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# Hints for New Teams

## Right after the Workshop

1. **Hit the ground running.**
   Do not wait to get started. You only have a limited build time before the tournament and time is of the essence. Another benefit of starting immediately is the workshop will still be fresh in your mind. If you can arrange it, you should plan on meeting sometime during the first week after the workshop**.**

2. **How often do we need to meet?**
   Most experienced teams meet a minimum of 2 to 3 times a week for several hours each session. More time is optimal if it is available as many teams meet everyday or every weekend for extended practices. The kids will be so motivated that they will want to work as much or as often as you will let them.

3. **Recruit some help.**
   It would be helpful if you have not done so already to recruit another teacher or parent to help out. Parents do not have to be engineers or programmers to help. Someone to help organize, bring snacks, sit in the classroom and oversee kids can be a big help. Watch out for the parent volunteer who wants to take over and do it for the kids. As long as they understand your philosophy that adults facilitate the student's understanding and don't do it for them, you will be okay.

4. **Use the manuals**.
   The Link, sensor and motor manuals contain a lot of useful information. They are electronic but some teachers choose to print them out and put them in 3 ring binders for easy access by the students. This is also true of the game rules & specifications and the documentation requirements.

   This can be a great student activity and it gives you an easy answer when students ask a question pertaining to those topics; "Did you look in the binder?"

   While on the subject of binders it is also a good idea to keep a "Lessons Learned" document. The students can refer to it as they go along and as you build your program from year to year it will be a handy resource for the new kids.

5. **Ask for help.**
   Other Botball coaches are a great resource and unlike many athletic coaches, most academic coaches are concerned about helping teach ALL students, not just the ones on their teams. You can use the Community site, the Team Home Base forums and you can also call KIPR tech support.

6. **Plan out the season.**
   Mark a calendar or Gantt chart with important dates:
   - 1st submission documentation due
   - 2nd submission documentation due

3rd submission documentation due
Tournament date

Students will not inherently know how to manage their time. Let's face it, it is hard for many adults! Students should be in charge of all submissions, but you can facilitate by reminding them of upcoming due dates.

A large calendar or project plan displayed where everyone can see it is a good way to go. This is also why we require a project plan in the first documentation submission from your team.

You can draw one out on your whiteboard (if the janitor doesn't erase it) or put it on butcher or poster paper. The local lumber supply store (Lowes or Home Depot) will carry 4' X 8' sheets of melamine backed 1/8" masonite, that is relatively inexpensive (~$12). You can write on it just like a whiteboard, using a permanent marker for the grid and whiteboard (erasable) markers for everything else. It can easily be cut into smaller sizes and mounted on the wall.

Team meetings can be held with the first order of business being going over the calendar and any upcoming due dates.

**Set a date that the robots must be built by and stick to it, it does no good to have an awesome robot(s) that never gets programmed.**

## Kit Organization

1. **Organize your kit components.** You can only use what is provided in your kit with the exception of a few items. You can often add paper or foil, line or thread and rubber bands. YOU CAN ALSO USE MATERIALS for LIGHT SENSOR GUIDES. Details are specified (size, #, type, etc) in the construction rules.

   Make sure your team understands what additional items may be used for the current year and place them in your kit components.

   If you lose or break a piece you can replace it with exactly the same part or piece. You may already have spare LEGO, and KIPR metal pieces can be purchased at our online store if needed.

2. You don't want the current year's components mixed up with all of the other stuff in the classroom. This will eliminate challenges by other teams at the tournament, for instance, "This team is using a _____, which is not in the kit."

3. Organized parts can lead to faster and easier construction and redesign of robots.

4. Many teams use Tupperware containers, tackle boxes, anything so that the parts are organized. This also makes it easier to lock or move the components when you have another class or are not working on the robots, including transporting everything to the tournament.

5. If a part breaks, it is easier to find a replacement if you have them organized.

6. This is a good job for team members and will help them learn what is in the kit by sorting and counting. This activity should be done periodically as the season progresses.
   Of course, as the students are going along and building the robots the number of components not being utilized in the construction of the robots will decrease. YOU DO NOT need to make them disassemble the robots at the end of the work or class period and put everything away.

