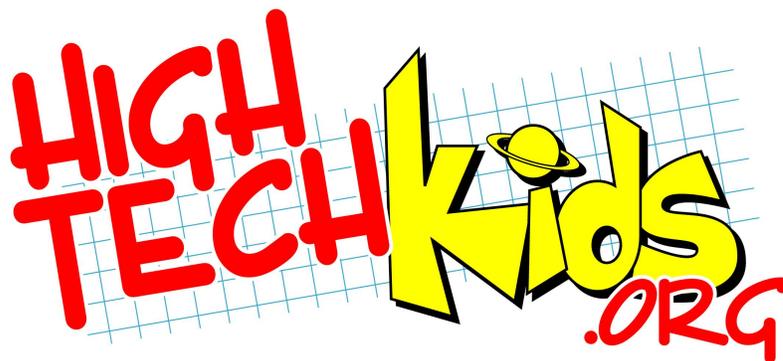




**Coaching  
FIRST<sup>SM</sup> LEGO® League  
Teams**

Version 1.1, August 9, 2004

By  
Kathy Bishop and Steve Jevning



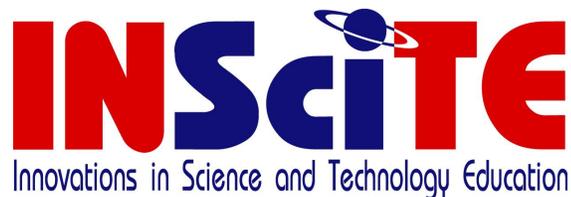
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## **FORWARD**

Coaching a problem solving team, such as a FIRST LEGO League team, can be one of the most rewarding, challenging, and frustrating jobs you ever take on. The purpose of this manual is to help increase the reward part and decrease the frustration part. When we set out we did not intend to write a curriculum, or a step by step manual, but rather capture some of the ideas and soft skills required to keep your team going.

This book fits well with the High Tech Kids mission, developed by INSciTE, to advance innovative programs that provide an environment where kids, educators, and the technical community come together to cultivate life long learning in science, math and technology.

When I pitch High Tech Kids to executive sponsors, I always tell them coaching a problem solving team of kids is the best management training you'll ever get. Throw out that MBA and coach FLL. Everyone will be better off in the long run.

I have spent 25 years in the technology research and development field competing every day with proposals, presentations, experimental results, analysis and global teams. Problem solving is a vital skill and one that can be introduced and taught to kids in FLL and other programs. Part of the mission of HighTechKids is to bring that level of experience in problem solving to programs that help kids.

It's been my pleasure to work with some phenomenal people in the development of HighTechKids. Steve Jevning and Kathy Bishop run a great organization called Leonardo's Basement, dedicated to uncovering the creativity and inventiveness in all kids. They were perfect people to write a manual such as this, to help you discover that ability in your own kids.

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# **Introduction: The Art of Coaching Kids**

The opportunity to coach children in a problem solving competition can be extremely challenging, as well as exciting and rewarding. As in many other situations, good coaching requires a commitment to the kids on your team, flexibility on your part and imagination. This guide is designed as a resource for developing coaching skills in the context of the FIRST<sup>SM</sup> LEGO<sup>®</sup> League competition, especially as sponsored by INSciTE.

As a coach, you will help children develop substantive knowledge as they participate in the program. Equally important, you will teach them creative problem solving and teamwork skills. Team members will learn how to overcome obstacles and accept the ideas of others. If all goes well, you and your team will learn new things, make new friends and have FUN!

The information that follows will help you to better understand your role as a coach, as well as your duties and responsibilities. We hope that these materials will be useful as you develop your own personal style of coaching.

The manual is divided into six sections:

- I. Goals of Minnesota FIRST<sup>SM</sup> LEGO<sup>®</sup> League as sponsored by INSciTE;
- II. The Role of the Coach;
- III. Practical Advice and Techniques;
- IV. Administrative Duties;
- V. Sample 8-week Program; and
- VI. Frequently Encountered Situations.

There is also a list of general resources at the end of the manual.

# I. Goals of the Minnesota FIRST LEGO League (INSciTE)

Each year in Minnesota, INSciTE sponsors the FIRST<sup>SM</sup> LEGO<sup>®</sup> League (FLL) competition. The focus of the program in Minnesota, as well as of INSciTE as an organization, is to inspire children to engage in creative learning opportunities. INSciTE is dedicated to providing opportunities for children to learn together while using technology and solving interesting problems creatively. The LEGO League program itself is similar to other problem solving programs that emphasize the importance of children managing all aspects of the project while being assisted by thoughtful adults.

Accordingly, the goals of First LEGO League in Minnesota, and your goals as a coach, are to help children on your team learn:

- Technical building skills.
- Computer programming.
- Design skills.
- Communication skills.
- Research and presentation skills.
- Persistence.
- Planning skills.
- Engineering skills.
- Experimentation techniques.
- Value of risk taking.
- Decision making models.
- Respect for and trust in others.
- Teamwork and cooperation.

# II. Role of the Coach

As a coach in this program, your job is to create an environment where the team members (kids) direct most of the activities, while you provide support and guidance. The kids should be actively engaged in the project, with you in the background asking questions and suggesting resources. Injecting good humor and fun into the process will be an important element of your success as a coach, as well as of the success of your team.

## A. Essential guidelines for coaches

### 1. What does “coach” mean?

Your job as a coach is to facilitate and guide your team to creative solutions. Because the kids on your team must develop their own solution to the challenge, your role is to lead your team members to discover their own answers. You will need to refrain from directing your team members toward a predetermined result.

While there are important exceptions, this kind of coaching has much in common with athletic coaching for children. Both types of coaching require basic skill instruction. Because coaches intervene in different ways depending upon the type of sport, the problem solving coach should be careful about modeling him or herself after the type of athletic coaching where a coach might “call the play”. A better model for LEGO League coaching is found in activities where student athletes determine strategy and “call the plays” themselves. In soccer, the coach provides opportunities for kids to develop skills and practice, but while on the field by themselves they make their own decisions about a play. In competitive dance programs, coaches teach technique while the dancers develop their own choreography. In LEGO League, the kids need to determine their own strategy and coaches shouldn’t provide substantive direction regarding solutions.

## **2. Use the kids' ideas, not yours!**

Perhaps the most important philosophical directive for FLL coaches is that the team's solution must be produced by the kids themselves. In order to follow through with this guideline, you will need to be comfortable with the idea that the team's solution will likely differ from yours.

Also, the kids' ideas about process will probably be different than yours would be. Again, the best approach is to follow their lead. When children drive the process it will be messy, but progress will take place. While team members are working, they are also learning about themselves, relationships, effective communication and experimentation.

You should also be comfortable letting team members evaluate ideas that you think won't work. Let it go! Testing and experimentation will expose flaws soon enough. In the end, the team will probably produce something you could never have imagined. It might even be better!

## **3. What kind of leadership should I provide?**

Successful teams are led by committed and attentive coaches. Try to be engaged and available at every practice. Modeling appropriate behavior is also important leadership. Admit mistakes readily and make it clear that you do not know everything.

You can help to facilitate the team process by offering logistical support and time management assistance. Have a plan and attempt to follow it, leaving room for creative breakthroughs. Keep your eye on the clock. Most of your kids will be too absorbed to notice the time!

It will be your job to provide time for breaks, exercise and food. This will free team members to fully absorb the content and use their wits and skills to solve challenges. Don't forget to leave time to clean up!

## **4. Safety.**

You need to ensure that the children on your team are physically and emotionally safe. It will be important for you to spend time thinking about how to create an environment where kids behave well, respect each other and stay safe. Relationships between team members may be particularly challenging. In order to chart these difficult waters, you must

model and insist on respectful interactions among team members.

Your team should establish rules for acceptable team behavior.

