

LEGO ROBOTICS DAY CAMP



Curriculum & Methods Overview

The curriculum as written assumes:

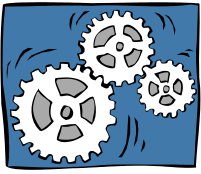
- ❖ Large blocks of flexible time.
- ❖ Campers work in small groups – three is optimal; groups will be determined in large part by similar age and experience as noted on the placement questionnaire when they register for the first day of camp.
- ❖ Camper groups are guided by technical mentors; the ratio of mentors to campers is about 1:6 (one mentor works closely with 2 groups of three campers).
- ❖ Campers do **not** have any Lego Robotics experience.
- ❖ Each group of three campers has one Lego Robotics kit and a programming station (laptop with Robolab 2.5, IR tower).

Several Teaching Approaches

Teaching takes place in a mix of hands-on lab time and “Circle Time”, when all the campers are gathered together away from the distractions of Legos and computers, except for some specific Lego visual aids. Concepts from Circle Time are reinforced by handouts, copies of handouts used as posters, and by the technical mentors and wandering troubleshooters in small-group and individual interactions. Camper handouts are intended not only for the immediate use of the campers, but for later use by their FLL teams and for explaining to Mom and Dad what went on during camp.

Emphasize Choices, Trade-offs, Decision-Making

The curriculum is structured with several opportunities to emphasize choice, engineering trade-offs, and decision-making. Notably, the “Build A Robot” block on Day 2 allows the girls to choose, with their PA’s help, between which of three robots (Acrobot, Roverbot, Scooterbot) to build. This is important early practice in team decision-making as a process and to keep campers open to other ways of doing things. Campers, like many other engineers, are peculiarly susceptible to tunnel vision and providing an array of workable choices helps to counteract that. That said, most teams have the best success and fewest frustrations with the Roverbot with wheels, not treads. The Acrobot is very robust, but has no gearing – very low torque, and often too fast for the light sensor to register thin lines. The Scooterbot shows great use of gears moving parts not attached to the motor shaft, but tends to have a lot of gear slippage. At least one team in the past has modified the construction to greatly lessen gear slippage, but I did not get diagrams of their



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changes.

Consistent Instruction

Training or orientation of technical mentors is very important. This helps ensure that they are all using similar language and concepts helps campers “get” and apply this knowledge. This training session also puts all staff on the same page about the amount of autonomy each mentor can expect with their group, which will vary with the length of the camp, the expertise of the PAs and technical mentors, and the group character of the campers. Monitoring and frequent short staff meetings help staff adjust autonomy and group pace as needed. Some Director/Instructors are comfortable letting groups go at their individual paces; others prefer to keep groups’ activities more synchronized.

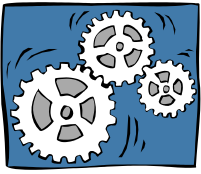
Repeat, reiterate, recapitulate

A useful rule of thumb is that a motivated adult with existing knowledge to which to connect new ideas, has to hear a new idea a minimum of three times before they have any hope of retaining that knowledge. Kids are sometimes intellectually quicker, but less able to put new knowledge into context. So - shore up your patience, repeat often and in a variety of ways, and help connect or apply new knowledge to things they already know or want to do.

For example:

- ❖ Constructing the Pushybot on Day 1 gets campers into the kits, provides a crude follow-construction-instruction experience, and shows the use of gears, and allows testing of torque vs. speed.
- ❖ Seeing the Gear Frame in Circle Time shows speed by counting the number of rotations, and reinforces the idea of changing gearing to get different behavior
- ❖ The handout “Lego Gears” explains these ideas in more depth and technical detail, and provides a reference when they start modifying their robots later, or are on a team.
- ❖ Mentors can then talk about torque for a weak robot, or speed for one that zips over dark lines too fast to see them, and can ask what a solution is.

Go With the Flow



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Our experience is that the character any session of campers varies widely, depending on many factors. Some are predictable; some not. The depth to which you cover any part of the curriculum, and the time spent on it may need to change according to the character of your group. A highly creative, playful group may spend a lot of time on the Pushybot, saying “What if I changed this ...?” Go with those moments, they are golden.

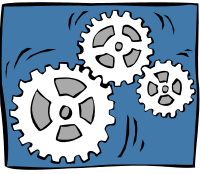
If you have a roomful of engaged kids, think twice about calling them up for Circle Time; sometimes PAs can introduce the new concepts to keep their groups moving forward. A later, condensed discussion at Circle Time and close monitoring by the Director/Instructor can ensure no one got left behind.

Another thing that varies drastically with the character of the group (and the facility) is the amount, timing, and type of playtime. Some groups need more large motor activity; some find silly camp games and songs a nuisance while for others they are a necessary release of tension. Some do well with two short snack breaks and a long lunch; sometimes a snack/game break and an hour lunch works better. This may change from day to day. Day 4 is especially fraught with frustration and intensity. While we had planned some craft activities, most campers wanted nothing to do with them, preferring either to be outside (drawing robots on the sidewalk with chalk was a great favorite) or working on robots and programs.