   Tupperware containers or cardboard boxes are great for holding the robots in progress. They make robots easier to transport, lock up and keep from distracting other classes.

7. There are no requirements to use all of the parts included in the kit.

## The Game Board

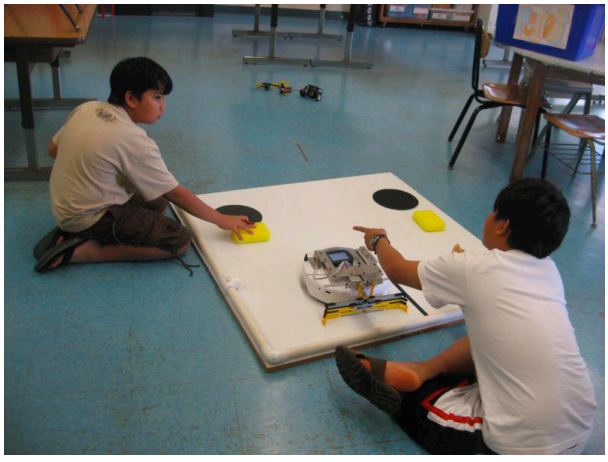
1. **Build the game board!** Most experienced teams immediately build the game board (they can reuse parts from last year's design). The instructions are on the Team Home Base. This is a great parent, mentor and student activity. The cost is ~ $100, but remember, you can reuse the FRP and if you don't glue it, some of the PVC for next year's game board.

2. The board is designed so that you can take it down and put it back up in your classroom. You can lay the FRP on the floor (using the floor to support it as opposed to plywood or particle board) and simply lay the PVC on top without permanently attaching it (you can use tape), if you need to take it down and put it back up repeatedly. The PVC can be securely hammered together (without any glue) with a rubber mallet.

3. Many teams have a classroom or another room in the school where they can leave it set up. Your school may or may not have another room you can use. It doesn't hurt to ask.

4. It is not required and you can get by without building a full board, but it is more difficult.

5. One alternative is to build a portion of the board, say ½. Remember the two sides may not be the same.



6. You could tape the outline of the board onto a floor if you have the right type of flooring or just use a couple of pieces of white poster board or FRP.

7. If you cannot get a full game board built, then you might be able to talk with another team who does have a board and see if they would let your team use it on a practice day. If you are in this position and don't know whom to contact, call us and we can make introductions and see if something can be set up in your area.

8. **Starting Lights**. All robots must wait for light and then start autonomously. The game board will have two moveable lights on each side that are controlled by our game board controller. The students can adjust the lights so that they are in direct line with their shielded light source and then calibrate their sensor prior to the hands-off period.

   If they do not understand and accomplish this, the robots will never start and they will be disqualified. MAKE SURE they understand how to shield and mount their light sensor, adjust the starting lights and calibrate. The specifics for the starting lights are on the Team Home Base. It would be wise to purchase a couple of them so that your students are familiar with them prior to the tournament. They are inexpensive (~$12), and can be used for future Botball seasons as well.


## The Game

1. **Make sure you and the students understand the game.** This is what you should go over with your students on the first meeting after the workshop. Go over the game by using the game table you have built or by drawing the game field on the board or by projecting the game field (on the Team Home Base) onto a screen.

   The goal is to have students identify game pieces and areas on the board where points are scored. They should also be able to identify areas of the board that are off limits or penalize a robot as well.

2. It is important to note that our competition tables are built to specifications with allowable variance**. DO NOT** engineer robots that are so precise a 1/4" difference in a measurement means they are not successful. For example: the specified height of the elevated platform is 15", but at the tournament the platform could actually measure 15 3/16". If your arm is set for exactly 15" it will not work.

3. We also put items and markings on the board to help team's robots navigate or locate their position. If it is on the board there is a reason for it. For example: A black line leading from the starting box to the scoring area could be used by a line following program.

