6024

MARCH 2018
ISSUE No.: 01 FREE

SAFETY | COMES | FIRST

MARCH, 2018
FREE FOR CIRCULATION IN FRC

Safety Is Everyone's Responsibility

We endeavour to provide a wonderful experience to all our team members, mentors, parents, visitors by providing them with a very safe, clean and well organised work spaces.

To achieve this, we will adopt the best operational practices, safety training and personal protective equipment.

We will strive to make everyone more responsible and accountable for Safety.

"Safety doesn't happen by accident!
It is always the result of intelligent and sustained effort!!!"

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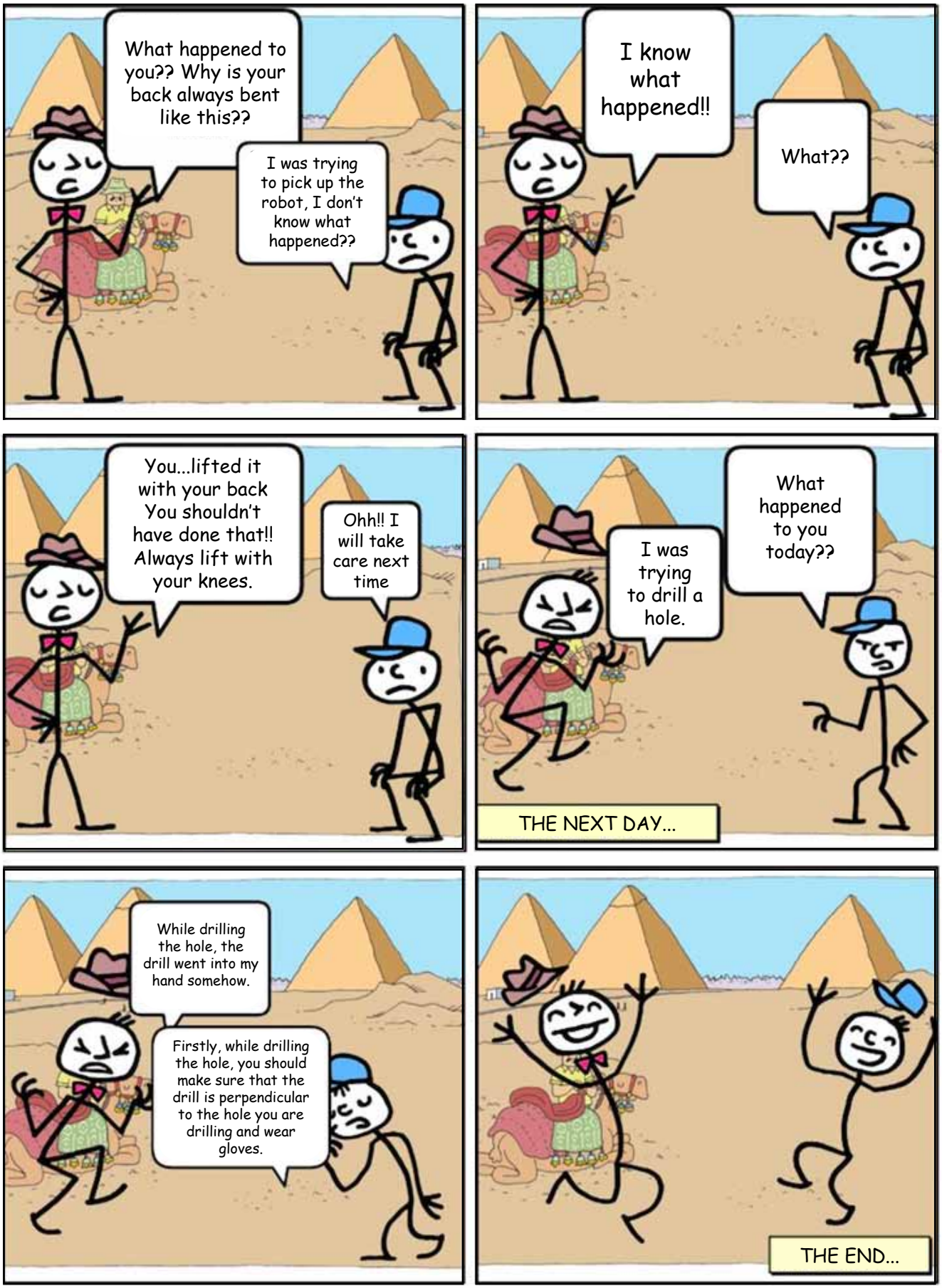
General Safety Procedures

In competitions like FRC, where countless loose parts are used, you can easily hurt yourself if you aren't careful. Nevertheless, accidents can be reduced - if not prevented - if team members are fully aware of their surroundings and knowledged in knowing how to react to any given incident.

