TEK Robotics

A 15 HOUR TECH CAMP PLAN FOR
CHILD, YOUTH & SCHOOL SERVICES

Equipment, Activity Plans

and more!

Everything needed to facilitate a Tech Program or Camp for middle school and teen youth is provided. Activity plans and demonstrations as well as suggestions for field trips are included.

Living in the 21st century will give us many opportunities to use and learn about robots. Whether it is to make our lives easier, safer or more interesting, robots are playing a more important role every day. This program will provide youth with an opportunity to learn about basic robot construction, programming and testing!

Army CYS Tech Program/Camp Guide 2

Acknowledgements

With thanks:

Lego makes a world class Robotics kit, but they offer no help in naming the pieces so team members can refer to them. We wish to thank David J. Perdue, author of "The Unofficial LEGO Mindstorms NXT Inventor's Guide" for providing the robot parts nomenclature used in this Program Plan.

CYS Services would also like to thank www.nxtprograms.com for additional inspiration. To honor the wishes of the copyright holder, we are not allowed to reprint the activities in this book. However anyone is free to visit the website and print everything you need, including the NXT software program files (".rbt") needed to run the robot.

In addition, we also acknowledge George Yaghmour of Lego Education who recommended NXTPrograms.com during the 2008 National Education Computing Conference (NECC) and the USAG Daegu, Korea Army Youth Center for sharing these photos of their Robotics Competition Program.

TEK Robotics

Table of Contents

Overview ..... pg 1

Robotics Resources on the Web .....pg 2

Materials in the Lego Education Sets ..... pg 3

Day 1

- Instructor Background - Getting Organized ..... pg 5
- Activity 1 - Hand me that “What-cha-ma-call-it!” ..... pg 21
- Instructor Background - Build a Car Challenge ..... pg 23
- Activity 2 - Build a Car Challenge ..... pg 25
- Activity 3 - Robotic Arm ..... pg 27
- Activity 4 - Beginner Robot ..... pg 29

Day 2

- Activity 5 - “Roving Mars” .....pg 31
- Activity 6 - Sensor Exploration .....pg 33

Day 3

- Activity 7 - Basic Obstacle Course (2D) for Light Sensor ..... pg 35
- Activity 8 - Advanced Obstacle Course (3D) .....pg 39

Day 4

- Activity 9 - Field Trip .....pg 43

Day 5

- Activity 10 - Advanced or Expert Robot ..... pg 45
- Activity 11 - Videoing your Robot Build ..... pg 47
- Activity 12 - Processing the Robotics Experience .....pg 49

Youth Program Plans ..... pg 51

Overview/Background

Robotics

Lego NXT Robotics Activity Program

This Robotics Program was designed to assist the Child, Youth & School Services Youth Technology Lab (YTL) Program Leads in providing excellent, interesting and exciting programs for middle school youth and teens which includes innovative and creative options and will support increased youth participation in CYS Services programs.

Army CYS Services Middle School & Teen YTLs received the Lego Mindstorms NXT Robotics Education Base & Resource Sets. These sets have become a world standard in teaching youth about basic robotics technology through Experiential Learning. That means there are other technology educators, like you, creating quality activity plans to use in their programs. . Many excellent and creative robot builds and instructions can be found at www.nxtprograms.com.

This Program Plan includes twelve activities. Others may be found on the following page "Robotics Resources on the Web". You can also search the World Wide Web for yourself. Each activity in this program should include plenty of time for youth to be "hands on". Less theory, more doing! Research shows this is the best way to learn and retain. Don't neglect to "process" the activity by asking leading questions that encourage youth to apply what they have done.

A word about robot building teams: It has been said before, "Two is a partnership, and 5 is a "posse." Therefore, the suggested team size for these activities is "3-4" youth per team. You may need to adjust this in your MST robot program. However, team building is a very important part of this program! The first two activities help the youth explore who may be best at which job on the team. Some people are better at documenting facts, while others are better at constructing the robot. Another team member may be best suited to video tape the obstacle course activity.

Robotics Resources on the Web

(These are listed in the order we felt would be most helpful to CYS Services Staff)

Start here. “NXT Programs - Fun Projects for your LEGO Mindstorms NXT
http://www.nxtprograms.com/

”Projects” at nxtprograms.com
http://www.nxtprograms.com/index1.html

Lego Corporate Page for the NXT system. Good examples & ideas.
http://mindstorms.lego.com/

First Lego League: Chosen by BGCA as the World standard for Youth Robotics Competition
http://www.firstlegoleague.org/

FIRST: For Inspiration and Recognition of Science and Technology
http://www.usfirst.org/

Lego Engineering
http://www.LEGOengineering.com/

“The NXT STEP - LEGO MINDSTORMS NXT Blog
http://www.thenxtstep.blogspot.com/

Lego UserGroup Network. The international fan-created LEGO users Group Network
http://news.lugnet.com/robotics/nxt/