## Task Analysis and Botball!

If you'd like a detailed explanation on how to use the "Task Analysis" approach in preparing your team for the Botball season then check out our "Hints for New Teams – Task Analysis" document which is also included on the Team Home Base!

## Documentation Hints

1. **Do not become overwhelmed** by the documentation. It is important for the kids to understand the importance of documentation in engineering, programming and science in general.

2. Depending on your team structure and management, someone should be assigned to make sure this is completed. One issue to keep an eye on is having the kids push this onto only one student or onto the girls on the team because they are perceived as good writers and not good builders. A great way to handle this and to make sure the whole team understands the importance of documentation is to make the whole team work on the documentation as a collaborative group activity. You can throw up the requirements and have everyone provide input while someone in the group is taking notes. This is helpful because everyone understands the importance of good documentation and it provides a good overview of what is going on. The alternative is to assign several students to go around and gather all of the required information and be in charge of the documentation.

3. **DON'T** fall into the trap of being so wrapped up in the construction and programming that the documentation is left out.

4. **DON'T** let the due date catch you by surprise. Remember the large calendar/project plan on the wall? You don't want to be trying to upload the files with only 1 minute to go! Maybe the due date on the wall should be one day earlier than the actual due date.

5. **DO** look at the examples provided on the Team Home Base.

6. **DO FOLLOW THE RUBRICS**. Read these well in advance of the due date. Students should use them as a checklist to make sure they have covered everything required in the submission. You do not score more points for going above and beyond the rubric requirements. Provide what is asked for and move on.

7. If you do miss a submission it is not the end of the world. Just try and make the next one. The overall points are cumulative so one submission is better than zero submissions.

8. **THERE IS AN ONSITE PRESENTATION**-One or two team members will present to judges at the tournament.

   **PLEASE USE THE RUBRIC**! It is very specific. Many teams give their presentation by marching right through the rubric items in sequence. This is a good idea as it is harder for the judges to miss something. Make sure your team looks at the example presentations on the website.

9. **You have to bring material with you for the presentation** such as a Science Fair type board, a notebook, poster, etc. NO ELECTRONIC MEDIA is allowed. This includes Power Point, computer animations, etc. Some teams choose to make a power point, print the slides and put them in a notebook.

10. **Practice** your presentation by going through the rubric step by step. Have teammates score the presentation using the rubric.

11. **If you forgot about it**, haven't practiced and have no material to present, have a student look over the material and go to the presentation anyway. A few points is better than 0 points.

## Team Recruiting and Organization

1. **Recruiting**- The more diverse your team the better off you will be. It is great to have different viewpoints when brainstorming solutions. Younger students are great because they can become the experts the following year as you build your program.

2. **Organization-**There are lots of options for organization; officers, division of labor by specialization such as design and build team, programming team, documentation team, etc. The number of students on your team will determine the best method for you. For large teams, dividing and conquering is a good idea. Irrespective of the organizational form the team takes, make sure it emphasizes teamwork and groups over dictators and czars. This means the team will have to work on disagreement and conflict resolution, which is good

because it facilitates collaboration and teamwork. Teamwork is not easy for students who have never had to listen to other peoples' ideas. This can be especially true for the high achieving kid who wants to only do it their way. You can use a group vote to decide on issues that are in dispute. If Bill wants strategy A, Lucy strategy B and others strategy C, outline the pros and cons of each and then vote as a team or as a subset of the team.

3. Don't put all of your eggs into one basket. Working as a team and having several people knowledgeable with each item will come in handy on tournament day when someone is sick or during the season if someone loses interest and drops out. This is also critically important for building a program. You don't want the whole team to go down because the star quarterback is sidelined.

## Team Management

There are lots of different ways to manage a team with the optimum one being to let the team members handle the management themselves. It sounds great, but it is ridiculous to expect your students to manage themselves and the project without being taught some skills, techniques and processes to accomplish this. As you develop your program this will get easier and easier.

