities
    - Purchase Supplies
- Week 4
    - Test all Activities
    - Continue to train volunteers
    - Deadline for signup
- Week 5
    - Take inventory of items that arrived

ACTIVITIES

1. CIRCUIT COLORING PAGE (10-15 Min)

Premise:

- Using printable coloring pages, graphite lead can be used to conduct electricity into a LED. This can be a good introduction activity. As kids come in they are given the paper and a pencil to color as we wait for everyone to show up. Then once everyone is sat down and settled the kids will be given the battery and can tape a LED to the page.

Lesson Goal:

- This activity is good for teaching kids how a circuit works. In order for the project to work, the kids will have to learn what is a positive and negative side of a battery. And what "completing the circuit" means. In addition they will learn what an anode and cathode is on an LED.

Supplies:

- Pencils
- Printable Page
- Tape
- 9v Battery
- LED

2. RUBBER BAND RACER (30 Min)

Premise:

- The kids will create and race their own wind up cars. The kids will cut out a rectangle in cardboard, their own circular cardboard wheels, and then use the straws with dowels to create an axel. Using the rubber bands the kids will be able to wind up the wooden dowels and make the car propel forward. The kids will then be able to race their wind up cars.

Lesson Goal:

- Let's see how different these cars are from the cars you see on the street! What's the way they move? That's right, the rubber band!
  When you pull the rubber band, tension starts to build up. Try and hold the wheel after you wind it up, do you feel the wheel trying to spin when you slowly let go? This is contained energy, or what we call potential energy. Now, let the wheel go. See how fast that spins? This new and moving energy is Kinetic energy, or energy in motion.
- Other aspects of design:
  - Friction: The weight of the car the materials the wheels and ground are made of affect the amount of friction between the wheels and the ground
  - Size or rubber band: will affect the amount of potential energy that can be stored.

Supplies:

- Cardboard
- Wooden dowel
- Straws
- Rubber Bands

3. TASK CODING (20 Min)

Premise:

- All the kids will have the same simple task (Ie. lifting an item and putting it into a cup or drawing a smiley face on a piece of paper) and then will have to create a set of paper cards with instructions to accomplish that task. After creating a set of cards with instructions, the kids will shuffle their cards and then switch cards with other people. The other people will then have to reorder the cards they were given to accomplish the task.

Lesson Goal:

- Here the kids will get introduced to basic programming concepts. All programming operates sequentially and programmers need to be very specific with their instructions to their compiler. Once everyone exchanges task cards, then they will be instructed for ways to "misinterpret" what is written down. This will be a fun way to introduce the kids to what bugs are in code, and how to be a successful coder they need to be more clear.

Supplies:

- Pre-cut slips of paper

4. BOTTLE ROCKET (45 Min)

Premise:

- Students will take empty 2 liter soda bottles and try to make the most aerodynamic rocket that we will then launch outside. The kids will work in groups and all get a 2 liter soda bottle. They will add nose cones and fins using the craft supplies available. This activity will happen towards either the end of the program, or right before snack time. Otherwise going outside may disrupt the kids' workflow and distract them.

Lesson Goal:

- Guided by the steps of the engineering design process, this activity demonstrates Newton's "Third Law of Motion" (for every action there is an equal and opposite reaction) and how changing the action force results in a dramatic reaction.
  A launcher powered by a pump fills a plastic bottle rocket with compressed air. When the bottle is released from the launcher, air escapes the bottle. As the bottle pushed out the air, the air pushed the bottle upwards (Newton's Third Law of Motion).

Students should be encouraged to create multiple design ideas, determine the one they want to create, test that model, and create new versions based on what works well.

- They will learn some basics about aerodynamics:
    - fins on the rocket help stabilize its flights by creating drag and preventing spinning
    - The nose cone minimizes air resistance, allowing the rocket to fly in a more streamlined path.
    - Ideally the design focuses on maximizing thrust while minimizing drag.
    - Center of mass: the balance point on the rocket, where all it's weight is considered concentrated, is ideally near the center of the rocket. Kids can add weights (tape coins) as needed.

Supplies:

- 1 Bottle Rocket Launcher
- 1 2 Liter Soda Bottle per 4 kids
- General Craft Supplies*

5. LEANING TOWER OF PASTA (20 Min)

Premise:

- Students will compete to create the tallest possible tower. Students will be given 20 pieces of spaghetti, and one marshmallow. Students will be able to use the marshmallow as glue and place it wherever. In addition the tower will be measured from its highest point vertically, regardless of whether it is bent over.

