FLL in the Middle School Classroom

**How often is this class run?**

This is perfect as a semester long fall class because the challenge is introduced in August, just before school starts and the first competition in Washington is in December. If you do well, you will compete in at the end of January as well, just after the semester ends.

You can choose to make this a year long class if needed, but I would suggest finding or creating a competition to do in May or June if you will have students after January. Students will lose steam after the FLL competition and will need a new challenge to focus on.

One idea is to start your own Invitational Competition. Invite other districts in your area to join. You can use the “Classroom Resource: STEM Robotics 101 Invitational Competition Specifications” tab in this curriculum to design and organize your own event.

[http://stempals.org/2014/06/03/record-turnout-for-south-sound-stem-robot...](http://stempals.org/2014/06/03/record-turnout-for-south-sound-stem-robotics-invitational-2/)

[http://stempals.org/2015/06/02/over-100-robots-compete-at-the-6th-annual...](http://stempals.org/2015/06/02/over-100-robots-compete-at-the-6th-annual-south-sound-stem-robotics-invitational/)

Another idea for Spring semester would be continuing the research project. I would only do this if there is still excitement about the project. For example, I had a group of students who were very excited about meeting with city council to create receptacles for plastic bags, but we didn’t have time to do this within the FLL season.

**Who should be in the class?**

It is best to have advanced students in this class who have mastered all the basics of programming and building and are ready for a challenge. They should know how to use all of the sensors, and should have mastered loops and switches. Starting with beginners will take a lot of the time that is needed to work on the challenge itself. It can take around a month to master the basics at the least, which is a lot of time to lose from working on the challenges for FLL.

First Year of FLL in Classroom:

Choosing students for this class is tricky. You will want to make it a prerequisite to take beginning robotics or have experience with EV3 robots either at home or in a club. Your first year may be difficult to get enough students to fill a class. To remedy this, you might ask math and science teachers for exemplary students who learn fast. If you need to do this, you can have students with experience(mentors) train the rookie students on how to build and program during the first week of school.

If you plan to do a mentor rookie training week for your first week, do not allow mentors to touch the robot. You can pair one mentor with one rookie and give rookies a task list to accomplish and get signed off. After each task, you can have mentors cycle through each rookie so rookies have a new mentor for each task. This will also help you determine who works well together as a team and makes sure each rookie learns from different types of experts. You can use this check off sheet to do mentor/rookie training by opening the document **attached below titled “Robotics Immersion 101”.**

If your school assigns students to this class without their knowledge, you will not necessarily have students who want to compete in the FLL events. You will want to inform students about the competitions and find out on the very first day of class who is interested in competing. It is a good idea to make students who want to compete commit to coming before or after school one hour a week. This will help students to realize that FLL will be a time commitment and is something they promise to attend. **Attached below is a “FLL sign up sheet”.**

Second Year of FLL in the Classroom:

Now you probably have more of an interest in FLL in your school and can find more students ahead of time. To recruit students for next year’s class, you should start a spring club. This club can learn about FLL by attempting some of last year’s challenges and can also participate in an invitational competition such as the ones outlined in the “Classroom Resource: STEM Robotics 101 Invitational Competition Specifications” tab in this curriculum if you are willing to design and organize your own event.

[http://stempals.org/2014/06/03/record-turnout-for-south-sound-stem-robot...](http://stempals.org/2014/06/03/record-turnout-for-south-sound-stem-robotics-invitational-2/)

[http://stempals.org/2015/06/02/over-100-robots-compete-at-the-6th-annual...](http://stempals.org/2015/06/02/over-100-robots-compete-at-the-6th-annual-south-sound-stem-robotics-invitational/)

Once you have a group of students willing to do the Spring club, you can create a list of students who are interested in FLL for the fall. Now you will have a class full of students who are all participating in FLL.

**Deciding Teams**

Start the class by completing a few different core values challenges, project challenges, and robot challenges. These should only take 1-2 weeks and are meant to introduce the different parts of FLL and to see how well teams work with one another. **Example challenges such as “Core Values Sample Challenges”, “Project Sample Challenges”, and “Robot Design Sample Challenges”, are attached below:**

While students are completing challenges, observe them to see how well they work with one another. Make notes about who you think would be a good team as they work.

When students have completed the challenges, allow them to complete an anonymous survey indicating who they would prefer to work with. A good idea is to ask them to name their top 5 students they want to work with and any students they would prefer not to work with. Here is a sample survey you can edit to meet your needs.

<https://docs.google.com/a/washougalsd.org/forms/d/1m8GPru8oUYm051BaufL_r8zVdiyW85q5gII7O9MEo9s/edit>

If you have a mixed class of students competing in the events and students only participating in class, make sure you assign teams according to that preference.