Day to day management of an open-ended project like this can be challenging. It is not like whole group instruction or "lab" activities. Think back to a lab, project or activity you have accomplished in your regular classroom. Was everyone working on a completely different task? It doesn't happen very often if at all in most classrooms. This is because it is hard if not impossible to manage unless the students are independent and some guidelines have been set. This is why we are taught to use lab manuals and write detailed plans so that everyone knows what they should and shouldn't be doing and the activity keeps them actively engaged for the entire period. In addition to that, you have taught the lab/activity numerous times and read it again prior to class so you are the authority who can answer any question. Compare it to this project where everyone or at least different groups are going in different directions at the same time. This information is new to you as well so you cannot be the sole source of information. You now must be the facilitator who is learning along with the kids. If you try to become the sole source of information, you will end up running around and putting out one fire after another with the students doing little more than waiting for your attention and becoming frustrated when they don't get it.

It is a good learning experience for students to realize that they are in charge. This is their project and they need to take the initiative to look for their own answers and solutions. Did they ask other students? Check their notebooks and manuals? Look online? Ask on the community site? Post an FAQ to the forum before coming to you? If so, then they are starting to take ownership of the project and they are simply using you as a resource. This will also provide you the opportunity to commit quality teachable time with a set group of students. Maybe you work with one group for a dedicated 20 minutes, this group for XX minutes etc.

When they do come to you, if you know the answer or solution, don't give it to them right away. Facilitate by asking leading questions that help them figure it out for themselves.

"The robot doesn't go straight!" You notice the wheels are not attached tightly and have some wobble to them. Instead of saying, "Fix those wobbly wheels!" You ask, "What could cause the robot to not go straight?" "Have you eliminated or fixed each possible cause you came up with?" The more independent they become in their learning and problem solving the more independent and easier they will be to manage. They won't freak out and quit working if you are busy with another group for an extended period.

**Your goal should be to teach your students how to teach other students to design, construct and program autonomous robots.**

Once your program is up and running your older more experienced kids can handle all of the training for your new younger kids as well as the management of the program and you can sit back and grade papers.

The project plan provides the framework for the mini tasks and documentation requirements provide the substance/activities. If everyone knows what they should be working on and where to look for answers and solutions, then management is easier. They should always have something they can be working on.

The alternative is to have small group or whole group instruction where everyone is working on the same task. "Today, everyone will learn how to use the simulator to program the…" This may work well in an off-season setting, but with the time constraints of the Botball season it is not very workable unless you have a very small team (~4) students and a lot of time to meet in which case management is probably not a big issue to begin with. Many teams use this technique in the off-season to bring up the overall skill levels of their team.

4. **Team Equality**- Do not let the boys overpower anyone on the team and become a czar or a group czar. "We will handle the building and you take care of the documentation". This can happen with any team but often happens when you have mixed teams of boys and girls. The team approach is better as long as you make sure it is all-inclusive and no single faction takes over. Because it is a team concept you can switch roles easily. Let's say this group has been working on the mechanical part of mini task 2, goal A, for some time. Now switch them with the group who has been working on documentation. In the end, they will be much more knowledgeable about the overall project.

5. One of the biggest benefits of working with the kids in a non-graded, teacher as facilitator scenario is the relationship that can develop between you as a mentor and the students. This is similar to an athletic coach who works with the kids in a non-graded situation to complete a task. You can use this to influence kids and point them in the right direction in other academic areas.

## Fundraising

1. **Spread the word-** Don't forget these kids are doing great things and people should know about this. Have the kids present their robots to: a parent meeting, school administration, local civic groups such as Lions and Rotary Clubs, and other schools including feeder schools. Invite a reporter or television crew to come out and do a story on your program or on the

success of your kids at the tournament. Contact your local representative, senator, and congressman and let them know what the kids in their district are doing and why it is important. The more people that hear about the program and are aware of it the easier it is to garner support.

2. **Its all about the kids**- Never forget that the kids should be the ones presenting whenever possible. Happy kids with cool robots = support.

3. **You can never have too many pictures and videos (bots and students working on bots)**

## Construction Hints

1. **Use the demobots** as a starting point and make design changes to them as you go.