“Extreme NXT” LEGO NXT hacks and robots. Taking NXT to the NEXT Level.
http://philohome.com/nxt.htm

Domabotics
http://www.domabotics.com/

Materials In the Lego Education NXT Base & Education Resource Sets

The activities in this program assume you are using the Lego Mindstorms NXT Education Base (9797) & Resource (9648) Sets that were delivered to Army Middle School/Teen (MST) Youth Technology Labs (YTL) in 2009. Each Army CYS Services MST YTL with seven workstations received two Education Base Sets and two Resource Sets. Larger labs with fifteen workstations received 4 Education Base Sets and 4 Resource Sets. No YTL's received the Retail Version as part of the YTL Refresh, however some Garrisons may have purchased them on their own. Note that the Lego Mindstorms Retail version may also be used for this program but be aware of the following differences that may affect your implementation of the activities.

Lego Mindstorms NXT

Retail Set (8527)	Education Base Set (9797)	Education Resource Set (9648)
619 Lego Technic parts and Bionicle parts, including Visorak pincers.	431 Lego Technic parts Intelligent Brick and 5 Sensors	672 additional Technic parts and Bionicle parts, including Visorak pincers.
Plastic containers/trays NOT included	Plastic Container with 2 trays	Plastic Container with 2 trays
AA batteries required	Rechargeable battery	Brick & Sensors NOT included

Please note the disclaimer at http://www.nxtprograms.com/help/parts/9797.html about using the Education Base Set (9797) vs. the Retail Version (8527). Sometimes pieces you are missing in one set or version may be substituted with pieces you do have. (For example, cosmetic pieces such as "fangs," "claws" and rubber connectors are NOT included in the Education Base Set, but you can find them in the Education Resource Set (9648) or substitute similar pieces (or rubber bands!) in your build version of a functioning robot).

A word about batteries, battery packs & recharging: Although recharging batteries is an "earth-friendly" practice to be encouraged, experienced robot builders recommend "new" "AA" batteries be used to generate enough lasting torque required by more advanced robot motor tasks. Your Education Base Set comes with a rechargeable pack which works fine for many builds (as long as its enlarged size does not interfere with connecting pieces to the bottom of the NXT Brick). You

also must ask the question, “Can I open the battery door AFTER this robot is built, or should I replace the batteries before building?”

GET ORGANIZED! As noted in the Youth Program Plans, keeping track of these small Lego pieces can be challenging. Make good use of the containers that come with the kits. Build pillars of character like citizenship, caring, and responsibility into your youth by maintaining an expectation that the youth will take part in this effort to STAY organized so your robotics program may enjoy a long productive life!

Instructor Background

Organizing the Lego NXT Mindstorms Education Base Set (9797)

& Education Resource Set (9648)

Containers & Trays

Why this Activity?

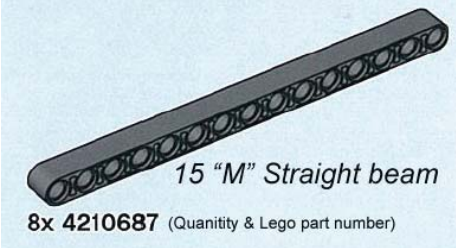
Hand me that “What-cha-ma-call-it”!

Naming and organizing the Lego NXT pieces does the following:

- Fosters scientific practice of naming and categorizing.
- Uses terms important in the engineering profession.
- Introduces terms important to scientific higher education.
- Improves/speeds up youth team communications.
- Helps keep your Lego kits in usable condition for years to come.
- Introduces language of Lego TECHNICS nomenclature.
- Fosters scientific need for accurate measurement.

The basic measurement for Lego NXT pieces is the “M” or “Module” length. One “M” (or “Mod”) is approximately 8 millimeters (mm) in length. This is the distance between the hole centers in Lego beams.