General recommendations include:

- No physical or verbal abuse. This means no pushing, inappropriate touching, name calling, etc.
- Respect people, the environment and the equipment.
- Listen to each other. Everyone should get a chance to share his or her ideas.
- Be on time. Call if you expect to be late or absent.
- Don't criticize another team member. Try to offer positive alternatives.

Children are often more critical of each other than encouraging. When you see put downs happening, act decisively and quickly. Stop all teasing, including any subtle taunting or "just kidding" attacks you observe. Encourage kids to give and receive praise by modeling it yourself. "Great idea!" "Good job!" "Perfect!" Your team will thrive in an atmosphere where everyone feels welcome and appreciated.

## **5. Ethics.**

Kids must do the work. One major goal of this program is to help young people learn the process of solving problems on their own. Although judges at the competition will be looking for a quality product, much of your success as a coach will be determined by the extent to which the kids made the decisions. For some adults this can be confusing. Many of us think as teachers, coaches or business people; we want to impart information or direct activity in such a way as to achieve successful results as quickly as possible. In LEGO League, you may need to sit on your hands while the kids take the time they need to understand issues and make decisions.

Adults need to help by providing general instruction on basic skills and techniques. They can support the problem solving process with expressions of interest and with questions, but NOT by providing their own ideas on how to solve the problem. Be sure parents or other adults understand this distinction. Help them to understand that the team will learn more and be more successful if its members complete the work themselves.

Play fair! Most kids are instinctively fair and honest. They want to be fair to others and to the process. Do not give them reason to question the importance of this value. For example, if there is a requirement about the number of permissible pieces, follow the rule. If a specific time limit exists, abide by the requirement. Failure to do so will permanently diminish your credibility in the eyes of your team.

#### **6. What do I say if I can't tell them what I would do?**

One way to engage kids without directing them is to talk through the problems together. Again, ask lots of questions! Open-ended questions are especially helpful in getting kids to think through their own answers. Have the team brainstorm lots of ideas. Suggest they try their different ideas and compare results. Ask them about conclusions they draw from their trials. Suggest that they ask each other for help. Solutions will emerge.

#### **7. Fun is important.**

The best way to facilitate a successful team is to take a lighthearted approach and prioritize the team having fun. The following are suggestions for you to maintain an atmosphere of enjoyment for everyone.

- Remember that play is children's work. If you have forgotten what play looks and feels like, sit back and watch. Your team will teach you how to have fun if you let them.
- Openly appreciate the contributions of your team members. Help them celebrate their progress. If you revel in even small successes, your team members will be better able to make it through tough times.
- If you keep a positive outlook, laugh at yourself and find humor in the smallest details, your team will be more successful overcoming problems. Remember that all kids have bad days. Give them room to shrug off a bad mood and recapture a positive attitude.
- Don't forget the importance of food! This is true for all ages. Snacks are a must for even short sessions. Anything over two hours may require something more substantial. Pizza and beverages are always welcome.

## **8. What do I teach the kids?**

As a coach, you will need to be sure the team members learn the general concepts and skills they need to solve specific problems on their own. You don't need highly developed skills in these areas yourself, but it will help if you have a grasp of the basic skills required. You need to know enough to ask questions and understand the answers. Mechanical engineering and programming classes are available through INSciTE.

Many of you may have questions about age appropriate expectations for knowledge and skill development. An excellent reference on this topic is the work of Project 2061 and its publications. Project 2061 is part of the American Association for the Advancement of Science (AAAS). In 1989, it published Science for All Americans, an outline of skills and knowledge in science, mathematics and technology, which all graduating high school students should have. In Benchmarks for Science Literacy, Project 2061 translated these goals into expectations for students at varying ages. These publications have significantly changed the development of science education and curriculum throughout the country.

## **9. Technical skills and social skills.**

A good coach needs to teach both technical and social skills. Successful teams generally have a coach who fosters a healthy mix of the two types of skills. Technical skills include planning, problem solving, engineering and programming. You will need to think about your own skill level in order to decide whether you need additional training. Another option is to find a mentor for your team. While its possible to learn most technical skills along with your team, training and mentors are available to assist you. Available resources are provided at the end of this manual.

A successful team needs social skills in order to work together as a team. Social skills include personal and group skills such as responsibility, mutual respect, communication and self-confidence. Help your team practice and value listening and sharing ideas. Hold brief "show and tell" sessions to share work. If you help your team members develop social skills, their teamwork will make them productive and successful.

## **10. Guide team members through problem solving.**

As Richard Safris explains in his book The Winning Edge, “Coaches are facilitators, not directors” (Safris, p. 18). This means that you help your team members learn basic skills that can be applied to their own creative solution. Rather than sharing your ideas about the problems that they face, you need to guide them through problem solving on their own.

Asking questions is frequently a helpful technique in facilitation. Some successful coaches try to respond to most questions with more questions. If a child wants to know why something isn't working, a coach can ask the child to explain what its doing wrong. If the child demonstrates the problem for the coach, it's often possible for the child to see the solution on his or her own.

Another facilitation technique is to observe the team's work and then ask questions. For example, kids may work for awhile on one plan and then decide to abandon it, rather than continue to address the problems they are having. A good way to guide learning in this situation is to ask questions aimed at understanding what they learned from the abandoned effort. Ask the kids to explain what they are doing and why. Listen for clues and cues in their conversation and offer suggestions.

## **11. Get help when you need it.**

It can be very difficult to coach a team all by yourself. There are many ways other adults and older children can support your work with the team. Assistant coaches can be parents, older children or community volunteers. They can organize a schedule of snacks or help manage the energy of the team, especially in the first weeks. They can teach individual team members learn new skills, control behavior and work with kids to identify jobs that need to be completed. Technical mentors can fill knowledge gaps when team members surpass coaches in their understanding of mechanical engineering and programming. The “Resources” section at the end of this manual should help you locate effective assistance in a timely manner.

## **12. It may be hard to measure what the kids are learning.**

Technical skills are generally easy to measure, and often have immediate physical results. Your robot and programs will provide tangible evidence of work being completed.

Examples of questions that measure such progress include the following:

- How many successful programs are complete?
- Is the presentation finished?
- How fast can we complete the missions?
- How reliable is the robot?

Social skills such as listening, accepting other people's ideas and working cooperatively are more difficult to measure. Nevertheless, if you pay attention to group interactions and to individual team members' behavior you will soon spot problems. Remember that these skills are an integral part of every successful team. Work on them constantly.

### **13. Encourage chattering.**

Contrary to what many adults believe, some children can talk, listen and work at the same time! Children will learn many ways to discuss ideas and share thoughts. They will likely move quickly from topic to topic, embracing good ideas and discarding bad ones. Chatter is a useful form of communication. With help, your team will use this type of communication as yet another tool in the problem solving process.

### **14. Problem solving is a high energy activity.**

Many children are thirsty for hands-on learning experiences. They may be searching for new opportunities to learn and explore. For some this may be their first experience building technology or programming. Expect that your team will be enthusiastic. The intensity of the team members' interest may lead to what appears to you as chaos. Rather than trying to impose your ideas of order, attempt to capitalize on the energy that comes with the kids' enthusiasm, especially in the beginning.

### **15. It won't be easy.**

Working with kids can be complicated and draining. The creative process can be very uncertain and mysterious. You will encounter many technical hurdles. You should also expect social problems. These issues will be similar to those that adults face when trying to work cooperatively on a complicated project with relative strangers and a looming deadline.

Approach the social problems in the same way you do the technical ones, one at a time. Relax, be patient, and try to put yourself in their shoes. Remind kids about unacceptable behavior and praise good work in both technical accomplishments and social behavior. When you observe your team members working respectfully, tell them how fantastic it is. By pointing it out immediately, you will help them recognize what success feels like. It will be easier for them to repeat the appropriate behavior and stay away from old habits.

In general, take satisfaction from small successes. Celebrate the unique talents and energy of your team members. Your enthusiasm will help keep everyone going.