Lesson Goal:

- Teach about basic structural design. When building structures with spaghetti and marshmallows, the basic principle of structural design lies in creating a stable base with a wide footprint, utilizing triangular shapes for maximum strength, and distributing weight evenly throughout the structure by connecting spaghetti pieces firmly into the marshmallows, essentially creating a network of interconnected supports to withstand pressure and load; the marshmallows act as compression points while the spaghetti provides tension to hold the structure together.
  In addition the kids will learn about prototyping, trial and error. The spaghetti noodles will snap on them multiple times, and their tower may not stand up the first time around. But through persistence the kids will be able to build a tall tower.

Supplies:

- Pasta
- Marshmallow

6. HYDRAULICS (45 Min)

Premise:

- Using two syringes connected by a plastic tube, a hydraulic system will be made for the kids. The kids will then use that one system to make the most creative and functional machine in order to grab an object. OPTIONAL: Students have to use the grabber in order to grab lego figures to “save” them

Lesson Goal:

- Do you know how hydraulics work? They seem magical but are very important in our world. Today we will learn how fluids can be used to transfer force and perform work through the principles of Pascal's Law. We will learn how pressure is transmitted through a fluid to create movement in the syringe. We will create a simple stick frame with a claw on the end to create movement with the syringes.

Supplies:

- 2 Syringes per Kid
- 1 Plastic tube per Kid
- General Craft Supplies*

7. BUILD A BOAT (30 Min)

Premise:

- Kids would create a floating object in a small cake pan filled with water. We would then take each floating object and add pennies until it sinks. Whomever manages to get the most pennies on the boat wins.

Lesson Goal:

- This activity tests the ability of the kids to iterate their designs. They should be encouraged to update their designs as they test. And should be encouraged to test frequently. The water should reveal design flaws like where water is leaking in or where the boat is too heavy. They should use that information to iterate and change the design. In addition, this activity will be created as a sort of a competition. By challenging the students to want to fit as many pennies as possible, the kids should be incentivised to keep innovating.

Supplies:

- Weights (Pennies)
- Small Cake Pans
- General Craft Supplies*

8. COPPER TAPE ART (30-35 Min)

Premise:

- Using a coin battery and copper conductive tape, a simple circuit can be made and attached to a piece of paper. We will then show the kids examples of this craft and what can be made with this. For example: light up flowers and lightsabers. While introducing the activity we can also demonstrate with multiple leds and copper tape the difference between a series and parallel circuit.

Lesson Goal:

- A paper circuit is a low-voltage electronic circuit that can teach the basics of electrics and how circuits function.
  What is a circuit? The pathway that allows electricity to flow from the power source to the item being powered and then back to the power source.
- Other terms:
  - Closed circuit
  - Open circuit
  - Short circuit
  - Terminals

Supplies:

- Copper Conductive Tape
- Markers
- Coin Battery

9. Marshmallow Catapult (15-25 Min)

Premise:

- The kids will use popsicle sticks to create a base for a spoon to sit on at an angle. They will then pull that spoon back in order to launch marshmallows at targets.

Lesson Goal:

- This teaches about the concepts of potential and kinetic energy, demonstrating how stored energy (potential) is converted into motion (kinetic) when the catapult launches a marshmallow. It explores basic mechanics like leverage and force through design modifications to optimize the launch distance
  Potential & Kinetic energy:
  - When you pull back on the catapult arm you store potential energy, which is then converted into kinetic energy when the marshmallow is launched.

  Leverage:
  - The design of the catapult, especially the length of the arm, and the placement of the launching point, influences the amount of force applied to the marshmallow.
- Force & Motion:

- By adjusting the force applied to the catapult, you can observe how it affects the distance the marshmallow travels, illustrating the relationship between force and motion.