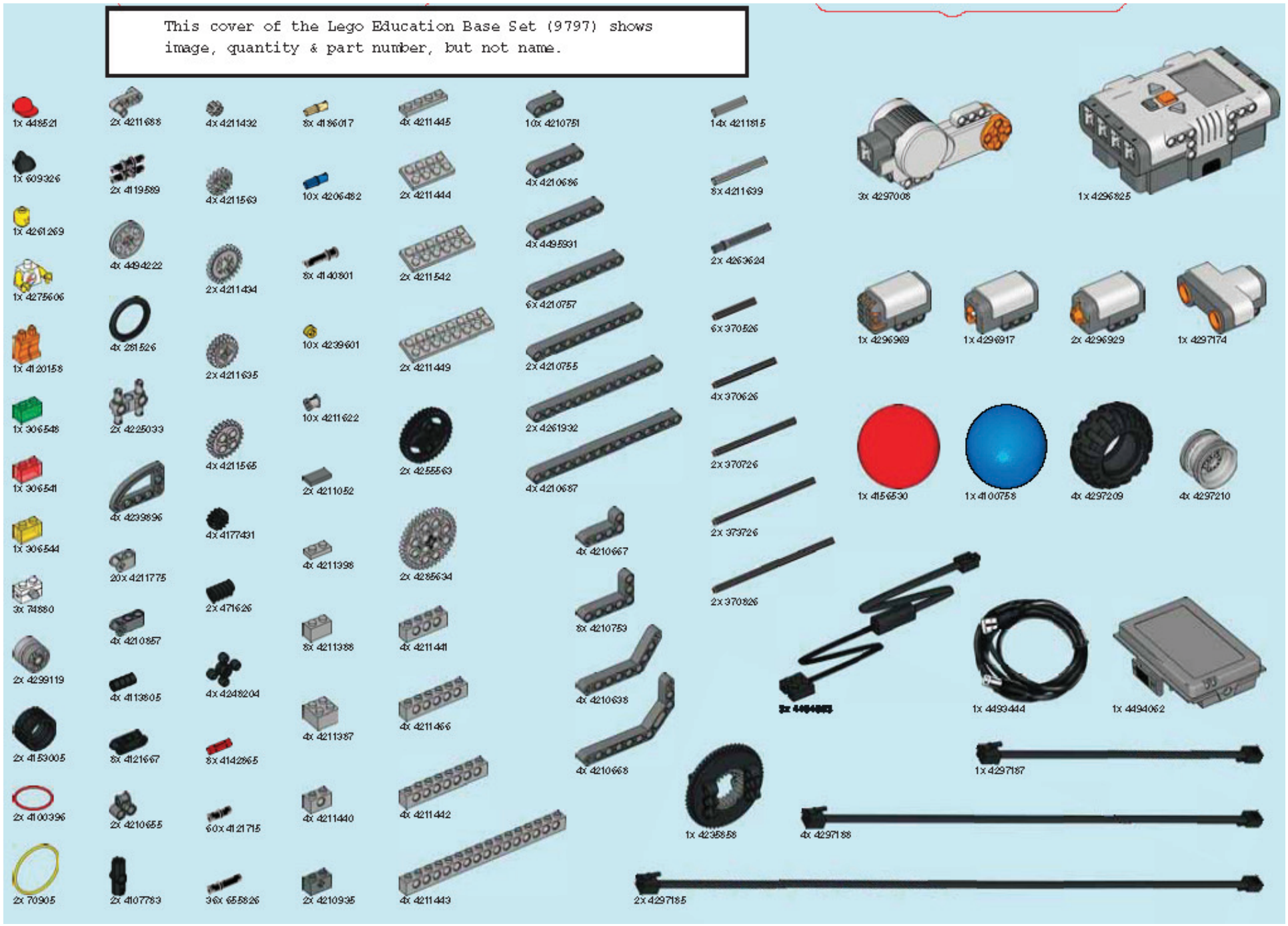
The longest Lego piece is the 15 M TECHNIC Straight beam.



The shortest Lego piece is the .5 M smooth bushing.

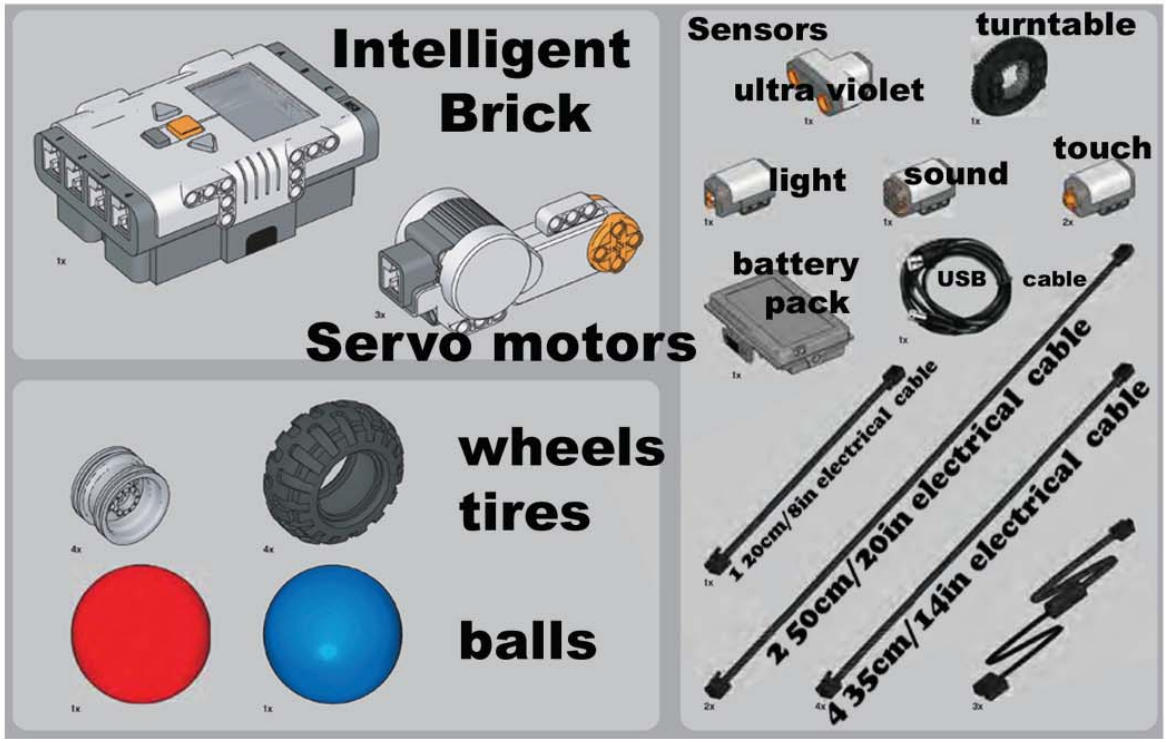
Use the following pages to help organize and name your Lego Sets.