### **17. You are the adult.**

The coach needs to be someone that team members can expect to behave in a predictable and responsible manner. When things get tense, people get frustrated, voices rise, and tempers flare, you must remind everyone (including yourself) that the project is not a life or death matter. Relax. Keeping perspective yourself will help the team manage their stress and have fun.

### **18. When to step back and when to jump in.**

If everyone is working on something and happily involved, you should step back and enjoy the scene. On the other hand, when you notice that someone is off task, getting frustrated or disruptive, step in to work with the child right away. This may mean sitting down and building something together. It may mean that you start brainstorming. Ask the child what his or her thoughts are about a problem. Find out what the child wants to do. The key is to jump in before things get out of control.

### **19. Maintain control**

Inevitably, kids will stray off task. After a time, they may also get disruptive. You will need to calm them down enough to determine why they aren't working. Redirect their energy to positive actions. Balance this need for order and productivity with your team members' need to play and have fun.

## **20. Take a break!**

When nothing is going right and team members are starting to blame each other, you need to insist the group take a break. Rather than a punitive response, the break should be seen as a healthy way of dealing with stressful situations. Take a walk, play a game, find a diversion. This is an opportunity for you to demonstrate that distance can sometimes have good results.

## **21. Team rules and workstyle.**

Coaches who impose their own rules and systems of work upon their team are likely to create unhappy groups. While it is important to abide by a basic set of rules and responsibilities, ask individual members for input about rules and respect different workstyles. Creating team rules is also a good team building activity. Remember to give the kids room to change their minds and change the rules if everyone agrees.

## **22. How do I know if I'm doing a good job?**

If the kids seem happy, engaged and productive, and if you feel comfortable, you are most likely on the right track. You don't need to measure your success by your team's robot or programs. If the team members are working well together, learning and having fun, you will be successful.

Also, remember that it's normal to be anxious about whether you are doing the right thing. There are a number of websites, which offer a forum for a coach to ask questions and discuss issues with other coaches. Finally, even though you feel uncertain, your team is probably doing better than you think. Get out of the way and watch as the process unfolds and your kids grow. Do not stop them when they are on a roll!

## **B. Summary of the role of the coach**

A good coach will be an enthusiastic and curious learner who respects kids and the creative process. A good coach will also be comfortable not having all of the answers and happy to learn from the kids. The following summary provides an overview of the coach's role and responsibilities.

- Prepare for practices: Review where the team was when it last met and imagine what could be accomplished next.
- Be prepared to explain concepts and principles that might help the team with their project.
- Engage the team in team building, whether through structured activities, regular meetings or informal socializing.
- Encourage the team members to work cooperatively with each other, rather than competitively. Help them see each other's strengths and talents.
- Be sure that someone is available to teach computer-programming skills and familiarize the team with the building materials.
- Try to encourage lots of questions from your team, but also try to respond with another question. This will encourage independent problem solving and more permanent learning.
- Avoid offering your own ideas on how to approach a challenge. A priority in this program is that the kids develop their own solutions.
- Ask the team to set goals as a team and as individuals. Review the goals from time to time with the team, and help them revise the goals or establish new challenges for themselves.
- Pay attention to individual needs. If all members of your team are participating to the best of their ability, the entire team will be more satisfied with its work.
- Solve social problems quickly. Respond to disrespectful behavior as soon as it starts. Don't be afraid to consult parents, teachers or other resources.
- **BE PATIENT** – with yourself and your team.
- Ask for help when you need it.
- Enjoy yourself!

# III. Practical Advice and Techniques

## A. Team Composition

### 1. Different kinds of teams

Teams come together in a variety of ways, resulting in different organizational and operational structures. For example, a team with a teacher for a coach might meet during the school day. A team with a parent volunteer coach might meet after school, in the evenings or on weekends.

a. School teams can operate within the curriculum or as an extra-curricular activity. During the school day, a team might meet for 45 minutes each day or for two to four hours each week. After school teams might practice two or three days each week with practice times ranging from one to two hours per session. These time estimates are not intended to create an expectation that teams need to meet 4-6 hours a week to be worthwhile. It is possible for motivated teams with kids who think about the problems on their own to manage with less meeting time.

b. Community teams might be organized as part of a church, Scout troop, park and recreation center, home school, museum or other youth program. They might meet at a school, community center, religious institution or private home. Depending upon the composition of the team, the group will probably meet after school, in the evenings or on weekends.

### 2. How many team members?

A team with five to seven members and one or two coaches seems to work best for most problem solving programs. This size is large enough for members to have defined (and often

multiple) roles but still small enough to make team-building activities and logistics easy to manage. The official limit for this program is 10 kids on a team.

Demand for participation might exceed your capacity. This creates a question of how you select kids for the team. One option is to use an application process where a student writes a short essay focused on the question “Why I want to be on a Lego League team?”

### **3. Veteran teams.**

Teams that continue from year to year show enormous growth. Over time, these children learn to assess situations and capitalize upon their individual strengths to support the team. They continue individual skill development as well as see the benefit of a more long-term commitment to a group. Also, remember that as in many types of child development, it may take multiple years to see such progress in the team.

### **4. Who ARE These Kids?**

Your team will be composed of a broad cross section of children. Many of them will be hands-on learners and most will be eager to experiment and learn. They may be especially interested in engineering and construction, but they may also simply crave a challenging science experience.

Expect a variety of learning styles among your team members. Hands-on learners frequently have excellent spatial relation abilities. While they are often skilled builders, they may be less skilled in reading and writing. On the other hand, you may have team members who are talented in a number of areas. There are many excellent resources for coaches who wish to learn more about learning style differences. An excellent starting point is Howard Gardner’s work on multiple intelligence theory, as well as other literature, which has developed on the topic. Also, Dr. Mel Levine’s work provides extensive information about differences in learning styles, as well as many suggestions for working with children’s uneven development. His books [A Mind at a Time](#) and [Educational Care](#) may be particularly helpful.

There will probably be a broad range of experience among your team members as well. Not all team members will have previous experience with LEGOs. Even those children who

have used LEGOs for years may have never built with gears, pulleys, and motors or programmed a computer. Regardless of their experience and specific interests, it is a good idea to review basic building and programming techniques. For beginners, the Constructopedia and the programming tutorials can be an excellent way to build basic skills for every team member.

There will also be a variety of personality characteristics among your team members. You should expect a full range, from detail oriented, serious, focused children to kids who seem unmotivated and act as if they resent being there. Remember that they all have the potential to be delightfully creative girls and boys.

Some children need help understanding how to learn from mistakes and recover from disappointments. Others need to learn how to share their ideas and become part of a functioning team. Some kids will be shy and need to be drawn into the group. Others will need periods of physical activity to keep them attentive. All members of your team will benefit from you trying to understand and accept their attributes and their skills.

## **7. Children with Special Needs.**

Many children with special needs are attracted to problem solving programs because of their emphasis on learning through activities. It is normal for children with identified learning difficulties to be highly skilled in one area but find it difficult to contribute in other areas. Children with emotional difficulties require thoughtful behavior management. Children with attention disorders may be impulsive and easily distracted. Learning Disabled children may become frustrated easily or act differently from the rest of the group. Someone may be loud, fidgety or act as if he or she knows everything you have to say. In order to accommodate him or her as a team member, you will need to learn about the child's specific needs. If you need ideas on how to manage different kinds of kids, or help with specific problems, use teachers, parents or other mentors as resources.

Team members will look to the coach for direction about how to work with children who look and act "different." Accommodating children with special needs will make the experience an incredible one for them but also profoundly

meaningful for the other team members. There are some simple rules that you should keep in mind to support children with special needs. These will be helpful for other kids too. They are:

- Provide food, drink and exercise.
- Establish a quiet and safe place for kids to get away from the chaos.
- Acknowledge appropriate behavior immediately and constantly.
- Develop clear rules and expectations for behavior.
- Confront inappropriate behavior quickly.
- Establish routines.
- Set clear goals with reasonable timelines.
- Kids may get frustrated waiting for a turn or sharing parts. Set time limits for popular or other high demand activities such as using the robot or the computer (kitchen timers work well).
- Ask parents for suggestions and advice about their children.