LOOK HOW THE STICK FIGURES WERE HAPPY IN THE END, THAT'S HOW HAPPY YOU WILL BE WHEN YOU DON'T CUT YOUR HAND OR DRILL INTO YOUR PALM...



These tips would help you a lot, believe me:

Drilling

- Always wear safety gear (safety goggles, safety gloves etc.)
- Keep the drill on the correct mode (Forward direction)
- Keep the drill exactly perpendicular to the object being drilled
- Use the correct sized bit for a particular hole

Lifting

- Always keep your back straight
- Bend your knees, not your back
- Pick up from non-harmful places (not from sharp edges)
- Use appropriate safety gear

Bolting

- Keep the driver exactly perpendicular to the the object being screwed in
- Keep it on max torque only when needed
- Keep the driver on the correct mode (forward direction)
- Keep the other size held with the correct size spanner if needed
- Use the correct sized bit for a particular screw
- Use appropriate safety gear (safety goggles, safety gloves, etc.)

Cutting

- Keep the power off while clamping the wood, metal or polycarbonate sheets
- Clamp it only according to the marking or longer, because if it's small then you can't make it longer
- Clamp it tightly so that the piece doesn't fly off
- Be on the front and on the side of the cutter so that no shards fly towards you
- Always keep the lid down
- Use appropriate safety gear (safety goggles, safety gloves, etc.)

When working with energy:

Electric Energy

Do's ☑

1. DO ask grown-ups to put safety caps on all unused electrical outlets. Covering outlets will also help save energy by stopping cold drafts.
2. DO make sure all electric cords are tucked away, neat and tidy. To keep it organised and to get to know which wire is what motor.
3. DO ask a coach or the captain for help when you need to use something that uses electricity.
4. DO keep electrical stuff far away from water. Most electrical accidents around the workplace happen when people use electricity near water.

Don'ts ☒

1. DON'T fly a kite near power lines. The kite and the string may conduct electricity – sending it right through you to the ground.(Ask Ben Franklin)
2. DON'T yank an electrical cord from the wall. Pulling on a cord can damage the appliance, the plug or the outlet.
3. DON'T plug a bunch of stuff into one outlet or extension cord. It could damage the electrical system in the factory or even cause a fire.

Pneumatic Energy

Do's ☑

1. You should wear and use necessary personnel protective devices.
2. The wearing of appropriate eye protection equipment is mandatory for team personnel when operating pneumatic tools.
3. Pneumatic tools should be laid down in such a manner that no harm can be done if the switch is accidently tripped.
4. Pneumatic tools and air-lines may be fitted with quick-disconnect fittings. These should incorporate an automatic excess-flow shut off valve. This valve automatically shuts off the air at the air-lines before changing grinding wheels, needles, chisels, or other cutting or drilling bits.

Don'ts ☒

1. Pneumatic tools shall not be connected to, or driven by air pressure in excess of that for which the tools are designed.
2. No idle tools should be left in a standing position.
3. Pneumatic tools should not be kept in bad operating condition. They should be thoroughly inspected at regular intervals with particular attention given to the ON-OFF control valve trigger guard (if installed), hose connections, guide clips on hammers, and the chucks of reamers and drills.

Emergency Procedures

Procedures to be followed:

In case of an incident

1. Attend to the incident
2. Assess whether incident needs emergency procedures to be activated
3. Attend to the situation / tool that has caused the incident
4. Follow the SOP for the situation

In case of an accident

1. Safety first, so get the FIRST AID KIT
2. Incase of grievous injury, contact the following:
   Police - 100
   Fire - 101
   Cooper Hospital - 22 2620 7254

In case of a fire

1. Pull the alarm trigger
2. Inform everyone
3. Follow the walkway / pathway and assemble at the assembly point
4. Contact the following emergency numbers:
   Police - 100
   Fire - 101
   Cooper Hospital - 22 2620 7254

Housekeeping and 5S Technique

5S Methodology

- Establish orderly flow
- Eliminate waste
- Organize the workplace

HOW DO WE MAKE SURE SURE THAT ALL THIS HAPPENS?

i. Sort - To make sure that all waste is disposed of properly, we have separate bins so that at the end of the day, each type of waste will be safely disposed.

ii. Set in Order- We have separated and sorted all our pieces according to their types in different bins which are colored and labelled appropriately so that we can keep track of all our parts in an efficient manner.

iii. Shine - We make sure that our workplace is clean everyday and all the waste material is disposed of properly. This allows us to work well.

iv. Standardize - We have a set of standardized rules to ensure that discipline and safety are the top priority.

For example, we have made a register to mark everyone everyday, if someone comes with open shoes or shorts, they will be marked on the register and they will do some task that does not include the robot for that day so that we can avoid injuries and accidents. Everyone also has to wear all safety equipment while working on or being around the robot.

v. Sustain - By adopting the above practices, we are able to ensure sustainability.