This cover of the Lego Education Base Set (9797) shows image, quantity & part number, but not name.



9797 Lego NXT Base Education Set ORANGE Tray 1 Parts

9797 NXT Edu Base Set Tray 2



9797 Base Set #1

9797 Base Set #2

8 tooth TECHNIC gear	 4x 4211432	 8x 4186017	*Axel Peg (smooth)*
12 tooth TECHNIC gear double bevel	 4x 4211563	 10x 4206482	*Friction axel peg*
16 tooth TECHNIC gear	 2x 4211434	 8x 4140801	*Bushed Friction Peg*
20 tooth TECHNIC gear double bevel	 2x 4211635	 10x 4239601	*half bushing (smooth)*
24 tooth spur gear	 4x 4211565	 10x 4211622	*bushing*
		 2x 4211052	*Tile 1x 2 w/ groove*
TECHNIC Gear 12 tooth double bevel	 4x 4177431		
		 4x 4211398	*Plate 1x2*
T Worm screw gear	 2x 471626		
		 8x 4211388	*TECHNIC Brick 1 x 2*
TECHNIC Knob Wheel	 4x 4248204		
		 4x 4211387	*TECHNIC Brick 2 x 2*
TECHNIC axel 2 notched	 8x 4142865		
Friction Peg	 60x 4121715	 4x 4211440	*TECHNIC Brick 1 x 2 w/ hole*
Friction Peg 3M long	 36x 655826	 2x 4210935	*TECHNIC Brick 1 x 2 w/ Axel hole*

9797 Base Set #3

Plate 1x4

Plate 2x4

Plate 2x6 w/ holes

Plate 2x8 w/ holes

TECHNIC Gear 36 tooth double bevel

TECHNIC Gear 40 tooth

TECHNIC Brick 1x4 w/ holes

TECHNIC Brick 1x6 w/ holes

TECHNIC Brick 1x8 w/ holes

TECHNIC Brick 1x16 w/ holes

TECHNIC Straight Beam 3

TECHNIC Straight Beam 5

TECHNIC Straight Beam 7

TECHNIC Straight Beam 9

TECHNIC Straight Beam 11

TECHNIC Straight Beam 13

TECHNIC Straight Beam 15

TECHNIC Beam 2x4 pull arm bent 90˚

TECHNIC Beam 3x5 pull arm bent 90˚

TECHNIC Beam 6x4 45˚ angle beam (liftarm)