As a coach, your job is to help each member of the team recognize his or her strengths and weaknesses to make a positive contribution to the team. As much as possible, you will need to understand and appreciate the unique qualities of each child. Use this information and the diversity of the group to strengthen the team and enhance the creative solutions team members generate.

### **8. Young and old.**

Generally it is best to form teams with children whose ages are no further apart than three years. Children pass through a series of varying developmental stages. Nine year-olds can be at a VERY different place in their development than fourteen year-olds! The grade level demarcation for divisions within LEGO League follows this philosophy.

Young teams need more adult attention and recognition for accomplishments. It is common for young children to miss complicated oral instructions or written rules. Make things as simple as they need to be to keep the team moving forward. Try to match your expectations to the developmental potential of the team members.

Older teams present a different set of challenges, most of which revolve around behavior. Teens push limits and struggle with their need to be independent. They are reluctant to admit mistakes and can be indifferent to praise. Despite these difficulties, teens are delightful to work with. Their ability to assume responsibility for their own learning and to appreciate their personal and team accomplishments makes them especially satisfying team members.

If you are coaching a team with a broad age range, expect a more challenging job. Many people embrace the philosophy of one-room schoolhouses where older students "help" younger students. This can be a marvelous experience for both groups, but remember to respect older children enough to ask if they want to teach before expecting them to do so.

Before you use a team member as a teacher, observe the child for a while. Next, ask him or her to undertake small instructional roles, monitoring both teacher and student to ensure success. Even though they may be effective teachers, remember that the older members of your team are also program participants. Be sure they are engaged in an appropriate part of the challenge and do not use them to do your job as a coach.

## **B. Facilitating the Team Process**

### **1. Introductions and team building.**

Start by introducing team members to one another. Even if they already know one another, give each child a chance to present him or herself to the group. Ask your new team members to share something about their experience with LEGOs, programming and the challenge. Also ask them what they would like to accomplish as a team member.

There are many team-building activities that can be used to help with the process of developing team identity. An excellent reference is 100 Ways to Build Teams by Carol Scarce. Perhaps the easiest team-building technique is to eat together. Kids are almost always hungry, and casual conversation over snacks is a great way to get to know each other. Another reliable practice is to play games, either for exercise or just for fun.

## **2. Practice schedule.**

The coach should set up a schedule that works for everyone. It is very important that teams meet at least once a week. Most teams will fare better if they meet more frequently. Some teams meet several times a week for an hour or more while others meet once a week for two to three hours.

To the extent possible, try to accommodate the differences among your team members in developing the schedule. Some children can't tolerate any activity for more than an hour. Others have difficulty with transitions and benefit from longer sessions. In either event, there is a lot to do in a short period of time. You should be prepared to add extra practice sessions as the tournament approaches.

## **3. Environment.**

You will need to create a setting that encourages playful and creative problem solving. It is also important to establish an atmosphere of trust, emotional safety and respect.

Use the space and equipment that you have to their maximum potential. Blackboards, desks, paper, computers, quiet spaces and books are all potential learning, study and experimentation aids. Sharing space and equipment with other teams can be a challenge but it is possible. Also, too many distractions in the environment will make it difficult for many kids to work productively.

Encourage children to be comfortable and to change positions as often as they need to. Make it easy for team members to work together in small groups. Your job is to provide the space, materials and a supportive learning environment. The kids will most likely respond with energetic productivity.

You should expect an environment that is more chaotic than your workplace or even your home. The energy and activity of your team members may threaten to overwhelm you. Try to step back and appreciate the many ways the kids are engaged in the project. Find your comfort level as a coach and set the atmosphere accordingly.

## **4. Communication.**

Either you, or someone who helps you, will need to provide for regular communication with parents. A functional communications system probably needs both email and a

telephone tree. Its best to distribute a written copy of the schedule, as well as a list of team members, parents and contact information. Keeping parents aware of the team's progress, goals and deadlines will help get the parental support your team needs.

### **5. Multiple teams in one location.**

Coaching at institutions with multiple teams can present the challenge of frequent comparisons. Remind your team members that they are competing against themselves to achieve their own goals. It is also worth noting that the milestones of another team's achievements can be beneficial. A cooperative approach among the teams can actually boost team spirit and lower stress levels. Encouraging each other and sharing their progress will most likely solidify each team's solution.

### **6. Practice sessions.**

In general, meetings should be both casual and focused on a specific goal. Goal setting for each practice is very important. A good routine to use at the beginning of each session is to review the team's progress and set goals for the day. Have the team members discuss what they want to accomplish, both as a group and individually. At the end of each session, talk about what has been accomplished and set goals for the next session. Providing this type of structure for your practices will help your team understand the positive ways in which they are moving towards their goals. A focus on specific goal achievement will keep the team's energy positive and minimize feelings of panic.

It is also important to allow time for play. Breaks for snacks are almost always helpful. Use break time to get to know each other. Talk as a team and in small groups. Use what engineers call "design review" or what kids know as "show-and-tell" to explain designs and projects to the entire team. Solicit new ideas from all team members. Ask questions. Relax!

### **7. Developing a team name.**

While it may seem simple, many teams have a very hard time naming themselves. Don't feel like you need to get this done immediately. There are many surprising pitfalls to this process. Unlike robot building and computer programming,

everyone probably feels they are equally good at picking a name. It's also a very subjective process, so it's difficult to find objective criteria to use for decisionmaking. Any preexisting social skill issues will likely be amplified during the exercise. Because of these concerns, it may be best to wait on developing a team name until everyone feels they have a valuable role and a sense of belonging.

### **8. Team goals.**

Helping your team set goals will be an important part of your job as a coach. Establishing team goals can be a team building experience that helps bring individual members together. It will also provide an outline for work to be completed. There are several different types of goal setting that can be helpful in this program. Individual team members may want to set personal goals for their own skill development. The team could also discuss goals for its development as a team. Performance goals can be deferred until the team is engaged in the challenge, but will be an additional part of the team's planning process.

Goals should correspond to what the kids want to accomplish. The coach should facilitate the discussions to ensure that the goals are realistic. It is also a good idea to put team goals in writing. Such a document will be an excellent reminder of progress that has been made.

Both short and long-term goal setting is necessary for the team. As explained in the section on practice sessions, meetings will be most productive when the team begins each meeting with a discussion of goals for the day. A goal could be open-ended such as "build robots and practice programming." Alternatively, the goal could be specifically focused on an element of the problem, such as "design and build three steering mechanisms and determine their turning radius." A job for you as the coach is to write these down at the beginning of each practice. Team members will have a map to follow for the meeting and a written statement that can be evaluated at the end of the session. Try to spend time at the end of the meeting for reflection and evaluation. This will give the team some perspective on what they have accomplished as well as an opportunity to set goals for the next session.

Long-term goal setting frequently involves discussion about the possibility of winning the state tournament. While winning is always a possibility, help your team frame team goals in terms of doing one's best, working hard and making improvement. Kids will come to understand that competing with themselves is as much or more rewarding than defeating others. If your team works hard and makes steady progress, they can be proud of their work regardless of how they finish at the tournament.

Something will remind your team about the upcoming tournament at every practice session. Use these opportunities to talk about the team's strategy of preparation for the event. Practice as much as possible. Help them to expect success while being prepared for problems and disappointments.

Developing a timeline for the season will help you keep track of both short-term and long-term goals. You might want two timelines: a general one created by your team and posted in a conspicuous place and a more specific one for you to use in planning practice sessions and tracking progress.

### **9. Developing the team throughout the season.**

Teams grow stronger through shared difficulties. Team building also develops from celebrating successes. Positive recognition of small accomplishments will reinforce the team's desire to keep going. Take care not to become so focused on the outcome that you lose sight of the fun. Develop relationships and talk about things other than the competition. Talk about what you did when you were a kid, tell stories and encourage them to do the same.