Inventory Management - BIN System

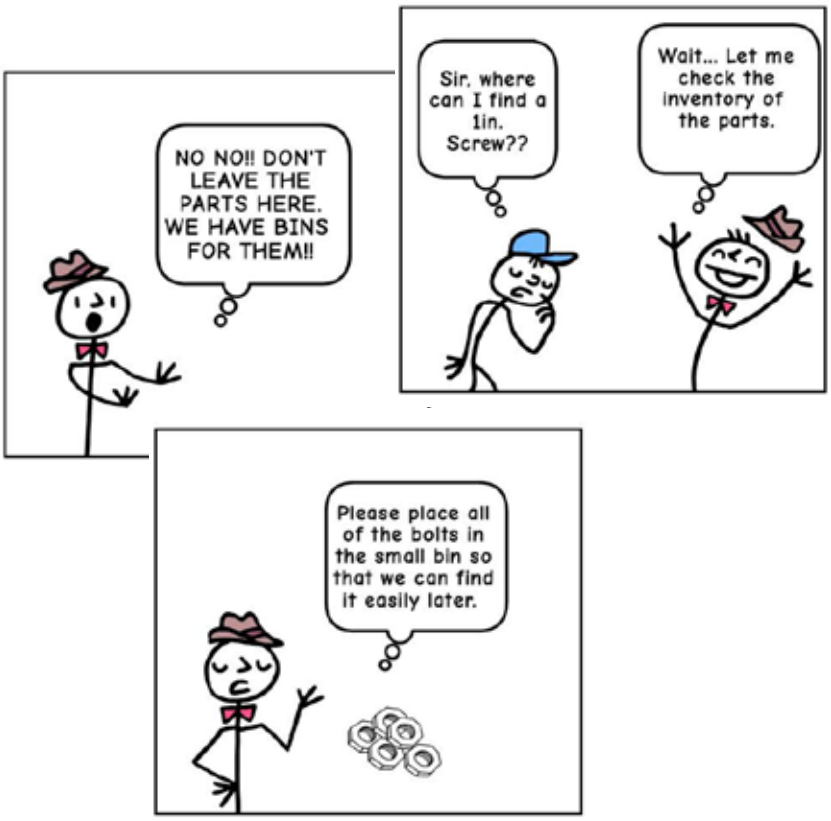
WHILE BUILDING A ROBOT, FINDING THE PARTS YOU NEED INSTANTLY IS VERY IMPORTANT.

To manage the inventory of our resources efficiently, effectively and conveniently we use a "BIN System" as follows:

1. Every part / component is classified based on it's function / use
2. All parts falling under similar use are classified as one category. Many such categories are defined. For example:
3. "Wheels", "Nuts, Bolts, Screws", "Flanges & Hubs", "DC Motors", "Geared Motors", "Bearings", "Gear Boxes", "Gears" so on and so forth
4. Based on the size of the component, 3 BINS are used – Small (S), Medium (M) and Large (L)

5 Numeric serial numbers are then given to the types of the BINS used like S1, S2.....M4, M5.....L9, L10

6 A table enumerating the Part Description, BIN Number and Quantity is displayed prominently on the work space as well as in the system



TO EXECUTE THIS EASILY, ALL PARTS HAVE BEEN PUT IN DIFFERENT BINS WITH NUMBERS SO THAT ONE CAN FIND EVERY PART EFFORTLESSLY WHEN THEY NEED IT. WE HAVE BINS OF DIFFERENT SIZES FOR DIFFERENT KIND AND QUANTITIES OF PARTS.

Inventory Management - BIN System

1. Big bins are used to keep parts like wheels, threads, brackets and electric wires.
2. Medium sized bins are used to store parts like, hubs, spacers, intake wheels, churros etc.
3. Small bins are used to store all kinds of screws, washers and bolts.

Bin No.	Description	Qty. (Packets)
S16	Nut Bolts Am: 1215	2
	Screws Am: 1193	1
	Screws Am: 3296	1
S17	Screws Am: 1232	8
	Screws Am: 2021	1
	Nut Am: 1015	1
	Nut Am: 1038	1
S17	Screws Am: 1197	2
	Nut Bolts Am: 1054	1

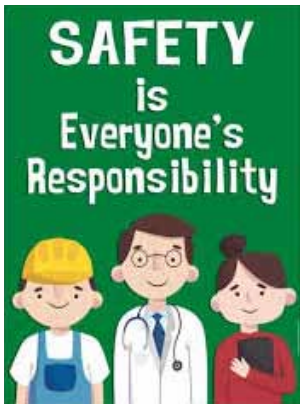
An inventory has also been created which includes the name, number and quantity of every part besides the bin number which leads to no confusion while finding a part and gets work done in no time.
Link to Inventory of Parts.
All parts are searched up on http://www.andymark.com/ for the right name and number of the part.