TECHNIC Beam 3x3.8x7 Liftarm bent 45˚ double

9797 Base Set #4

TECHNIC Axel 3 (gray)
14x 4211815

TECHNIC Axel 5 (gray)
8x 4211639

TECHNIC Axel 5.5 w/ stop
2x 4263624

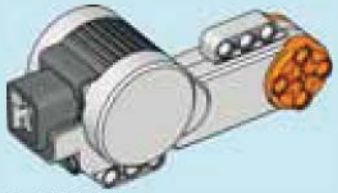
TECHNIC Axel 4
6x 370526

TECHNIC Axel 6
4x 370626

TECHNIC Axel 8
2x 370726

TECHNIC Axel 10
2x 373726

TECHNIC Axel 12
2x 370826


3x 4297008
Servo Motor


1x 4296825
NXT Intelligent Brick


1x 4296969


1x 4296917


2x 4296929


1x 4297174

Sensors: Sound *Light* *Touch* *UltraSonic*


1x 4156530

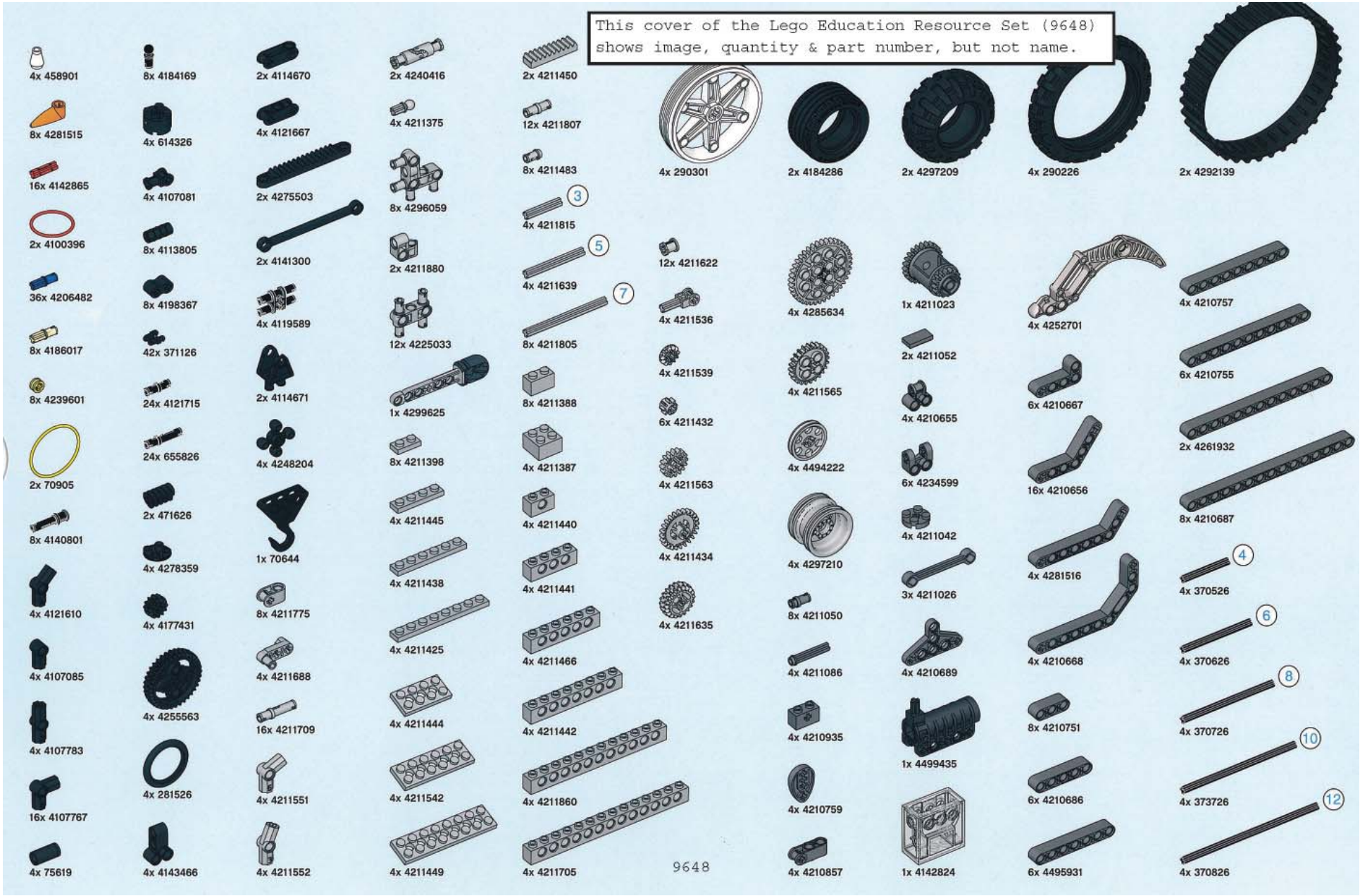

1x 4100758


4x 4297209


4x 4297210

Balls *Tires* *Wheels*

This cover of the Lego Education Resource Set (9648) shows image, quantity & part number, but not name.