### **10. Determine individual strengths and weaknesses.**

Working from strengths is important for children's self-confidence. It allows them to take risks in the creative process and develop themselves in other areas. A coach should try to identify individual skills and encourage team members to take advantage of them. Start by talking with each member of your team. Find out what the child wants to contribute, as well as what skills and interests he or she would like to develop. Sometimes children will want to learn new skills and try unfamiliar roles. Also, matching individual strengths and weaknesses of team members with identified roles can lead to successful partnerships.

You may be surprised to find that some children might be inclined to hide their strengths. As members become comfortable with you and the rest of the team, they will become more willing to provide leadership in their area of strength.

You will also need to be gentle in your approach to weaknesses or vulnerabilities. It can be hard on a child's pride to ask for help. The fear of criticism can be paralyzing. Some children might be working in a group for the first time, never having measured themselves against other kids. It's critical that you show them how to respectfully offer and ask for help. Teach them how to ask questions responsibly and how to offer appropriate criticism and praise.

The following types of inquiries may be helpful as you identify strengths and build the team:

- Observe children as they work. Are they easily distracted? What seems to pull them off task? Do they work alone? Can they concentrate in a group?
- Is there one kind of activity the child seems drawn to? Afraid of?
- Ask the children, their parents and/or their teachers about strengths and weaknesses.
- Can you tell what motivates the child? What seems to make him or her happy? Sad?
- Think about how each child seems to learn.
- Another idea is to use a team building exercise. About halfway through the season, ask every team member to write something every other team member is good at. Give the summary to each child on the team.

### **11. Jobs/roles on the team.**

Every team-based problem-solving program is structured so participants are confronted with the need for members to play different roles to generate a solution. Rather than following a prescribed plan for division of labor, the coach should let the team members develop their own roles. You should facilitate a thorough discussion of the tasks that need to be completed. Be sure to include discussion of the work involved in developing the presentation. After the tasks are identified, write them down. This process should lead naturally to a discussion about the roles each team member would like to play in creating the solution. The opportunity to define their

own roles and responsibilities will probably help the team members learn to trust one another.

While its important that each team member participates fully on the team, it is impossible to expect that everyone will develop equal skill levels in every area. Some sort of division of labor will inevitably develop. As a coach, you will need to work with the team members to be sure everyone on the team understands his or her role. Each team member needs to be able to explain how he or she contributes to the team, as well as how the team functions together.

## **12. Teamwork.**

Your team members do not have to be friends to build a strong team. They may not especially like each other. If you help children learn how to work successfully with others you will be teaching them a valuable life skill.

The ability of team members to work together is so important that FLL presents a separate award at tournaments for teams that "best exemplify the meaning of teamwork." You and your team should review the criteria judges will use to evaluate teams for this award early in the season. While these are admittedly subjective criteria, judges will be looking for evidence that you and your team work well together. Some of the qualities that are valued in this category include the following:

- Student initiative and "kid directed" work.
- Participation by all team members.
- Student understanding of process and objectives.
- Growth as a team based on individual members' contributions.
- Cooperation and competition are valued equally.

INSciTE recognizes that there are different definitions and examples of good teamwork. The interview process at the tournament should reflect the team's individual teamwork style. By the end of the season, a well-coached and kid-driven team should be running itself, with confidence and independence.

## **13. Conflict and Discipline.**

Team members will inevitably argue and disagree. Remember that negotiation among team members is part of the learning process. Don't be too quick to step in. The team may resolve

the dilemma on its own. If the team cannot come to an agreement, you can intervene with mediation or other types of conflict resolution. Strategies for conflict resolution will be necessary and it's important to be prepared. Free Spirit Publishing offers many resources on such strategies. Their website address is [www.freespirit.com](http://www.freespirit.com).

Discipline within the team is another issue to think about, hopefully before meeting with your team. Your own behavior will set the standard for behavior of your team members. This means you should be prepared, accept ideas from others, admit mistakes, accept team decisions and respect and trust everyone on your team. A commitment to these values will provide a strong basis for a disciplined team.

It is essential that you respond quickly to inappropriate behavior. If this becomes an on-going problem with a team member, speak with him or her outside of the regular meeting. Ask a parent to participate in the discussion if necessary. Do not let disruptive behavior go unchecked. Remind the team of the rules and enforce them.

Another helpful guideline is that time heals many wounds. Disagreements are often forgotten within days or even minutes. Watch antagonists closely for signs of continued stress or reconciliation but do not keep asking about a past incident. If the kids don't bring it up, they have most likely let it go.

#### **14. The presentation.**

You may find that most of your team members will be primarily interested in building robots or computer programming. However, building and programming a robot is not the only thing required in the competition. The team is also responsible for researching and preparing a presentation that explains their understanding of a current science issue. This issue will be connected to the specific challenge for the season.

Your hands-on learners may be less interested in completing the research necessary to develop the presentation than they are in the other components of the LEGO League program. On the other hand, developing the presentation may appeal to team members who are less interested in building or programming. This aspect of the program also provides an

outlet for creative children who might choose to convey their material through a movie, a PowerPoint® presentation, a skit or another imaginative form of communication.

The most interested team members can provide leadership on the research, while still finding ways to be sure each team member makes a contribution. It is important that all team members be involved in planning and decision making about the presentation in some way. All team members must also be familiar with the final product and be able to discuss the presentation with judges.

Once again, your team should review the criteria judges will use to evaluate presentations. These include:

- Variety of research sources used.
- Level of understanding of age-appropriate material.
- Ability to relate research to robot missions in the challenge.
- Presentation is structured with a clear beginning, middle and end.
- Level of enthusiasm about the topic and sharing the research.

### **15. Preparing for the tournament.**

As the tournament gets closer, the anxiety level of your team will escalate. Help the kids to relax and slow down. This is especially true with verbal presentations. Tell the kids that if they do not slow down, they run the risk of not being heard or understood.

Despite your best efforts, you may need to schedule extra practices to get ready for tournament day. While necessary, this will add to the team's stress. Talk with parents about schedule changes and the team's anxiety. Pay attention to everyone's needs for sleep, food, exercise and breaks.

Help your team discover the importance of checklists, documentation and other preparation tools **BEFORE** the tournament. Being prepared can make the difference between success and failure. Children very often anticipate only what they want to happen. As the coach, you need to imagine all of the things that might happen. Try to envision the day with all of the accompanying features, such as time limits, an absent team member, pressure, mistakes and noise.

Expect unforeseen problems. Someone may be sick; there may be technical problems or there may be another kind of crisis. Many unforeseen events have disrupted team plans for the tournament, but even a disaster can be overcome with good sportsmanship and a light-hearted attitude. The team's task is to carry on. Do not allow your team to fall apart when the pressure builds. If you need to remove them from a stimulating area to help them "get a grip," do so.

Finally, know how your team will be judged. Your team should discuss the criteria that judges will use to evaluate their work. Work on those areas that program organizers have identified as important. This will greatly improve your team's chances for success.

## **C. Creative Problem Solving**

How do you solve problems creatively? Children will do this instinctively if you provide opportunities for them. The problem solving process is an important lifelong skill, which is easy for children to understand and use. The process is essentially composed of the following steps:

- Identify the problem.
- Generate possible solutions.
- Evaluate solutions.
- Try them! Experiment!
- Evaluate results and proceed or start process again with another possible solution.

These elements are discussed more thoroughly in the following pages. This section also attempts to describe both philosophical guidelines and practical strategies for coaches to use in facilitating the creative problem solving process.

### **1. All kids are creative.**

Remember that all your team members can contribute to the creative process. Equally important, the creative potential of your team members may not be quickly apparent. Some children present themselves as boisterous or disruptive. Others appear shy and timid. Try not to make judgments about the kinds of contributions that any child might make. The bold child might offer an outlandish idea that fits with one the shy child would like to try out. Make room for all these children. Your job is to help them bring life to their creative ideas.