Safety Awareness and Implementation

WHAT DID STUDENTS OF TEAM R FACTOR DO TO SPREAD AWARENESS ABOUT SAFETY AT OUR WORKSHOP?

We created a sustainable framework by implementing best operational practices, using personal protective equipment and safety training. Our motto was "Safety Is Everyone's Responsibility"

1. **Put posters about safety for awareness.**



2. **Set fixed dress codes.**

   Everyone must wear:

   - Full pants
   - Toe covered shoes
   - Safety glasses
   - Gloves and mask if required

We have a safety checklist which tells us when one has not worn the proper outfit.

Student Name	21	22	23	24	25	26	27	28	29	30	31
Aadit Lakhani	S						FLL	FLL			
Aarav Parikh							FLL	FLL			
Aarushi Majumder	S						FLL	FLL			

For our team members who were found to be short on safety - we conducted intensive safety training program and sensitization.

Safety Awareness and Implementation

3. Safety Training Sessions

Students and parents were informed about the rules and punishments that would take place if safety precautions were not taken.

We also discussed why safety is important and how it will help us be successful in Sydney.

4. We conducted a fire drill to ensure everyone understands our emergency procedure.

5. Made a parody on "Man's Not Hot" called "Mans Not Safe" to promote safety. This video was shared and showed to friends, family, other FRC teams from all around the world and the students taking part in the FIRST Lego League Mumbai Regionals to promote safety.

These are some of the ways Team R Factor learned and spread awareness about safety.

Handling and Disposal of Hazardous Waste

**"THERE IS NO SUCH THING AS 'AWAY'.
WHEN WE THROW SOMETHING AWAY IT MUST GO SOMEWHERE"**

~ ANNIE LEONARD

Hazardous waste is essentially any material that is either ignitable, reactive, corrosive, or toxic.

It is harmful to humans, animals, natural resources, environment and our ecosystem. It has to managed well and disposed off correctly.

These characteristics are further defined by the following parameters:

- **IGNITABILITY:** Wastes that spontaneously ignite under temperatures less than 60°C.
  Examples: flammable compressed gas, oxidizers

- **REACTIVITY:** Wastes that are unstable and react vigorously with water or air, generate toxic gases, and explode under either normal conditions or high temperatures
  Examples: cyanide/sulfur-bearing waste, peroxides, ethers

- **CORROSIVITY:** Waste of pH < 2.0 or > 12.0 with the ability to corrode steel
  Examples: strong acids, alkaline degreasers, (waste) - water treatment chemicals

- **TOXICITY:** Wastes which release toxic materials
  Examples: lead, mercury, cadmium, elements classified in the TCLP (Toxicity Characteristic Leaching Procedure) table
  Given these characteristics, such waste needs to be handled with care. You need to wear your personal protective equipment i.e. safety glasses, lab coats, gloves, etc. - it's not an option.

In addition to that:

When using ignitable materials, make sure you're working in a cool environment (with ventilation) and that there's no fire-source in the area.

When using reactive or corrosive materials, ensure that you do not make ANY physical contact with these substances. If you do, treat it immediately!

When using toxic materials, wear a mask to prevent inhalation of any fumes and don't eat anything (even if you're hungry).

Flammable

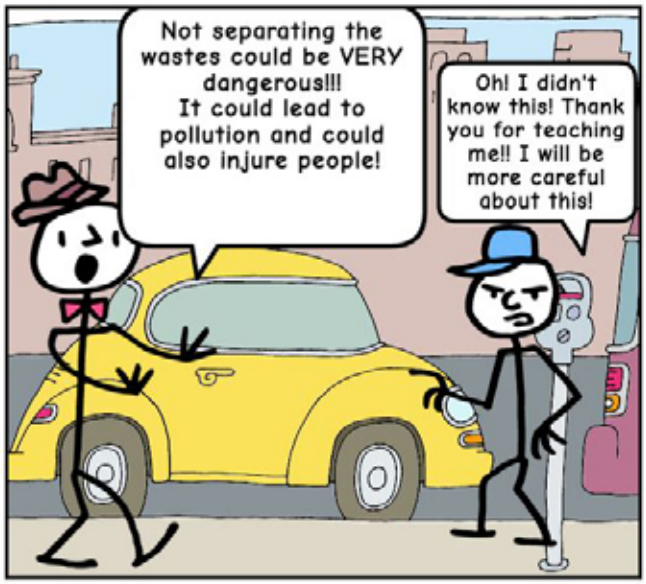
Corrosive

Toxic

SIMILARLY, THESE CAN NOT BE DISPOSED USING CONVENTIONAL METHODS, EITHER, INSTEAD, A RATHER TEDIOUS METHOD OF DISPOSAL IS TO BE IMPLEMENTED FOR THIS.