9648

9648 Lego NXT Education Resource Set Tray 1 Parts

1. Misc.

2. Pegs
Connectors

3. Cranks
orange teeth

4 Axels

5. axel pegs

6. Misc.

7. belts, & worm gears

8. friction pegs

9. Bushings

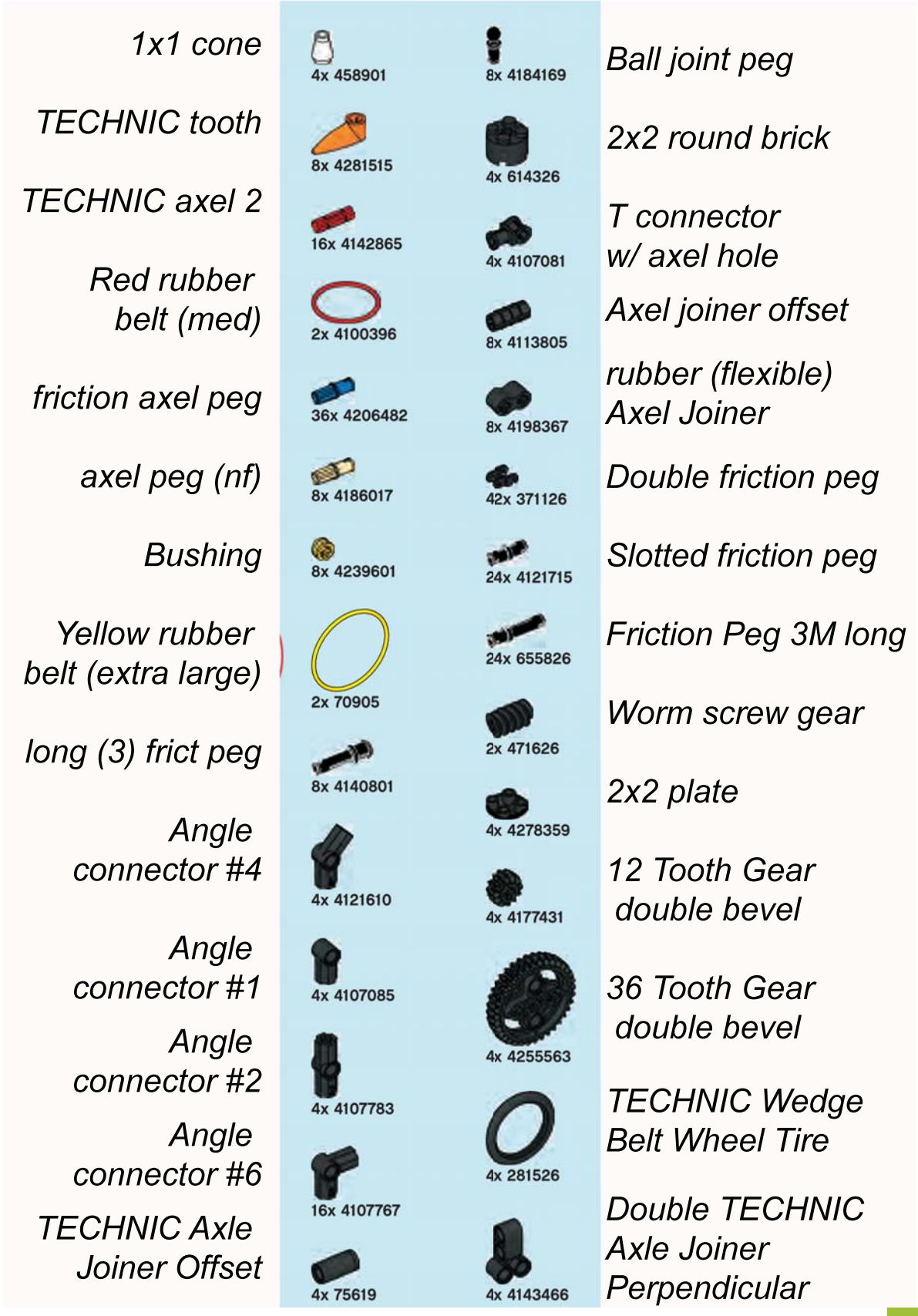
10. Angled Beams

11. Blocks & Connectors

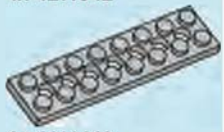
12. TECHNIC Bricks

13. Gears

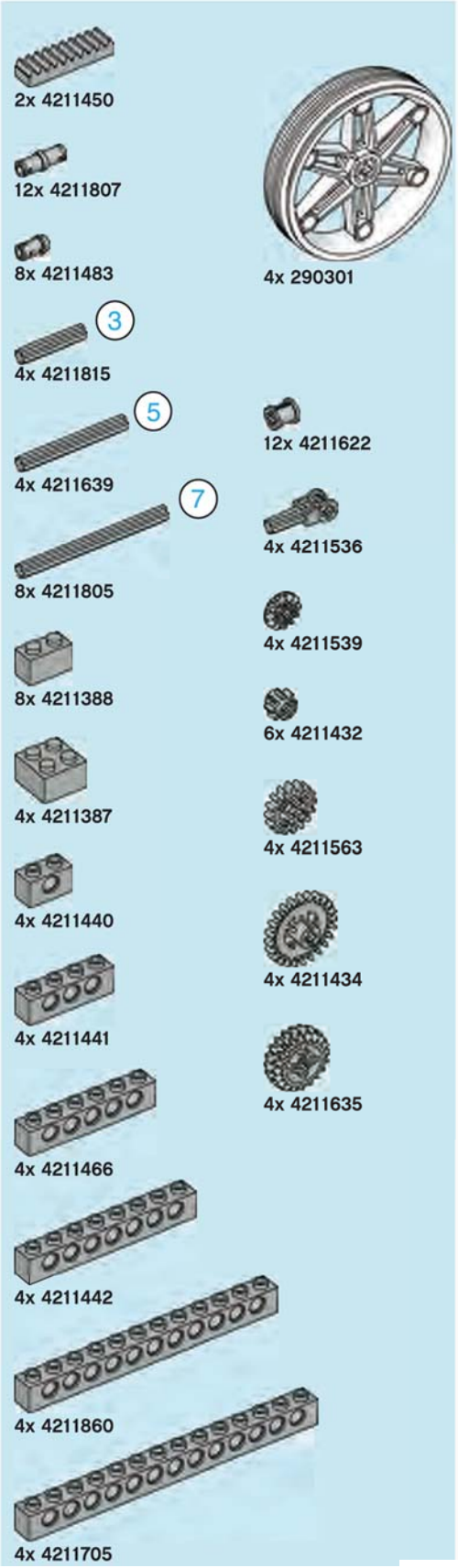
9648 Resource Set #1



9648 Resource Set #2

TECHNIC Axle Joiner Perpendicular 3 Long	 2x 4114670	 2x 4240416	*Pin*
TECHNIC Axle Joiner Perpendicular 3 Long w/ hole	 4x 4121667	 4x 4211375	*Ball joint peg*
TECHNIC Gear Rack 1 x 8 with Holes	 2x 4275503	 8x 4296059	*3x3 perpendicular peg 4 pins*
Steering Link xL	 2x 4141300	 2x 4211880	*Cornered peg joiner*
TECHNIC Pin 3L Double	 4x 4119589	 12x 4225033	*TECHNIC Axle Joiner Perpendicular 3L w/ 4*
TECHNIC Steering Arm with Connectors	 2x 4114671	 1x 4299625	*TECHNIC Competition Arrow (Complete)*
TECHNIC Knob Wheel	 4x 4248204	 8x 4211398	*Plate 1x2*
TECHNIC Hook (large metallic)	 1x 70644	 4x 4211445	*Plate 1x4*
		 4x 4211438	*Plate 1x6*
Cross Block 1x1	 8x 4211775		
		 4x 4211425	*Plate 1x8*
TECHNIC Beam 3 x 0.5 Liftarm w/ Boss and Pin	 4x 4211688		
		 4x 4211444	*Plate 2x4 w/ holes*
long (3) frict peg	 16x 4211709		
		 4x 4211542	*Plate 2x6 w/ holes*
#5 Angle Connector	 4x 4211551		
		 4x 4211449	*Plate 2x8 w/ holes*
#3 Angle Connector	 4x 4211552		

9648 Resource Set #3



TECHNIC Gear Rack 1 x 4

TECHNIC Peg

TECHNIC Peg 1/2

Axel 3 (gray)