Now, make your team sizes. A good team size is between 3-6 members. You are allowed to compete with up to 10 students on a team, but it is difficult for all students to be engaged with such a large team.

**Organizing Kits and Pieces**

You can assign one robot per team. Since students will be using the same robot all year, they might get lazy with organizing their pieces. It is a good idea to organize the pieces in the kit every other week so students can keep track of pieces to prevent losing them. I would not suggest a full inventory until after the season is over, but students should do a quick look to see if pieces are there.

**Syllabus**

**Attached below is a class syllabus for an FLL class.** Modify this syllabus for use in your class or use simply as an outline for yourself.

**FLL Student Contract**

To make sure that students and parents understand the implications of being part of FLL, it is important for both of them to sign a contract. Make your expectations clear and go over any words that may be confusing with students. **A sample “FLL Student Contract’ is attached below.**

**FLL Parent Night**

Hosting a parent night for students in your class is important to explain what you are doing and make sure you have support. Parental support is crucial in FLL as you will need their resources, transportation, and their respect of the time it takes for their students to participate. Hosting a meeting early in the year will help ease any fears and make clear what their child has signed up for. You can also have parents complete registration of their students at this meeting if they have not done so already.

**Attached below is an agenda for a “FLL Parent Night”,** including a list of parent volunteer duties and a **“Volunteer Signup Sheet”**.

**Organizing the Project**

**Attached here is a “FLL Project Guide”** for working on the research project. The one attached is formatted specifically for the Trash Trek Challenge, but can be modified to match the current theme for FLL. When introducing this, have the team go through the document and write the name of the team member who is going to do each part of the project. It is best to have students divide the duties equally so that when they arrive at the competition, any team member is able to answer questions about the project. Each section would be easy for a pair of students to work on together. You can decide on dates you would like each section to be completed by and sign off on the corner of each page. The entire packet will be due before the date of your first tournament.

In the Community Resources section, students are building connections with community members to strengthen their research and teach them about their solution. You will have students develop a script to call or email companies or people in the community that can provide them with information on the topic. The script should include the student’s name, school’s name, grade, class name, purpose of the class, and purpose of the project Students should ask if the person would be willing to be a guest speaker in the classroom, through skype, an advisor, or allow us to come for a field trip. If the person says no, the script should have a respectful reply. If they say yes, they should be thanked and given the teacher’s contact information to set up a time to visit one another. They should also get contact information from the person they are talking to. Students can either call or email the community member. If they choose to email, make sure your administrator approves and have your student CC you in the conversation. Also, only allow students to call with the classroom phone so you can monitor the phone call.

Once you have secured guest speakers, make sure students come up with great questions to ask the speaker that will help them with their project. **Attached below is a sample “Guest Speaker Questions”** worksheet for students to ask questions on.

**Organizing the Robot Design**

**Attached below is a** “**FLL Robot Design Engineering Process Log”** guide for working on the robot design. When introducing this, have the team go through the document and write the name of the team member who is going to do each part of the project. It is best to have students divide the duties equally so that when they arrive at the competition, any team member is able to answer questions about the robot design. Each section would be easy for a pair of students to work on together. You can decide on dates you would like each section to be completed by and sign off on the corner of each page. The entire packet will be due before the date of your first tournament.

**Organizing Core Values**

Attached below is a **“Core Values Goals”** slideshow for goal setting in core values. When introducing this, have the team read the scoring rubric for core values. They should be deciding on a goal for each section and assigning someone in their group to hold them accountable for meeting each goal. This is made in a slideshow because students will add new slides every month to reassess their goals. You can decide on dates you would like each section to be completed by and sign off on the corner of each page. The entire packet will be due before the date of your first tournament.

**Mock FLL competition – Summative Assessments**

This is a great way for students to have a practice competition before the real competition, and is also a way for students who plan not to compete outside school to have a summative assessment for their work. This also allows students to see each other’s work and gives them ideas for how to improve their projects, which actually helps with the coopertition, team spirit, and sharing parts of the judging rubrics!

This would be best to do 1-2 weeks before the regional competition. You can assess students on all three areas (core values, robot design, research project), over the period of a week. Here is a sample schedule you can follow:

Tuesday: Research Project Summative Assessment

Have students present their research projects to a panel of judges. You can have parents, family members, high school FRC/FTC members, community professionals, other teachers at your school, or people from your district office come be judges. Students can present in your classroom, or you can reserve another area of the school to make it seem more official. Make sure to invite judges to come a bit early so you can explain the rubrics to them and see if they have any questions. Have one of the judges, or yourself, time the presentations and only allow them 5 minutes to present. After each group presents, allow judges to ask the students questions to fill in any gaps from the rubrics, and allow students in the audience to question the team presenting. They should only ask questions for up to 5 minutes. After all presentations are done, you can show students their scores from the judges to give them feedback before the real competition. Make sure you get the rubrics back so you can use them to assess students for grades.