The process that we follow is as follows:

1. Segregate all hazardous waste
2. Identify and label this waste
3. Deliver this waste to another local factory (eg: ParleG, as that's where our workshop is located) so that they can dispose of this well



Material Safety Data Sheets

A **MSDS** is very important to have for every type of part that is being used. We have made sure that we can collect different material safety data sheets for things like our batteries so that we can react appropriately if any hazard or accident happens and we would generally know how to use the part, battery or power tool, safely and effectively.

We have put up printouts of different material safety data sheets in our workplace so that in case we need to know anything, it will be right there. We have also read them to understand everything about that certain component and this helps us use it in the most productive way. Here's one of our **MSDS**.

WD-40 COMPANY:

Hazards: Flammable aerosol, may be irritating to eyes and skin. Low oral toxicity. May cause gastrointestinal irritation, nausea, vomiting and diarrhea. Product is an aspiration hazard. May cause nasal and respiratory irritation if inhaled. Intentional abuse may be harmful or fatal.

NOMENCLATURE FOR ALL MSDS

Emergency Overview

Signal Word - Danger

Hazard Statements

- Harmful if swallowed
- Harmful in contact with skin
- Fatal if inhaled
- Causes severe skin burn and damage
- May cause an allergic skin reaction
- May cause cancer
- May damage fertility or the unborn child
- May cause respiratory irritation
- Causes damage to organs through prolonged or repeated exposure

This product is an article (battery) which contains chemical substances. Intended use of the product should not result in exposure to the chemical substances. In case of rupture, the above hazards exits.

Appearance-Solid **Physical state**-Solid **Odor**-None

Kaizen

KAIZEN IS THE JAPANESE OPERATIONS PHILOSOPHY OF CONTINUOUS IMPROVEMENT OF WORKING PRACTICES, PERSONAL EFFICIENCY, PROCESSES AND PROCEDURES.

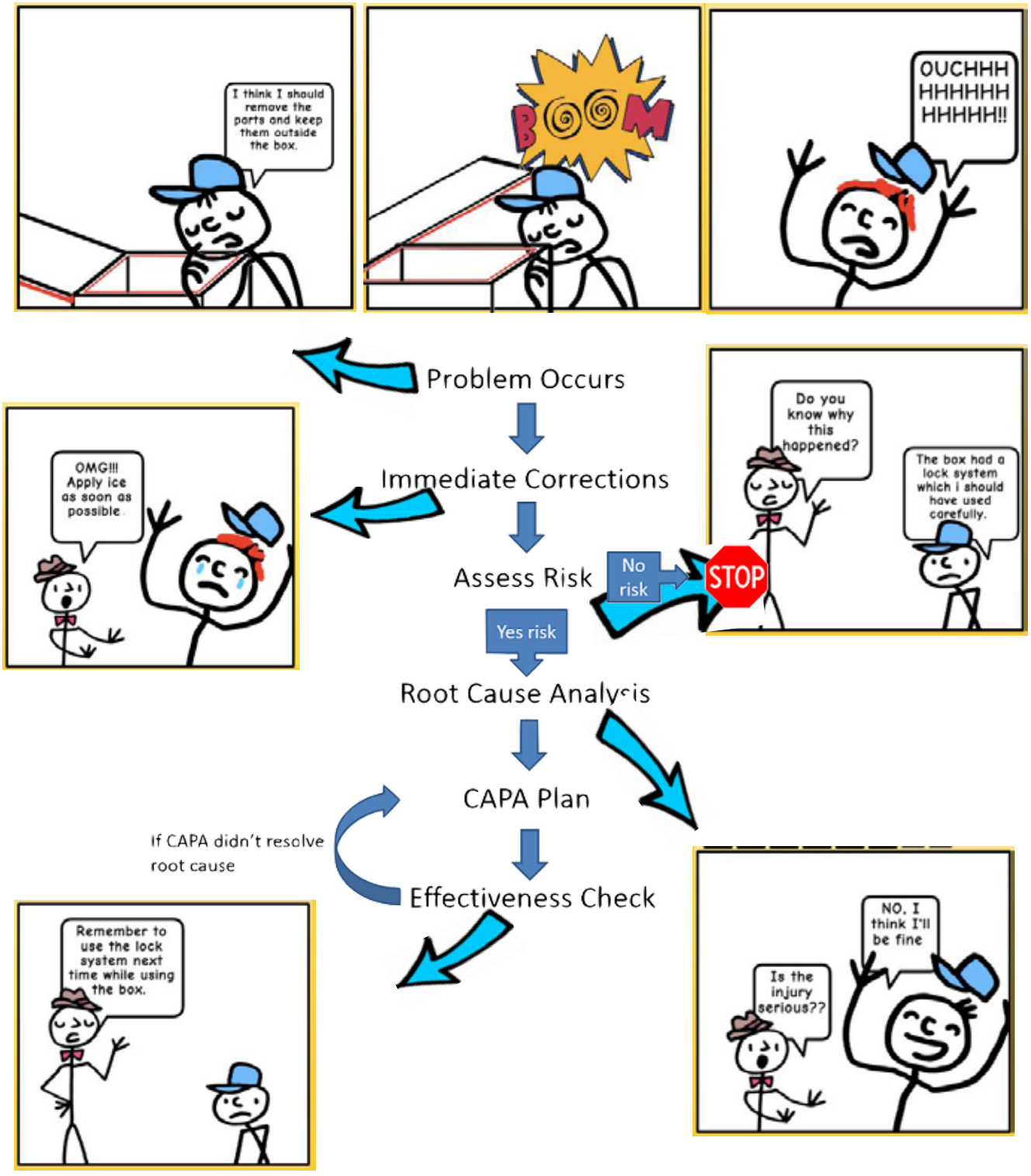
Automotive giants like Toyota reaped huge benefits of this philosophy to introduce to the world very effective concepts like Standardisation, Modularisation, Lean Manufacturing, Just In Time (JIT), Root Cause Analysis – Ishikawa Fishbone Analysis, Plan-Do-Check-Act concept etc.