## **2. Playfulness.**

Play is an essential element of creativity. As a coach, you should encourage a certain amount of playful interactions. Some of the most successful inventions emerge from relaxed and spontaneous experimentation.

In this context, play means having fun while working on problems. It does not mean that you should let a practice be dominated by frivolous or off task activity. Let a playful spirit dominate the business of getting the work done. As the process develops, kids will enjoy using their existing knowledge to shape their next creative actions.

## **3. Go slow.**

Being creative means traveling into the unknown. The adventure can be frightening for the uninitiated. Creative thoughts and ideas are very personal and sharing them can be difficult. Many children are accustomed to a more structured process in their activities. It will help to start slowly with newcomers and let them progress at their own speed. One way to help everyone get involved in the process is to form small groups. The groups can work on different problems or even the same problem before sharing their work with the rest of the team.

## **4. Taking risks and accepting failure.**

In his book The Winning Edge, Richard Safris asserts that “Creative risk taking is, or should be, the basic concept underlying all creative problem solving competitions” (Safris, p.16). While it seems a contradiction, fear of failure inhibits creativity: it generates inactivity and “safe” thinking. Try to help your team understand the necessity of taking risks. Teach them that failure affords excellent opportunities for learning.

You should be comfortable with the idea that “failures are but one step of the process” (Safris, p.2). When something doesn’t work, it is really an invitation to generate a new idea. One way to demonstrate this lesson is through trials of rickety robots or incomplete programs. Have the team focus on what doesn’t work, so they can develop ideas about how to improve it.

Your attitude will be an important barometer for the team as it matures in this regard. Team members should expect you to

be positive when things go wrong. Children know what it feels like to be embarrassed by a mistake. They will express their creativity much more freely when they know that no one will deride them for an unsuccessful attempt.

Another constructive response to failure is to learn to seek help. Other team members, mentors, books and other resources can help provide inspiration and motivation. Help your team work through small and large failures and keep going. While the team will naturally strive to avoid failure, it can also learn to recognize it as a necessary step on the path to success.

### **5. Possessiveness.**

Good teams are willing to abandon individual ideas when better ones come along. However, you might need to allow team members to keep an old product or idea until it can be fully compared with new idea(s). On the other hand, the entire team may choose not to risk failure with a new idea. Remember that it is a team decision.

### **6. Help your team see the rewards of creativity.**

As a coach, you can help your team members by encouraging them to develop incrementally. For example, team members could start by completing a mission with a basic robot and the built-in programming. They can then build on their success with modifications to the robot or the program. The early accomplishment puts the team in a position to experiment with something that already works. It sets the stage for interesting new challenges and satisfying creative development.

The rewards of creative problem solving are tangible and exciting. When something works, it is VERY obvious. It can be tested and measured. The thrill of discovering a solution can be a personal achievement and collective accomplishment. Also, less competitive children will find satisfaction in the creativity of the solution, even when they do not enjoy the competition itself. Your own enthusiasm for the team's ideas will be important fuel for continued creative development.

### **7. Brainstorming.**

Brainstorming is an important tool for generating creative ideas. Many children will have had some experience with this technique. The brainstorming process will help your team

members develop possible solutions to large and small problems. They can brainstorm everything from team names to robot features and accessories. Brainstorming can also help children shift from a focus on their own ideas to an interest in trying another person's proposal. It can be a powerful team building tool.

There are some simple policies to follow when brainstorming. Be sure your team understands the guidelines before you start. Standard practice for brainstorming with a group is basically as follows:

**a. Identify the problem:**

Before you begin brainstorming you must clearly identify the problem. If the problem is so complex that it can't be stated simply, break it down into manageable pieces and solve each problem separately.

**b. Make the list.**

Have the kids list as many ideas as possible for a solution. Write them down. The more possibilities the team can think of, the more likely they will be to develop a good solution.

- Do not allow discussion of the ideas until the list is complete. This first stage needs to be done without evaluation or judgment.
- It's fine to combine ideas or build on suggestions already on the list.
- Encourage free and fast thinking. It's fine if the ideas sound impractical. Try to get them to flow with ideas while you write.
- Sometimes it helps to include an idea that can be rejected quickly. It's fine to offer such a suggestion, knowing that it won't be acceptable. It can stimulate discussion, as well as provide an example of how to narrow the list later on.

**c. Discuss and evaluate.**

After you have a list of ideas, lead the group through a discussion of the advantages and disadvantages of each idea. Try to bring out the positive aspects of an idea before discussing its drawbacks. It's generally best to use a blackboard or its equivalent so everyone can see the overall scope of the ideas as the discussion progresses.

#### **d. Experiment.**

Once the group seems to understand how each idea might or might not work, make a plan to experiment with the ideas. Try out whichever idea the group selects. Try them again if they don't work. Help the team identify benefits to the solution, as well as any new problems. Repeated trials are very important at this stage.

### **8. Decision making.**

The first method for decisionmaking among team members is informal discussion. If this doesn't lead to an agreement, you might let things sit until the next session. Taking time off may help soften strong feelings. Of course another option is to ask the team to vote on different ideas. In most cases the "one-person one-vote" model leads to bad feelings and dissension within the team. As elsewhere in the world, politics (even with a group of kids), personalities and emotions complicate objective decision making.

There are at least two decision-making models that can work better than "majority rule" voting in problem solving programs. Both methods can be used by the same team at different times, or the team can adopt a decision-making policy. In either event, you can help the team members learn about the benefits of different decision-making processes. Using these suggestions will also help the team develop as a cooperative group.

#### **a. Consensus by alignment:**

Many successful teams use a consensus decision-making model. Consensus requires that every team member participate in the discussion, at least to verbalize his or her views. It also requires a willingness of individual team members to accept other members' ideas and to compromise. While the process generally takes longer than other models, it has many rewards. Kids who have joined together to find a solution that works for all members of the team usually have an elevated level of unity as a team.

#### **b. Matrix decision-making:**

Another way to make decisions without voting is to use a matrix. This is a technique called Quality Functional Deployment (QFD). It became prominent as part of the quality movement in Japan in the 1970s. It is now a

commonly accepted engineering practice. In his book The Winning Edge, Richard Safris applied this methodology to problem solving teams. His example has been modified below to reflect a robot construction scenario, but is essentially as outlined in The Winning Edge.

**i). Situation:** Your team members have been building robots for a couple of weeks. They have three designs that seem to work okay with basic programs: One with big rear wheels and small front wheels, one with medium-sized rear wheel and a skid plate, and one with tracks. All designs can accept attachments to complete the missions. The group disagrees about which design will be most successful.

**ii) Problem:** Which robot design should the team use?

**ii) Choices:** The team knows the three design choices are as follows:

- a. Big/little wheels
- b. Medium wheels
- c. Tracks

**iii) Factors:** The team must now discuss what factors need to be considered to evaluate the choices. The list the team identifies are:

1. Speed. Which is fastest? Time matters.
2. Control. Will the robot stop where necessary?
3. Steering. How well will the robot navigate?
4. Can the robot climb a slight incline?
5. Does the robot fit easily into the base?
6. Can the robot carry a heavy load?

**iv) Ranking:** Next, make a chart or table. One way to set up the chart is with the choices in a column along the left side and the factors at the top as shown below. Each choice is then ranked from 1 to 10 based upon the factors at the top of the matrix.

	Speed	Control	Steering	Climbing	Fit on base	Carry load	Total Rank
<b>Big Wheels</b>	10	5	5	5	5	4	<b>34</b>
<b>Medium Wheels</b>	7	7	8	6	8	6	<b>42</b>
<b>Tracks</b>	2	9	7	7	6	8	<b>39</b>

v) **Analysis:** In this example the robot with medium-sized wheels gets the highest ranking, but just barely. The result might be more decisive if the six factors were "weighted" based upon their importance. The scores for each factor could be multiplied by that "weighted" value. For example, speed might be the most important factor and it would get a value of 10. The ability to climb might be the least significant and it would be given a value of 1. The choices above factor #1 are all multiplied by 10 and those above factor #4 multiplied by 1. Weighting the factors should yield more accurate results and remove lingering questions about the decision making process among team members.