Wednesday: Core Values Summative Assessment

Have students complete their core values task with one or two judges. You can have parents, family members, high school FRC members, community professionals, other teachers at your school, or people from your district office come be judges. You can split students up into different areas of the room and assess them all at the same time, but you will want to make sure each group has a different task so they are not watching one another instead of working as a team. You can complete this in your classroom, or you can reserve another area of the school to make it seem more official.

Make sure to invite judges to come a bit early so you can explain the rubrics to them and see if they have any questions. Make sure each pair of judges times the students completing the task and only allows them 10 minutes to work. At the beginning of their time, the judges should ask them a few questions that they are not likely to see during the task, such as:

1. How has your team balanced all three aspects (Robot, Project, Core Values) of FLL this season?
2. How has your team applied FLL values and skills outside FLL (ability to describe current and potential examples from daily life)?

 After asking these questions, judges will tell students the tasks. If you are looking for example core values tasks, you can use the **“Core Values Sample Challenges” worksheet attached below.**

Judges should watch while students perform the task and take notes on the rubric. After the group completes the task, judges should take time to completely fill out the rubric based on what they saw the team do during the task. When judges finish, you can show students their scores from the judges to give them feedback before the real competition. Make sure you get the rubrics back so you can use them to assess students for grades.

It is helpful to have a reflection discussion as a class after completing the judging session. Have each group share the following:

1. Their answers to judges’ questions.
2. What task they were asked to do.
3. What was their strength and weakness as a team.
4. What would they do differently next time.
5. Advice for other teams.

**Attached below is a “diagram of a Mock FLL competition set up”.**

Friday: Robot Design Summative Assessment

Have students present their robot to a panel of judges. You can have parents, family members, high school FRC members, community professionals, other teachers at your school, or people from your district office come be judges. Students can present in your classroom, or you can reserve another area of the school to make it seem more official. Wherever you do presentations, make sure you have an FLL table set up next to the presentation area for students to use. Make sure to invite judges to come a bit early so you can explain the rubrics to them and see if they have any questions. Have one of the judges, or yourself, time the judging session and only allow them 10 minutes to present.

When students start their session, have judges ask students if there is anything they would like to show them with the robot. They can show a mission, design feature, attachment, programming code, or anything they want on the robot. After each group shows off their robot, allow judges to ask the students questions to fill in any gaps from the rubrics, and allow students in the audience to question the team presenting.

After the judging session is done, you can show students their scores from the judges to give them feedback before the real competition. Make sure you get the rubrics back so you can use them to assess students for grades.

**Assessments**

All assessments in this class are based off of the judging rubrics which are linked here:

<http://www.firstlegoleague.org/sites/default/files/combined-rubrics-2015.pdf>

Here is a sample assessment schedule for a semester long course:

Week 3: Pre-assessments (core values, robot design, project)

Week 5: Formative assessments 1 (core values, robot design, project)

Week 7: Formative assessments 2 (core values, robot design, project)

Week 9: Formative assessments 3 (core values, robot design, project)

Week 12: Summative assessments (core values, robot design, project)

All together, this is 15 assessments in the gradebook.

Pre-Assesment:

Once your teams are decided, you will want to show students the rubrics and give students two weeks to get ready for their pre-assessment. During these two weeks, students will be working on the organizing worksheets for each of the 3 areas, **“Research Project Organizing Worksheet”, “Robot Design Organizing Worksheet”, and “Core Values Goals Organizing Worksheet” attached below.**

After students have had two weeks to work on organizing their ideas, you should make time to meet with each team to give them a pre-assessment. Do only one area at a time (project, robot design, core values), so students don’t feel overwhelmed.

A sample pre-assessment schedule might look like this:

Day 1: Pre-assess all teams on project. Goal setting when finished.

Day 2: Finish project pre-assessment, prepare for robot design pre-assessment.

Day 3: Pre-assess all teams on robot design. Goal setting when finished.

Day 4: Finish robot design pre-assessment, prepare for core values pre-assessment.

Day 5: Pre-assess all teams on core values. Goal setting when finished.

Day 6: Finish core values pre-assessment. Reflect on pre-assessments.