The above techniques are applied in the following way:

1. Identify a problem (recurring acute problems / not random problems)
2. Use CAPA – take corrective action to mitigate the adverse effect of the identified problem. If the problem is identified take preventive actions to avoid the future occurrence of the problem. Deploy the actions across for all similar situations to prevent any other eventuality. If the proble is not easily identified use Ishikawa Fishbone Analysis
3. Identify possible causes using the Ishikawa Fishbone Analysis
4. Identify the Root Cause or Causes
5. Use PDCA concept to: a) Plan – make a plan / solution for elimination of the cause / minimise the adverse effects of the cause b) Do – execute the plan / solution c) Check – implement the solution / carryout testing to check if the planned goals / objectives are achieved d) Act – if the implementation / testing is successful, prepare a SOP / revised SOP and communicate to all concerned. If unsuccessful, begin the PDCA again with other causes / root causes

CORRECTIVE ACTION / PREVENTIVE ACTION

CAPA (Corrective and Preventive Action) is a system implemented in order to assist with the collection and analysis of data, which is later used to identify and investigate key problems, and hence resolve any existing issues.

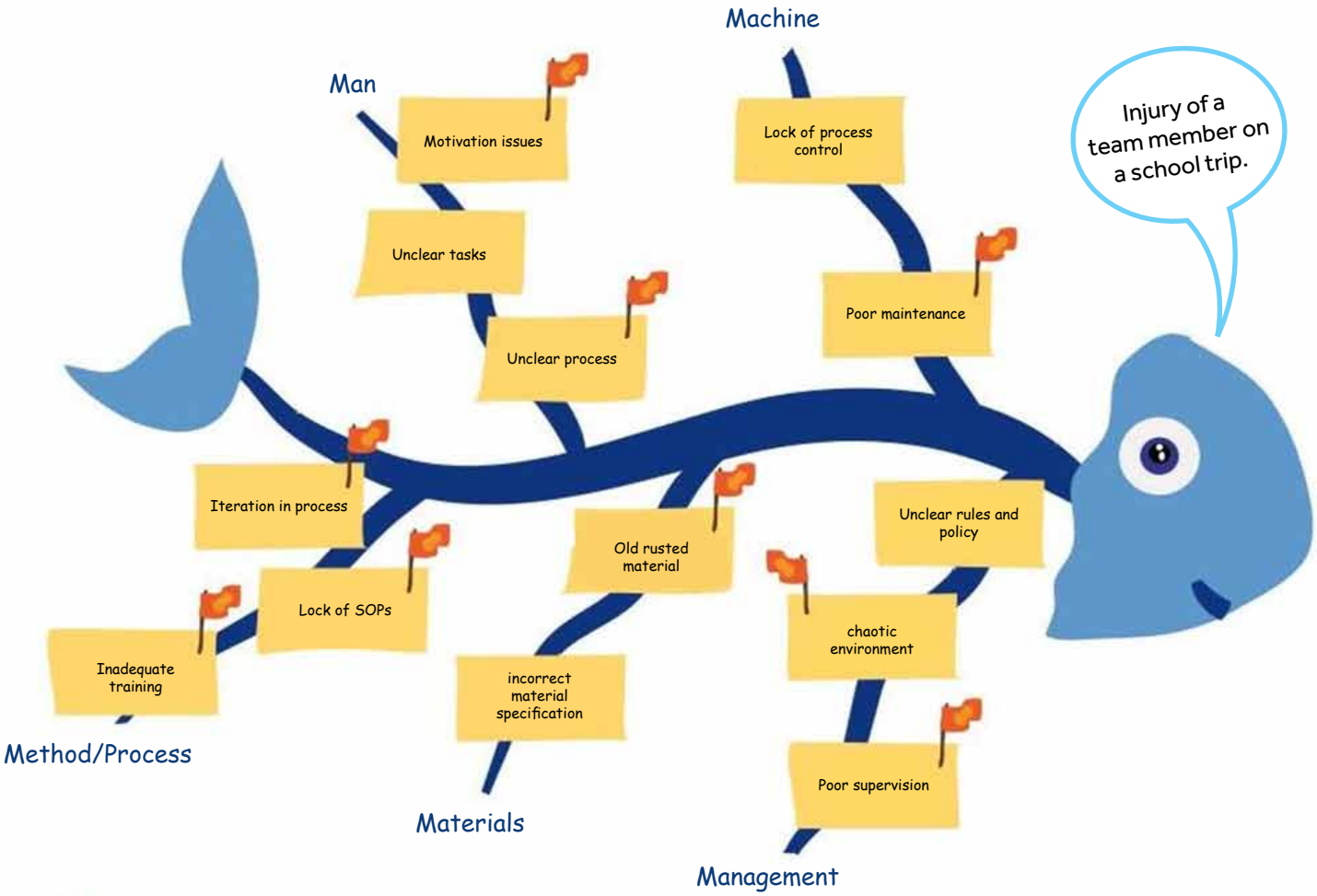


ISHIKAWA / ROOT CAUSE ANALYSIS

The ishikawa diagram (fishbone diagram) is a visual cause-and-effect analysis breakdown of any procedure, used to continuously improve the workings of a system or setup.

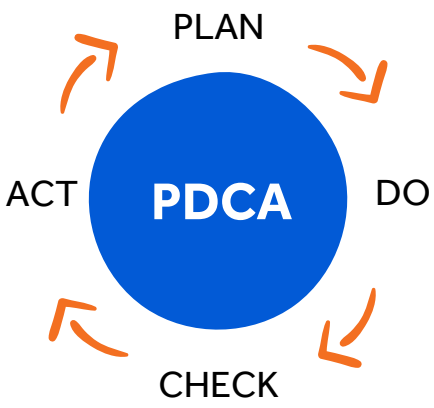
In a recent school trip, one of our team members injured herself badly. Misinterpreting the instructions, her partner forgot to latch the heavy machine while she was using it. As a result, the machine's lever slipped and hit her, leading to a broken nose.

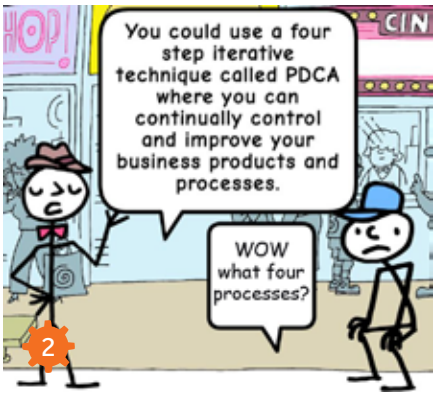
Reflecting upon the incident, she evaluated the plausible contributing factors with the help of the ishikawa diagram.

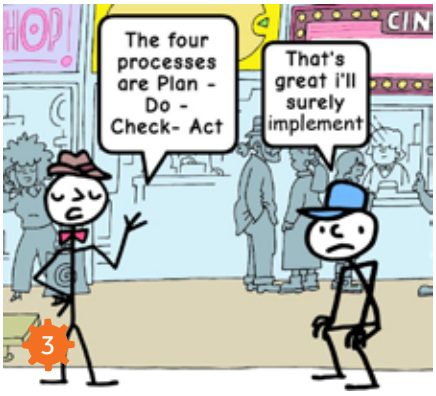


The plausible factors contributing to the incident have been indicated with a flag in the diagram above

PDCA IS A PROCESS WHICH PROVIDES A SIMPLE AND EFFECTIVE APPROACH TO PROBLEM-SOLVING AND MANAGING CHANGE MORE PRACTICALLY TO GAIN GOALS OR DESIRED RESULTS.