# IV. Administrative Duties

## A. General Duties

### 1. Check with host institution about rules.

- Plan for equipment, storage, use of building, keys etc.
- Have back up plans.

### 2. Communication.

- Distribute program information and rules.
- Provide a list of email addresses, telephone numbers and mailing addresses to team members and parents (get permission from parents first).
- Establish a communication link with the Minnesota FIRST<sup>SM</sup> LEGO League program director (the website is listed in the resources section of this manual).

### 3. Meetings.

- Require parents to attend the first meeting (with their own and their children's calendars in tow) to participate in discussion about the program and to establish meeting schedules and a timeline.
- Determine the frequency and length of meetings.
- Assume that meetings will get longer and more frequent as the program nears completion.

### 4. Budget.

- Costs may include registration fees, equipment, supplies and food.

### 5. Mentors.

- Coaches may arrange for a mentor to work with a team on a routine or occasional basis.
- Mentors may be engineers, scientists, educators, artists, inventors, and programmers.
- Mentors teach general skills. They DO NOT solve problems.

## **6. Parents.**

- Parents can assist coaches, take photographs, provide transportation (car-pools if needed), food, fundraising, etc.

## **B. Administrative duties for Minnesota FIRST<sup>SM</sup> LEGO League**

### **1. Pre-season tasks.**

- Register team(s) at the national level.
- Acquire and organize materials and equipment.
- Secure a practice facility.
- Build the table: build the course as soon as the kit arrives

### **2. Tasks throughout the season.**

- Register with your state.
- Understand the challenge problem.
- Understand the rules and seek clarifications. It will help to keep copies of all rules clarifications. It is also important to pay attention to what the rules imply or infer.
- Know whom to contact when you have questions.
- Document your team's progress or have the team do it.
- Facilitate research for the presentation.
- Back up programs on floppy disks.
- Talk about the tournament and answer questions.

### **3. Tasks to prepare for the tournament.**

- Get signed release forms.
- Submit team roster, name, and registration number.
- Communicate the event's schedule and details with parents.
- Prepare the kids for the scale and intensity of the event. If you are a first time coach, ask some veteran coaches about what to expect.
- Confirm roles for kids, especially robot operators and lead presenters.
- Understand the scheduling and judging process.
- Practice timed runs and talk about how to handle any unfinished work.
- Plan the day.
  - Organize materials and supplies to bring.
  - Bring food and drink to the event.

- Have someone available to take photographs.
- Be prepared for disasters.
- Relax.
  - Play games, read, listen to music.
  - Watch other teams.

#### **4. At the tournament.**

- Have FUN!
- Plan a party for after the event - kids and adults will need and deserve it!

# V. Sample 8-week Program

The following overview suggests a rough structure for the season. It is not intended as a comprehensive schedule but to provide examples of activities your team may be working on each week. After two to three weeks, each team will differ widely in their approach and time management. Additional suggestions for specific lesson plans are available under the Coaching 101 section of the [mn.hightechkids.org](http://mn.hightechkids.org) web site. You will need to register to create a login to access this material.

It's likely that 80% of the work will be completed in the last two weeks! Relax. There may be more going on than you realize, but you should plan for extra practice time at the end, if at all possible.

## **General guidelines for individual practice sessions include:**

- Have a goal for the session.
- Hold brainstorming sessions early in the practice if needed.
- Wrap up each session by looking at what the kids have accomplished, review new problems, identify plans and set goals for the next session.

## **Tentative schedule for the season:**

### Week One

- Introductions.
- Team building exercises.
- Introduce challenge.
- Develop team rules.
- Set short and long-term goals.
- Explore materials and build the course.
- Provide how-to-build instructions and books.

### Week Two

- Get to know the members of your team.
- Understand the challenge and the rules.

- Utilize available building and engineering lessons (see Resource section of this manual).
- Discuss a research plan for the presentation.
- Start to develop roles for different team members.
- Introduce the programming language your team will use.
- Brainstorm a possible strategy for the missions.
- Build as many robots as you can with your available parts.

### Week Three

- Try to get a working robot.
- Connect robots to programs.
- Begin research for the presentation.
- Experiment with many ideas.

### Week Four

- Complete one or more robots.
- Revisit mission goals and priorities.
- Modify robot design.
- Outline research project.

### Week Five

- Continue above.
- Try to get one simple successful program.
- Develop presentation.

### Week Six

- Final robot design.
- Use small groups to get work done, perhaps outside of regular practice times.
- Share presentation with team.

### Week Seven

- Panic! Have faith; your team will amaze you.
- Perform timed practice missions.
- Modify robot and mission sequence.
- Start to talk about tournament.

### Week Eight

- Practice for the tournament. Learn to solve problems and deal with mistakes.
- Use a stopwatch, this is dress rehearsal.
- Practice, practice, practice.

- Schedule extra sessions and buy lots of food and beverages.
- Don't worry. Be happy with the progress of your amazing team.

# VI. Frequently Encountered Situations

This section is designed to provide examples of challenges you will likely face as a coach in this program. While these examples come from the experience of former coaches, the names of participants and many of the actual facts have been changed.

**We have one kit and six team members, all of whom want to build the robot.** One kit per three kids is ideal, but expensive. You can buy an additional RCX brick for half the cost of a new kit, but this is still expensive. Take the time to talk about all the different jobs that need to be completed, as well as the different roles for team members. You'll also need to develop a plan for sharing robot construction, such as having some kids build components and others build the main structure. Make sure everyone who wants to build gets a chance to build.

**Parents come to watch and start offering suggestions for how to build the robot.** Take them aside and tell them that the team needs to make decisions about the project. Explain your role as coach and the balancing act between teaching basic skills and giving answers. If they understand and appreciate the situation, ask them to help.

**One of our team members has a kit at home and wants to build a robot and bring it to practice.** Does he want to let the team use and modify it? Will he allow his parts to be mixed with the team's kits? Are his parents involved in the discussion? If these and other questions are resolved, go for it. You will still need to discuss the decision to allow one member to build a robot at home. Some members of the team might feel cheated while others will be reluctant to give control to another team member. These might be minefields, so try to anticipate problems and proceed cautiously.

**Jim is always sneaking up behind Tony when he is at the computer, tapping him on the shoulder and then pretending it wasn't he. He may also be engaging in other attention seeking behaviors.** Tell him to stop it. If he persists, take him away from the group and explain how disruptive and disrespectful the behavior is. Try to figure out whether Jim wishes Tony would pay more attention to him. Watch to see if Jim annoys other team members as well. Help Jim find a meaningful task to work on, perhaps with another child. He probably needs to feel connected to other kids but doesn't have the requisite social skills. Watch him and try to help him figure out how to get what he needs.

**Sandra really wanted to be on the team but she misses practice and is often late.** Make time for her to explain her absences and reaffirm her commitment to the team or quit. Have this discussion sooner rather than later. Also, be sure to talk with her parents about the problem. Replace her if the team chooses to or carry on.

**Max gets overstimulated by the excitement of building and creating and being around so much activity.** Help him find ways to protect himself from outside forces: Is there a quiet place or even another room in which he could work? Other ideas include reminding him to take routine breaks, giving him a set of headphones or ear plugs for the noise, talking to him about other ways he deals with stimulus, and talking with his parents.

**All my team wants to do is play. They throw LEGO pieces, act goofy and avoid the work that needs to be completed.** Ask yourself whether all the team members participated in determining goals for the team and rules about behavior. Make sure that these discussions have occurred and implement what the team agreed to do. It is possible that your expectations are too high. Do you wish they would be serious during the entire practice session? How often are they really disruptive and nonproductive? Cut them a little slack, but help them focus on the immediate goals for the practice session. Suggest easy tasks that are likely to be successful so everyone learns how to be productive.