2. **Keep it simple**. Simple robots are easier to build, program and troubleshoot.

3. If your kids are not familiar with the LEGO or our KIPR metal pieces we are using in the kit, they should be given time to just build and play without having to build a working claw, arm etc. Have them build the tallest structure given XX pieces. This will give them a better understanding of how the pieces can be used.

4. **You don't have to reinvent the wheel**. Look online at pictures of other robots. See how claws are built. This isn't cheating - it is using your resources to build on previous knowledge. To think that a student with no experience with LEGOs , engineering or building can magically come up with a design for a complicated claw is ridiculous. It is okay to start with something existing that works and then modify and improve it later.

   **Check out the pictures** of drive trains, claws and sensor mounts on our website that may provide some inspiration for your students.

5. Do not allow for major changes to the design close to the contest date or on the day of the tournament. It took 6 weeks to get where you are and you are not going to be able to completely redesign the robot in just a few hours. The team needs to know this ahead of time. You will not be in the pit with them at the tournament and that is usually when this happens.

## Programming Hints

1. Attention to detail is the key. If there is one syntax error the program will not run (a missing semicolon, etc). The debugging software will tell you where the error occurred (line #). Fix the first one on the list and try to compile again. You can debug the code by going from error to error.

2. Make sure the students comment their code. If you have numerous students programming they must comment the code so they and everyone else knows what the code does.

3. Make a Gantt chart of desired library functions or a cheat sheet the students can refer to as they begin to learn the functions. Sounds like another great notebook.

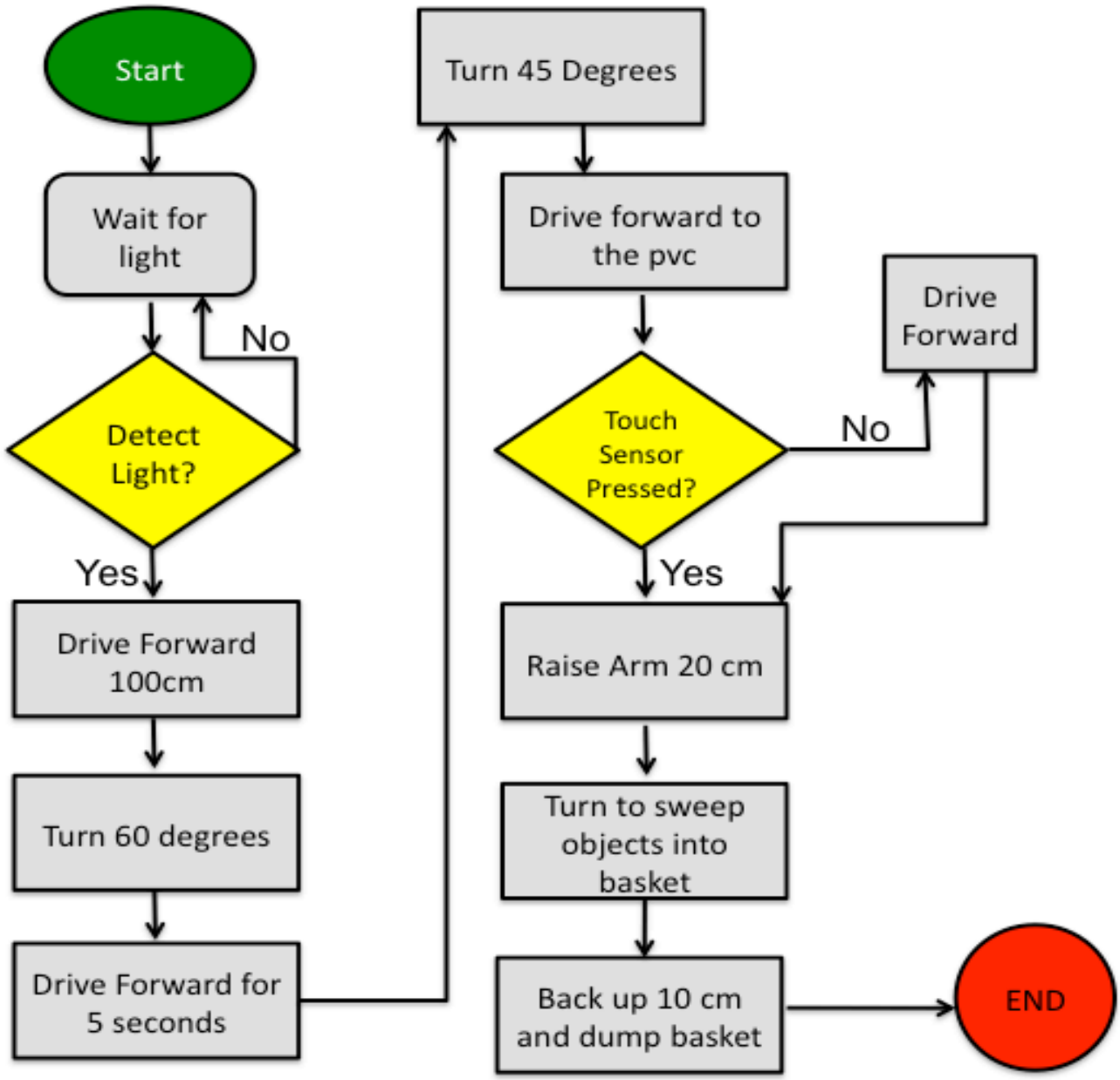
4. You have the workshop activities WITH the solutions.