Axel 5 (gray)

Axel 7 (gray)

TECHNIC Brick 1 x 2

TECHNIC Brick 2 x 2

TECHNIC Brick 1 x 2 with Holes

TECHNIC Brick 1 x 4 with Holes

TECHNIC Brick 1 x 6 with Holes

TECHNIC Brick 1 x 8 with Holes

TECHNIC Brick 1 x 12 with Holes

TECHNIC Brick 1 x 14 with Holes

Wheel 81.6 x 15 Motorcycle

Bushing (smooth)

TECHNIC Pole Reverser Handle

TECHNIC Gear 12 Tooth Bevel

TECHNIC Gear 8 Tooth

TECHNIC Gear 16 Tooth

TECHNIC Gear 24 Tooth

TECHNIC Gear 20 Tooth Double Bevel

9648 Resource Set #4

9648 Resource Set #5

81.6 x 15 motorcycle tire

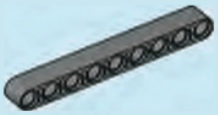

4x 290226


2x 4292139

TECHNIC Tread w/ 36 ridges

TECHNIC Bionical weapon pincer


4x 4252701


4x 4210757

TECHNIC Straight Beam 9


6x 4210755

TECHNIC Straight Beam 11

2x4 pull arm bent 90


6x 4210667


2x 4261932

TECHNIC Straight Beam 13

4x4 45°angle beam (liftarm)


16x 4210656


8x 4210687

TECHNIC Straight Beam 15

7x3 45°angle beam (liftarm)

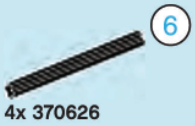

4x 4281516

4x 370526

Axel 4

Technic Beam 3 x 3.8 x 7 Liftarm Bent 45° Double


4x 4210668



4x 370626

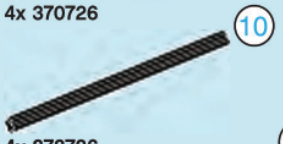
Axel 6

4x 370726

Axel 8

TECHNIC Straight Beam 3


8x 4210751



4x 373726

Axel 10

TECHNIC Straight Beam 5


6x 4210686

4x 370826

Axel 12

TECHNIC Straight Beam 7


6x 4495931

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity	Hand me that "What-cha-ma-call-it"!
Activity POC	
Length of Activity	30 minutes
Recommended Group Size	
Date of Activity	