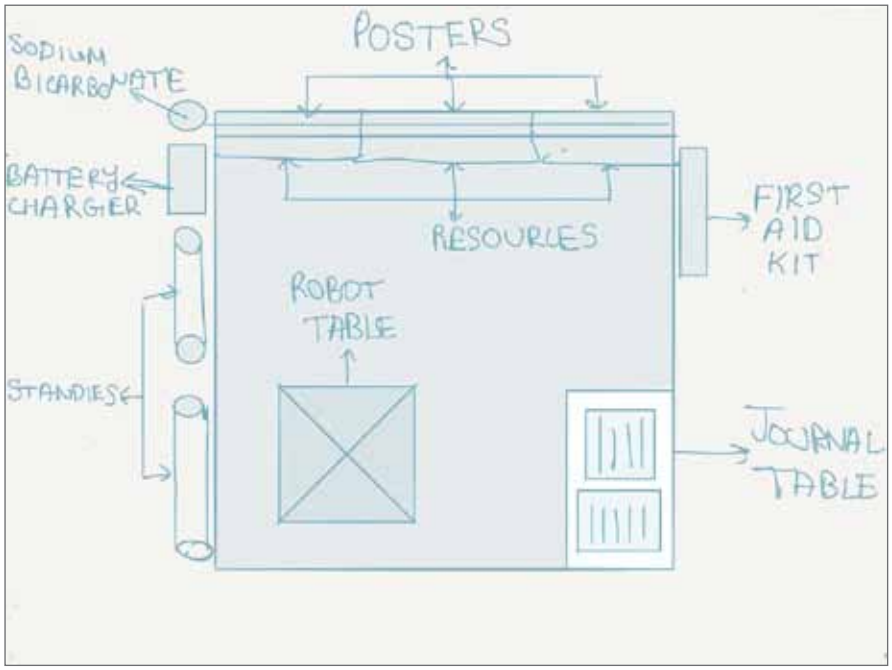






PIT Management

PIT LAYOUT

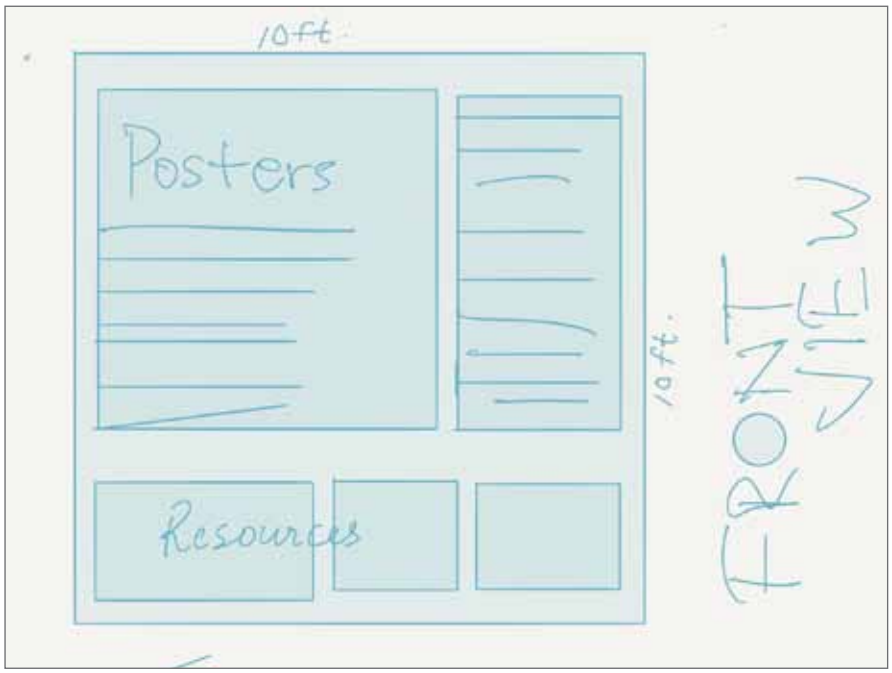


OUR PIT WOULD BE 10 FEET BY 10 FEET.

It would include:

- 1 Table for the robot
- 1 Journal table
- 1 First aid kit
- 2 Standees (text and images)
- 1 Battery charger (3 battery ports)
- 1 Bucket of sodium bicarbonate (for battery leaks)
- 1 First aid kit
- And 1 3 frame by 3 frame poster
- 3-5 Resource boxes

ELEVATION OF FRONT FACE OF PIT LAYOUT



THE 3 FRAME BY 3 FRAME WILL HAVE MULTIPLE RESOURCE BOXES IN THE BOTTOM 3 FRAMES AND POSTERS IN THE TOP 6.

People in the pit:

In the pit there would be:

- Maximum 5 people (Including coach)
- 1 Safety team member at all times
- 2 construction team members, 1 electricals team members and 1 team member during maintenance time.
- Backup pit team during team matches (including safety)
- Members of drive team right after matches (to explain the problems)

The Safety Team

Aadit Lakhani

Jai Jariwala

Radhika Sekhsaria

Shiv Kampani

Soham Warke

Vansh Diora

Vedanshi Shah

Yashvi Jaju

NOTES

“Safety doesn’t happen by accident!
It is always the result of intelligent and sustained effort!!!”