5. You can have students post questions on the community site.

6. Call Tech Support at KIPR.

7. To facilitate the student's understanding of how they should program their robot, have them pretend to be the robot. Arrange the room so that there are some open areas and a few obstacles. Explain the task to be completed, (Some teachers make a classroom size model of the current year's game board). Make sure they must go around some obstacles, make a few turns and end at a specific location, (Maybe back to where they started). Blindfold the student robot or simply have the student close their eyes. Put them in the "starting box" and have the other students provide directions to complete the task. They should only give **1 direction at a time**. For example; move forward 3 steps. Now, stop. Turn to the right. Stop. Students should quickly realize that the instructions have to be very specific, concise and direct for the student robot to complete the course. If one direction is a little bit off or left out completely it multiplies and the robot is way off in the end. The other fun thing to do is after the student robot has gone through numerous commands, ask them where they are in the course and in relation to other objects. Are they lost or confused?

   This is similar to the assignment of having the students write directions on how to make a peanut butter and jelly sandwich or the Science Olympiad "write-it, do-it contest. They always take steps for granted and leave them out. Now we are back to the task analysis for the code. If you document the instructions the students provide to the "student robot" you can have them write out or flow chart each step needed in the program. When they begin to run the program they can analyze it for success one step at a time. This is a great whole group activity. Here is an example of a program flow chart.




## Tournament Hints

1. Come prepared by bringing your robots, chargers, computers, spare parts etc.

2. Have the students make a pre-game checklist for their robot set up. When they are called up to the game table, they will be excited, it will be noisy and if they have a complicated set-up and calibration, steps can easily be forgotten. **MAKE A CHECKLIST AND USE IT!**

3. Students need to wear neutral-colored or the pre-ordered regional Botball shirts AND team tags they received at check in. They cannot go to the game table with a brightly colored shirt that might distract a robot.

4. **Adults are not allowed in the pit area.** After the team checks in, they go to the pits and you go to the bleachers. This is a good time to interact with other coaches and discuss ideas. Your students **should be independent** by now and know going in that you cannot be in the pits.

   **Your students should be prepared for this and not surprised by this rule when they show up.**

5. It will be noisy and hard to hear. The students need to pay close attention to announcements and graphic displays that indicate when they will be called up.

6. Practice opens on all game tables when it is announced. The students should be ready to practice and calibrate their sensors on the tournament game boards.