Some groups are more intense, and beg to come in from lunch to continue working on the robot. Our experience is that this type of group is less likely to forge ahead with “What if I did this?” type of questions, and look for more structured guidance – they want instructions on how to build a touch bumper, rather than guess-and-try. These groups may need a leash on their competitiveness, and persistent encouragement of exploration and creativity. They may also need firm guidance away from NIH syndrom (“Not invented here” – that is, one camper cannot see that anyone else’s ideas have worth) and grabbiness on the part of more assertive and/or advanced campers.

Our experiences with a group of campers acculturated to a more authoritarian way of working together:

- ❖ The campers were uncomfortable with not having specific instructions. Instead of “Build the robot on page 10” break it down into
 - “How many of you have built something out of Legos using instructions?”
 - “Turn to page 10 in your Constructopedia.”



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- Assign two people to find parts, and one to build. Switch roles often.
- Mentor closely, and try to mix some directions with more specific leading questions.
- ❖ The campers were intimidated by, “What do you think?” and required extra support through the whole process of coming up with and trying an idea; sometimes you will just need to give answers. At that point, try to lead them through why.
- ❖ The campers, I think in part because of their discomfort, were highly distractable.

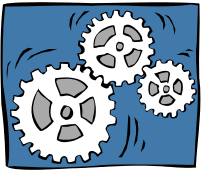
Tips & Tricks

Some strategies for dealing with groups with a high level of ability/ rate of progress:

- ❖ Ask for lots of explanations and demonstrations; often these kids are intuitive thinkers and have skipped some of the step-by-step.
- ❖ Have them add ruffles and flourishes to programs such as songs, dances, returning to base.
- ❖ Send them to a higher level of programming – for example, have them re-do the Can Do Challenge in Inventor Level Three after doing it in Pilot 4.
- ❖ Have them help, show, or demo to a group who is not making such quick progress. Coach explanations.
- ❖ Ask for alternate ways of doing things; have them show you.

Some strategies for dealing with groups with a low level of ability/ interest/ rate of progress:

- ❖ Try to rearrange staffing so that one PA can spend more time with the group. Have the PA review the leading questions and use them.
- ❖ Try having a different PA take the group for an hour or two – it may be a question of teaching style or personality.
- ❖ Can you figure out a hook? Decorating the robot? Naming it? Relating programming to teaching a two year old?
- ❖ Some of these groups just need more breaks than others, if it can be done without distracting other groups too much. Sometimes it helps to run an optional game of icon bingo for 20-30 minutes.
- ❖ Most groups, even those that look hopelessly behind on the morning of Day 4



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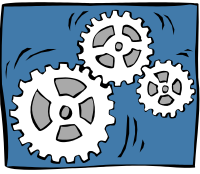
do have something to show off by the afternoon of Day 5.

Some strategies for dealing with different learning styles:

- ❖ Have campers draw diagrams – gears, program plans, etc.
- ❖ Have one or more campers act out what the robot is/should be doing. Ask questions to help them differentiate behavior from perception from desire. Blue masking tape is handy to make lines or circles on the floor to help act out line following or the Can Do Challenge.
- ❖ Have campers read/examine some of the visual aids/ documentation/ handouts and read them aloud to you; ask how that applies to the current problem/concept.
- ❖ Have campers tell you a story – every robot has one, what is this one's?
- ❖ Encourage campers to take notes.

Some strategies for dealing with behavioral/social/personality issues:

- ❖ If one instructor is doing Circle Time and the group is unruly, a second adult or PA calling the group to order saying “I think you are being disrespectful to Jo” is more effective than Jo calling the group to order. (But this could be Jo!)
- ❖ Have one PA, or better yet, an adult volunteer devoted to a group with an especially challenging member. Director/Instructors should check in often.
- ❖ The response to any putdown is: Ok, you've made a putdown, now you have to come up with three compliments. Look the person in the face while you do so.
- ❖ Focus on the goal. You don't have to like each other; you don't have to be friends. You do have to be respectful and work with each other toward the goal.
- ❖ Be sure you have the whole story from all parties before jumping in. Play good cop/ bad cop.
- ❖ Privately, ask the victim “How could you have handled this better?”
- ❖ Privately, ask the aggressor “Why do you want to be mean? How can you make your point without being mean?”
- ❖ Together, ask the involved campers what each of them could have done to keep the behavior/ conversation within bounds and moving them toward their goal.
- ❖ We have found rearranging groups, especially groups with difficult personalities, is very disruptive. You must ask all involved parties before making any rearrangements – that means at least two teams' worth of kids. Sometimes these inquiries uncover additional information such as a history of bullying at



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school or in a troop.

Additional tips on group management and expected age-appropriate behavior is available in the PA training guide from the Girl Scouts Columbia River Council.

For more information on catering to individual learning styles, search for “Multiple Intelligences” or “Howard Gardner” on the internet.

Positive Reinforcement

- ❖ The biggest reward for every camper is working hard and doing the task themselves. It’s even better when PAs and Directors notice and comment.
- ❖ Reward note-taking by documentation checks – relevant notes (about robotics & programming, not PAs or snack!) get rewarded with candy (or stickers, or other small swag). One or two a day at snack time or just before works well.
- ❖ Share at Circle Time – “Lab 5 had a really good idea. Can you show us?”

The exhibition and a little fuss handout certificates and patches go over big. Allow time for PAs (and sometimes Directors) to sign camper notebooks. It’s worth the hassle.