Supplies:

- Popsicle Sticks
- Marshmallow
- Spoons
- Rubber Bands

SUPPLY LIST

Item	Cost Per Unit	Items Per Unit	Cost Per Item	Total Units	Total Cost
1. Paper Circuit					
LED	8.99	200	0.04495	1	8.99
Markers	24.99	144	0.1735416667	1	24.99
Colored Paper	6.24	96	0.065	1	6.24
2. Rubber Band Racer					
Hot Glue Gun	16.99	6	2.831666667	1	16.99
Bottle Caps	9.9	100	0.099	1	9.9
Popsicle Sticks	6.99	100	0.0699	2	13.98
Straws	7.99	200	0.03995	1	7.99
Rubber Bands	9.85	600	0.01641666667	1	9.85
3. Task Coding					
Index Cards	5.94	200	0.0297	1	5.94
Markers	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
4. Bottle Rocket					
Bottle Rocket Launcher	40	1	40	1	40
2 Liter Soda Bottle	1.44	1	1.44	5	7.2
5. Spaghetti Tower					
Small Marshmallows	1.19	10	0.119	1	1.19
Spaghetti	2.06	16	0.12875	3	6.18

6. Hydraulics					
Syringes	16.99	30	0.5663333333	2	33.98
Plastic Tube	8.99	10	0.899	2	17.98
Food Coloring	4.59	3	1.53	1	4.59
Popsicle Sticks	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
7. Sink or Swim					
Aluminium Foil	9.18	125	0.07344	1	9.18
Straws	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
Plastic Cups	3.6	100	0.036	1	3.6
Popsicle Sticks	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
Foam Board	29.99	50	0.5998	1	29.99
Clear Tape	9.4	12	0.7833333333	1	9.4
Duct Tape	16.95	6	2.825	1	16.95
Pan	16.99	10	1.699	1	16.99
Pennies					
8. Copper Tape Art					
Copper Tape	13.99	6	2.331666667	1	13.99
LED	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
Markers	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
Colored Paper	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
9. Marshmallow Catapult					
Spoons	2.7	50	0.054	1	2.7
Popsicle Sticks	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0
Rubber Bands	SEE ABOVE	SEE ABOVE	SEE ABOVE	SEE ABOVE	0

ESTIMATED COST & PROFIT

Location Cost: 240
Supplies Cost: 370.36
Total Cost: 610.36
Gross Profit: 1700
Net Income: 1089.64

FINAL COST

Tech & Tinker Costs				
Category	**Name**	**Details**	**Count**	**Cost**
Room Rental		6 hours	1	240
ORDER 1				
Activity	Hydraulic Claw	Silicone tubing	1	8.99
Activity	Misc	Dowels 100 pack	1	6.99
Activity	Paper Circuit	LEDs Pack of 200	1	8.99
Activity	Paper Circuit	Batteries Pack of 20	1	8.49
Activity	Misc	Rubber bands Pack of 120	1	9.95
Activity	Paper Circuit	copper tape	1	6.99
Activity	Hydraulic Claw	30 pack	1	10.99
Activity	Rockets	Launcher	1	39.99
Tax				6.08
ORDER 2				
Activity	Paper Circuit	Copper tape pack of 6	1	13.99
Prizes	Rocker keychain	pack of x	1	8.99
Prizes	fidget spinners	pack of 16	1	15.99
Prizes	Slingshots	pack of 25	1	12.99
Activity	Hydraulic claw	tubing. single roll	5	44.95
Activity	Paper Circuit	Batteries Pack of 20	1	8.49
Misc	Snacks/Prizes/napkins/paper towels/pencils			121.33
Misc	Kid Scissors	pack of 12	1	9.72
Misc	Adult scissors	pack of 5	1	6.79
Misc	Cardstock		1	14.99
Misc	Rubber bands		2	9.58
Misc	Name Badges		1	8.99
Misc	Crayons		5	7.45
Misc	Markers		5	19.95

Misc	Tape		3	8.67
TOTAL EXPENSES				660.33
INCOME				1700
PROFIT				1039.67

CONCLUSION

We hosted our first ever tech and tinker on December 14th, 2024. We are already planning on hosting 2 more before the end of the year, one in April and one in May. Our final costs were $660 total, $240 was for the location. We ended up charging $85 to 20 kids. Meaning we had a gross income of $1,700 and a net profit of $1,040. We were able to keep roughly 60% of our profit.

We ended up with 20 kids, even though we had wanted 30-40 kids. But after hosting those 20 kids, we have realized it is way too hard to control a large volume of kids. The most we would do in the future would be 25.

Our team has a philosophy of always examining everything we do through three lenses: don't forget, do differently, and do more of.