7. Seeding rounds begin and they will run 3 times before the lunch break.

8. During the Seeding and Double Elimination rounds they need to bring their team sign (provided at check in) with them. It has their team number and name on it. The judges will attach this to the game table so that the audience will know who is competing.

9. When they are called up to the on-deck area, **ONLY 2** students are allowed. You can rotate this or better yet, the students who have practiced setting up the robots can come up.

10. If they have a problem setting up in the allotted time, they do have one red time out card that can be used anytime during the day. It is best to save this for the Double Elimination rounds because the Seeding round score is an average of the best two of the three runs. (They can afford to get a 0 on one Seeding round.)

11. **Teams will be asked to initial the score sheet after every game.**

    **IF THEY DO NOT AGREE WITH THE SCORE THEY SHOULD NOT SIGN THE SCORE SHEET and immediately ask the judge for a clarification.** The judges are friendly and want to help. Make sure your kids are not afraid to politely ask the judges for a rule or scoring clarification.

    **ONCE THEY SIGN THE SCORE SHEET AND LEAVE THE TABLE, THE RESULTS ARE FINAL** and cannot be changed. Everyone who goes to the game table should understand the scoring and the rules associated with the game.

12. After lunch the Double Elimination portion of the tournament begins.

13. If they lose TWICE they are eliminated and are now in the **Alliance Matches** where they will be paired up with another team. Each team gets to use one of their robots to compete together against the board with the idea of scoring the most points. **MAKE SURE THEY KNOW THIS AHEAD OF TIME** and will be ready to play. After all the work they have accomplished, you don't want them leaving after their second loss.

14. **Stick around for the awards ceremony**. There are numerous special awards that the special awards judges have been judging the entire day. Make sure the students get the

recognition they deserve and point out how important it is to cheer for everyone who is recognized.

15. Take a week or two to rest and then consider taking your team to the **Global Conference on Educational Robotics** in July. You can rapidly advance you and your student's skills by attending the conference and competing in the International Botball Tournament. You and your students can write and submit papers to the conference.

## Terminology

**Inside edge**-This refers to the PVC or often to markings taped on the board surface (starting boxes, scoring areas, your side). We use duct tape that is ~2 inches wide so we must specify inside or outside edge.

**Vertical Projection**-This refers to a boundary such as the inside edge of a taped marking that extends vertically (upwards) into the air. Sometimes you cannot enter this air space and sometimes a game piece can score if it enters the air space by breaking the vertical projection.

**No-Touch Zone**-Areas of the board that the robot cannot touch. If touched by the robot, it can lead to disqualification.

**No Fly Zone**- Areas of the board you cannot break the vertical projection or violate the air space above the area.

**Must touch the surface**- The game piece must be touching the FRP surface of the board to score (Not held in a robot's claw above the board, stacked on another game piece, etc)

**Dead Reckoning-**navigation based on measurements of distance traveled from a known starting point. Move forward 100 cm or move forward for 2 seconds etc.

**Tensile-** to put under tension. In Botball this often refers to string used with a pulley etc. *It is hard to use string that is not being put under tension.*

**Hands Off-**Period in Botball game after the robot is set up and you cannot touch it anymore.

**Virtual height-** Most often used for the starting boxes and is a measurement of the airspace above the surface. Specifications may say; the starting boxes are 15" X 15" square with a virtual height of 15".

**Tethered (as in tethered projectile)-**attached/tied to the robot, most likely with a string.

**Structural-**Provides structure to the robot. A good test is to ask the students if they took the item away would the robot or part of the robot fall apart.

**Seeding Rounds –**Portion of Botball tournament where teams run unopposed against the game to score the most points possible**.** The scores are used to seed or place them into the Double Elimination tournament bracket.

**Double Elimination-**Portion of Botball tournament after the Seeding rounds where teams compete head to head. Winners move forward and losers move to the consolation side of the bracket. It takes 2 losses to be out of the tournament and placed in the Alliance Matches.

**Alliance Matches**-Portion of the Botball tournament when a team is out of Double Elimination and pairs up with another team to form an alliance. Alliance teams work together to score as many points possible.