**All seven kids want to operate the robot at the tournament.**

Suggest the team members take turns. Perhaps all seven team members can operate the robot at the tournament. There will be at least four opportunities to run the robot on the day of the tournament. Two kids from each team will operate it during any one run. Potentially, everyone could have a turn. This means that there are likely to be different jobs for each of the two kids running the robot. (One lines it up and starts the programs while the other retrieves the robot and gets attachments ready.) This approach will only work if everyone who runs the robot has enough practice before the scheduled run. Sometimes a child changes his or her mind about running the robot after seeing the pressure operators are under. The key to success here is PRACTICE!

**Nobody wants to work on the presentation.** This is a hard one. The attraction of the FLL program is building and programming robots. At the same time, an important part of the program is scientific research and presentation. The team will need to understand that the work needs to get done. It is probably best to share the work. Having a set of goals, and being able to check them off as they are accomplished, will help kids share the load! Everyone on the team should be capable of understanding the issues and contributing to the presentation. Perhaps a few team members would agree to provide leadership on the presentation, especially if others offer to help keep them involved in the building and programming process. The more you make the presentation part of each practice, the more the entire team will understand and participate.

**Beth is a skilled LEGO builder and she is constantly reminding other team members about her prowess by offering unwanted suggestions for changes.** Take Beth aside and talk to her privately about the effects of unsolicited advice. Affirm for her that it can be hard to wait for someone to figure out something for him or herself, but that she needs to find a way to support the other builders without intrusive suggestions. Make a plan for what she can do and help her get started with it. Praise her when you see her holding back on suggestions and gently remind her of the plan if she slips up. Again, try to do this privately.

**We have three robots and one computer. Kids are really frustrated waiting for a turn programming.** One approach to this situation is to try to reduce the number of competing designs to one or two, not three. Different designs could be evaluated using built-in programs. Another way to evaluate designs is to build “brassboard” models that only do one element of a problem. For example, the challenge may require lifting an object. The team could build multiple lifting arms and run them at the object using simple carts. It should be possible to see which design is most likely to lift the target, as opposed to knocking it down. Finally, teach the kids to program in small modules—go straight, left turn, right turn, go to the wall, etc. If they have these, they can link them together into larger programs MUCH more efficiently than working on long program chains on instruction at a time! If necessary, you can also set a timer by the computer and give programmers five to ten minute turns. It's easy for them to save their work if not finished or write part of the program and test it.

**One of our team members spent a lot of time building a really cool robot with a sophisticated steering mechanism. The other team members do not think the mechanism will work and want him to disassemble it so they can use the parts.** If the team members cannot come to an agreement through discussion you could suggest that they test the various robots to see how well they do perform. This is a good time to develop a decision-making matrix. The team can evaluate how each robot performs against an identified list of factors, which the team has agreed are important.

**Your team only wants to build and program; the team members are not interested in setting goals, brainstorming, looking at their progress, or anything else.** Try to get the kids to understand the overall challenge. Perhaps you could simulate the competition by asking them to practice the challenge. This may instill the need to set goals and talk about the problems with their robot. On the other hand, if all members agree they don't want to focus on tournament preparation, this is their decision. Be sure you point out the consequences of their choice and try to live with it yourself.

**Some team members are passive and will do nothing unless given a specific detailed task. They won't even do that if they don't like the task.** There could be many reasons for this kind of behavior. The child or children might be shy, or intimidated by the rest of the group. There may be extenuating factors from a child's life, which are affecting his or her participation. Also, past difficulties with other team members may be unresolved and at the same time, impossible for you to divine. Try to find out if any of these possibilities are getting preventing the kind of participation you expect from all your team members. If you have specific needs to brainstorm a problem like this, try to find help either from the school, the parents or even on-line resources.

# Closing

The techniques suggested in this manual have worked for some teams. They may or may not work for you and your team. As a coach you must determine how you want to facilitate the process. Just as every creative solution should be unique, every team will have its own style and personality. Your approach to coaching will set the tone for your team's growth as a team, as well as for its success with creative solutions.

One guiding principle to fall back on when you are uncertain about what direction to take is to follow the children's lead. If you always place their interests first, encourage creativity and trust the problem solving process, they will surprise and astound you.

Despite the emphasis on cooperation and teamwork, this is a competition. Help your team members to understand that they are competing with themselves to reach their full potential as individuals and as a team. If you guide the children respectfully and lead them to understand, believe in and value the process, you will all be winners!

Good luck!

Have fun!

Enjoy the amazing children on your team!

# Resources

The High Tech Kids web site contains a wealth of information for coaches. In order to access most information, you will be required to register to create a login. If you are a coach in MN, register as a coach, otherwise, register as a guest.

<http://mn.hightechkids.org/>

- A complete package of training material for LEGO robot building, programming, and coaching is under Training Downloads:
- The Coaching 101 section contains a variety of training materials and weekly lesson plans. These have been created to help with your first five weeks, and include mini-challenges to teach specific concepts during practice sessions.

If you would like to receive announcements pertaining to both FLL in general and MN FLL join the MN FLL email list at:

[mnfll-announce-subscribe@yahogroups.com](mailto:mnfll-announce-subscribe@yahogroups.com)

If you are interested in an email list that has more discussion, you should subscribe to the following list:

[Mnfl-subscribe@yahogroups.com](mailto:Mnfl-subscribe@yahogroups.com)

Questions about financial assistance, mentoring, volunteering, and tournaments should be directed to the MN FLL Program Manager, Colleen Riley.

[colleenriley@hightechkids.org](mailto:colleenriley@hightechkids.org) or 612-723-1965

Questions about registration, matching mentors with teams, coaches training and all other coaching assistance should be directed to Deb Mans, MN Program assistant at

[debmans@hightechkids.org](mailto:debmans@hightechkids.org) or 612-723-1970

# Acknowledgments

This manual is based upon research and writing completed by Fred Rose, the guiding force behind FIRST<sup>SM</sup> LEGO<sup>®</sup> League competitions in Minnesota. Fred's ability to integrate the pragmatic world of engineering with the art of teaching young people about science and technology is remarkable. His experience developing problem solving programs is equally impressive. He understands the value of "kid directed" learning and the educational philosophy that fills these pages. His draft of this manual served as the starting point, and readers familiar with his work will undoubtedly recognize many specific sections, examples and general philosophies.

Fred is also committed to making this material available to all that wish to use it. This manual, as well as other instructional materials developed by INSciTE (Innovations in Science and Technology Education) is available online at <http://www.hightechkids.org/>

Many of the basic principles for coaching contained in this manual came from information in the Virtual Odyssey of the Mind Boosters Organization (VOMBO) coaching handbook for Odyssey of the Mind, edited by Bill Allen, Dee Urban, Steve Shearer, Kris Shearer and Bruce Urban. Another important source was Richard Safris' guide, entitled The Winning Edge: Tips for Creative Problem Solving Teams, Kidcorp Ltd, 1995. Mr. Safris presents many wonderful ideas about team building and management of problem solving teams and we have leaned heavily on his work.

Dr. Andrea Bieberich, child clinical psychologist, provided very practical strategies for working with children who have special needs. Her experience mirrors that of the authors in recognizing the attraction of LEGOs for children with attention and emotional difficulties. While these children may require extra attention, they also have unique gifts to offer any group. Her suggestions for accommodating special needs children are beneficial for all children.

Lynn Bick and Ted Cochran, both skilled and seasoned LEGO League coaches, contributed many ideas about coaching and inspired several of the "Frequently Encountered Situations."

They reviewed this manual along with Jen Reichow, Fred Rose, Karen Marty and Jim Gagnon. We are deeply indebted to each of them for their suggestions and comments.

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Scearce, Carol. 100 Ways to Build Teams. Arlington Heights, IL: Skylight, 1992

This book provides basic activities for team building. It is a good reference on team development, and could be especially helpful for beginning coaches.