Don't Forget

Next time, it is important to not forget cleaning supplies. Having STEM activities such as launching bottle rockets outside using water power, gets very messy. We ended up having to clean up a ton of mud the kids tracked back into the elementary school. In order to do that next time we should bring mops, table cloths, and a cheap rug for kids to wipe their shoes on.

While our goal was to get kids excited about STEM, the kids inspired us. The first activity was the spaghetti tower. The kids built crazy looking structures that wobbled and shaked. And we did not anticipate that when those towers fell, that the kids would want to keep on building. But instead the kids took every failure in stride, and tried again. Even though our first camp did not get the amount of people we wanted, we were reminded that 20 people was fine for our first try. We even ended up liking that number as even 20 elementary scholars was sometimes a logistical nightmare. Just like those kids, we need to not forget that sometimes it is ok to have setbacks. What matters most is what you do next.

Do Differently

After one event we have already identified that we need to do some things differently. After we broke all the kids into groups of 4 for all the STEM activities, we assigned team members to lead the groups of kids. However we assigned too many people to be just “floaters” and those team members did not have a clearly defined role. Next time, we need to just assign all the team members to groups of kids in order to ensure everyone has something to do. The perfect amount of team members to each group was two. Once we had three there was always a team member with nothing to do, and with only one it was hard to adequately address each kid's questions.

Another issue we ran into in the clean up was that kids did not take their projects home. At the end a lot of the projects were mixed together or the kids just forgot to take them at the end. Next time we are planning on giving each kid a bag to put all their creations inside. That way at the end they can just pick it up and go. In addition, we would place a flyer inside those bags advertising our team, *FIRST*, and our district event.

In addition, at the end we had trouble ushering kids out. The kids either wanted to spend extra time with the robot or complete their projects. We could use this information in two ways: we either need to learn to more effectively end or we need to extend to camps. Ending more effectively could be as simple as handing every kid their gift bag with projects, since this would help identify the camp is coming to a close.

Alternatively, we could extend the camps. We thought we would have too few activities, but instead we had too many. Out of our 9 planned activities, we only completed four and a half of them. We did Circuit Coloring Page, Bottle Rocket, Leaning Tower of Pasta, Marshmallow Catapult, and at the end the kids could choose to drive the robot or start the Pneumatics project. What we learned was that we either need to plan 9 simple activities, or we can do a few longer form activities. But we can’t combine the two due to time management issues.

We originally planned to make all of the projects competitions between the group, with the best group getting a prize at the end of each activity, For example the tallest tower group and farthest marshmallow group would get a prize. However, all of the kids ended up wanting a prize and taking a prize, even if they had not won anything. It became messy as all of the prizes ended up all over the floor at the end since the kids had grown bored of them already. This could be better managed in the future by making sure all of the kids pick up their prizes in the end. All of the kids would still end up with the prize, but this way they would not leave them at the end.

Do More Of

One important thing to take away from an event is what went well, or what we should do more of. Throughout the event we allowed kids to come up and drive our competition FRC robot. At the end of the event, the kids were all lined up to drive it while their parents came in. Since the robot was the focal point as the parents picked up the kids, the parents started to ask questions about it. This let us better spread the first mission to the community, as we were able to tell all the parents about FIRST and FRC. We were also able to invite all of the parents as they left for our district event in March that we hosted. The kids were enamored with the robot, and they were also very entertained by all the activities. The activities we planned were fun, and none of the kids complained of boredom. In fact, most of the kids kept asking what was the next activity since they were so excited for what comes next.

To start the kid each kid was sorted into groups in an icebreaker activity. Each kid got a nametag on their back with an animal. They had to ask questions to other kids to learn which animal was on their back, and that animal was their group name. This led to a stronger sense of camaraderie amongst the kids as they were able to affiliate themselves with a team name for competitions. And also allowed all the kids to start talking to each other at the beginning. In addition each kid got a name tag. We required parents to sign a photo release, and kids without a release had a star on their name tag. This made it incredibly easy for our photographer to take pictures and from a glance know who they can and can not take photos of.

As we hold more and more of these events, we will continue to grow and become a stronger force in our community. In the future, we anticipate that we will be able to attract more kids, leading to more profit. In addition we will be able to lower costs through reusing materials that were left over and not buying in excess like we did for the first event.