When you meet with each team, let them tell you how they are meeting each part of the rubric. Ask them questions where they are gaps. Have them self-assess before you give them a grade on each part of the rubric. For the core values section, give them a practice task. If you need ideas for practice tasks, **“Core values sample challenges” are attached below.**

For the pre-assessment, you will want to give students full credit for completing the pre-assessment no matter what their score ends up being on the rubric. Students should not be penalized for their initial learning. In the gradebook, you can make each rubric worth the amount of points there are on the rubric: core values (9 points), project (10 points), robot design (9 points). Everyone on the team will get the same score in the gradebook as long as you can see that they all contributed equally to the work.

To make sure each individual contributes to the pre-assessment equally, you can do a few things:

1. Make sure each student speaks during the pre-assessment.
2. Have each student point to the organization worksheet or goal worksheet to show who did what.
3. Have students fill out an anonymous assessment to see if all group members believe they did equal work. Here is an example of an anonymous assessment you can use:

<https://docs.google.com/a/washougalsd.org/forms/d/1gV-G4ieKP6XyWBIcg1guy1v6sJBtoeoxe5hEzqqPulU/edit>

Spend only ten minutes with each group and base your pre-assessment rubric score on what they can show you in ten minutes.

Goal Setting:

When the pre-assessment is finished, have students look at their score on the rubric and make a goal for what score they would like to achieve the next time they are assessed in two weeks. They have to choose at least one level above their score on the pre-assessment. Have them write on the back of the rubric or on a separate piece of paper how they plan to achieve this score the next time they are assessed.

Formative Assessments

Every two weeks, have students complete a formative assessment and a goal setting session. Assess them exactly the same way you did the pre-assessment. During the formative assessment, students need to achieve at least three of their goals.

Example grading of formative assessment:

Students set nine goals for themselves on the core values rubric, one for each section of the rubric.

Three of those nine goals are required to be met by the next formative assessment. The other six goals need to be met or the same as their previous score.

Scenario A: Team 1 set nine goals on their pre-assessment. They achieved three of these goals. The other six areas of the rubric were the same as they were on their pre-assessment. They will receive a score of +9/9.

Scenario B: Team 2 set nine goals on their pre-assessment. They achieved two of these goals. The other seven areas of the rubric were the same as they were on their pre-assessment. They will receive a score of +8/9.

Scenario C: Team 3 set nine goals on their pre-assessment. They achieved two of these goals. Five areas of the rubric were the same as they were on their pre-assessment. Two areas of the rubric were lower than they were on the pre-assessment. They will receive a score of +6/9.

**Attached below is a picture of an “example scoring rubric with a grade”.**

Summative Assessments:

See the section in this document titled: “Mock FLL competition - Summative Assessments” for how to assess students. Use an average of the judges scores during this competition to compare to the student’s goals and give students a score in the gradebook.

Make sure you agree with the judge’s scores. As the teacher, you are held accountable for the standards students are graded by. Since the other judges are not always teachers, they may be harsher or easier on students than you would be. Discuss the grades students receive with students and see if they agree they are fair. Allow students to make up their grade by adding or taking away parts of their presentation for you as the teacher if needed.

**Standards Taught in the FLL Classroom**

21st Century Skills:

If you are teaching this as a CTE class, these standards can guide your learning targets and justification for assessments:

|  |  |  |
| --- | --- | --- |
| Standard | Task | Assessment |
| 1.A.1 Use a wide range of idea creation techniques (brainstorming etc…) | Project and Robot Design Organization WorksheetsCore Values Goal Worksheet | FLL Judging Rubrics |
| 1.A.2 Creates new and worthwhile ideas using both incremental and radical concepts |
| 1.A.3 Elaborates, refines, analyzes and evaluates their own ideas in order to improve and maximize creative efforts |
| 1.B.1 Develop, implement and communicate new ideas to others effectively |
| 1.B.2 Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work |
| 1.B.3 Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas |
| 1.B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes |
| 1.C.1 Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur |
| 2.A.1 Use various types of reasoning as appropriate to the situation |
| 2.B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems |
| 2.D.1 Effectively solve different kinds of non-familiar problems in both conventional and innovative ways |
| 2.D.2 Effectively identify and ask significant questions that clarify various points of view and lead to better solutions | Guest Speaker Questions Sheet | Guest Speaker Questions Sheet |
| 3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts | Project and Robot Design Organization WorksheetsCore Values Goal WorksheetMock FLL competition  | FLL Judging Rubrics |
| 3.A.2 Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions | Guest Speaker Questions Sheet | Guest Speaker Questions Sheet |
| 3.A.3 Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade) | Mock FLL competition | FLL Judging Rubrics |
| 3.A.4 Utilize multiple media and technologies, and know how to judge their effectiveness as well as assess their impact | Project and Robot Design Organization WorksheetsCore Values Goal WorksheetMock FLL competition  |
| 3.A.5 Communicate effectively in diverse environments (including multi-lingual) |
| 3.B.1 Demonstrate ability to work effectively and respectfully with diverse teams |
| 3.B.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal |
| 3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member |
| 5.B.1 Understand and utilize the most appropriate media creation tools, characteristics and conventions |
| 6.A.1 Use technology as a tool to research, organize, evaluate and communicate information |
| 6.A.2 Use digital technologies, communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy |
| 6.A.3 Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies |
| 7.A.1. Adapt to varied roles, job responsibilities, schedules and contexts |
| 7.A.2. Work effectively in a climate of ambiguity and changing priorities |
| 7.B.1. Incorporate feedback effectively | Core Values Goal WorksheetJudging Rubrics Reflection | Judging Rubrics Reflection |
| 7.B.2. Deal positively with praise, setbacks and criticism |
| 7.B.3. Understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multi-cultural environments |
| 8.A.1. Set goals with tangible and intangible success criteria |
| 8.A.2. Balance short-term and long-term goals |
| 8.A.3. Utilize time and manage workload efficiently | Project and Robot Design Organization WorksheetsCore Values Goal Worksheet | FLL Judging Rubrics |
| 8.B.1. Monitor, define, prioritize and complete tasks without direct oversight |
| 8.C.1. Goes beyond basic mastery of skills and/or curriculum to explore and expand one‘s own learning and opportunities to gain expertise |
| 8.C.2. Demonstrates initiative to advance skill levels towards a professional level |
| 8.C.3. Demonstrates commitment to learning as a lifelong process |
| 8.C.4. Reflect critically on past experiences in order to inform future progress | Core Values Goal WorksheetJudging Rubrics Reflection | Judging Rubrics Reflection |
| 9.A 2 Conducts self in a respectable, professional manner | Mock FLL competition  | FLL Judging Rubrics |
| 9.B.1. Respects cultural differences and works effectively with people from a range of social and cultural backgrounds | Project and Robot Design Organization WorksheetsCore Values Goal WorksheetMock FLL competition  |
| 9.B.2. Respond open-mindedly to different ideas and values |
| 9.B 3. Leverage social and cultural differences to create new ideas and increase both innovation and quality of work |
| 10.A.1. Set and meet goals | Core Values Goal WorksheetJudging Rubrics Reflection | Judging Rubrics Reflection |
| 10.A.2. Prioritizes, plans and manages work to achieve the intended result | Project and Robot Design Organization WorksheetsCore Values Goal WorksheetMock FLL competition  | FLL Judging Rubrics |
| 10.B.1.a Works positively and ethically | Core Values Goal Worksheet |
| 10.B.1.b Manages time and projects effectively | Project and Robot Design Organization WorksheetsCore Values Goal Worksheet |
| 10.B.1.c Demonstrates the ability to multi-task |
| 10.B.1.e Present oneself professionally and with proper etiquette | Mock FLL competition  |
| 10.B.1.f Collaborate and cooperate effectively with teams | Project and Robot Design Organization WorksheetsCore Values Goal Worksheet |
| 10.B.1.g Respects and appreciates team diversity |
| 10.B.1.h Is accountable for results |
| 11.A.1. Uses interpersonal and problem-solving skills to influence and guide others toward a goal |
| 11.A.2. Leverages the strengths of others to accomplish a common goal |
| 11.A.3. Inspire others to reach their very best via example and selflessness |
| 11.A.4. Demonstrates integrity and ethical behavior in using influence and power |
| 11.B.1 Acts responsibly with the interests of the larger community in mind |

NGSS Standards:

If you are teaching this as a science class, these standards can guide your learning targets and justification for assessments:

|  |  |  |
| --- | --- | --- |
| Standard | Task | Assessment |
| Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. | Robot Design Organization Worksheet | Robot Design Judging Rubric |
| Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. |

Common Core ELA Standards:

These standards can guide your ELA learning targets and justification for assessments:

|  |  |  |
| --- | --- | --- |
| Standard | Task | Assessment |
| [CCSS.ELA-LITERACY.RST.6-8.7](http://www.corestandards.org/ELA-Literacy/RST/6-8/7/)Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). | Research Project Organization Worksheet | Project Judging Rubric |
| [CCSS.ELA-LITERACY.RST.6-8.8](http://www.corestandards.org/ELA-Literacy/RST/6-8/8/)Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. |
| [CCSS.ELA-LITERACY.RST.6-8.9](http://www.corestandards.org/ELA-Literacy/RST/6-8/9/)Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. |