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***	
☐ Sports, Fitness & Health	☐ 4-H	☐ MWR
☐ Life Skills, Citizenship & Leadership	☐ BGCA	☐ Other _____
☐ Arts, Recreation & Leisure	☐ NAYS	
☐ Academic Support, Mentoring & Intervention	☐ School	

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics.
- Character Development; Sharing, Teamwork, Persistence.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

1. Divide into teams of 3-4
2. Each team has one Lego Education NXT Base Set (9797).
3. Pour all 431 pieces of the kit in a single pile on the table. (You read right!)
4. Cut out the labels for the orange trays for the 9797 Set (found on page 8).

Note: If you have too many teams you can also use the Education Resource Sets (9648) too and cut out the gray trays found on page 14.

5. Insert these labels into the track divisions to which they belong. (Use double sided tape so the labels stay put).
6. Work as a team to sort the kits as fast as possible.
7. Use the names on the labels listed on pages 8 and/or 14.

Processing:

1. What did you do in this activity?
2. What was the easiest part…the hardest part?
3. Without simple names, how would you describe the pieces?
4. How does this simplify team communication?

Making the Character Connection

Yes, you can show you are a person of good character even while doing the simplest of jobs or jobs you don't feel are important. What would others learn about you if you:

- Broke random pieces as they were sorted
- Decided not to help at all
- Deliberately put pieces in the wrong trays

How would these actions affect the rest of the robotics activities? (It could slow down the activities so they might not be completed and people might not want to work with you because they couldn't trust or rely on

you.)

Remember; always do your best – even when it doesn't seem that important. Character Counts all the time.

Materials & Equipment Needed

- Tables and chairs for the teams
- One Lego Education NXT Base Set ((9797) or Education Resource Set (9648) for each team
- One copy of paper labels for each Set (page 8 and/or 14)
- Paper instruction hand-outs
- One pair of scissors per team

Preparation Needed

- Make copies of the labels for the trays from pages 8 and/or 14.

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choking hazard.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**

Instructor Background

Build a Car Challenge

Provide one set of the materials listed below to each team. The object of the activity is to teach the team to work together. There is no right way to put the car together. A sample of what the car might look like is also provided.

Provide each team with the following:

4 wheels, 4 tires, 2 axels (length=10M), 4 TECHNIC straight beams (length=13M), 4 TECHNIC bricks (1 x 15), 2 TECHNIC bricks (1 x 5), 1 TECHNIC plate (2 x 4), 1 minifig head, hat, torso and legs.

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity	Build a Car Challenge
Activity POC	
Length of Activity	30 minutes
Recommended Group Size	
Date of Activity	

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***	
☐ Sports, Fitness & Health	☐ 4-H	☐ MWR
☐ Life Skills, Citizenship & Leadership	☐ BGCA	☐ Other _____
☐ Arts, Recreation & Leisure	☐ NAYS	
☐ Academic Support, Mentoring & Intervention	☐ School	

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics.
- Character Development; Sharing, Teamwork, Persistence.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

1. Separate into teams of 3-4 youth per table with a Lego Education NXT Base Set (9797) at each table.

   Note: Do your best to keep sets separate one to a table to avoid intermingling set pieces.

2. Identify one youth to be blindfolded but able to use their hands.
3. Instruct the other team members to put their hands in their pockets.
4. Put the following separate pieces on the table in front of the blindfolded member:

   4 wheels, 4 tires, 2 axels (length=10M), 4 TECHNIC straight beams (length=13M), 4 TECHNIC bricks (1 x 15), 2 TECHNIC bricks (1 x 5), 1 TECHNIC plate (2 x 4), 1 minifig head, hat, torso and legs."

5. Instruct the entire team that they are to assemble a simple four wheel car with a “mini fig” driver where the blindfolded team member assembles the car and figure using only touch and verbal instructions from the other team members! *Note: The other team members (with hands in pockets), may not touch any pieces or assist in assembly other than through instructions for the blindfolded assembler.*

Processing:

1. How did you work together as a team to accomplish this task?
2. What words were used to describe the parts/process?
3. Was someone established as a leader? Did this help the process?
4. What would you do differently next time?

Making the Character Connection

This is a fun activity to demonstrate and practice teamwork. But, it is also a way to practice good character. What Pillar of Character is used to:

- Truthfully describe the pieces and how they work? (Trustworthiness or Responsibility)

- Explain to the blindfolded person patiently and without becoming frustrated that a mistake is being made. (Caring or Respect)

Have you ever found yourself in a similar situation in real life? Have you ever helped someone who was visually impaired, helped a friend in a cast or helped an elderly person with a household chore? (share experiences with the group) How does it make you feel to help someone else? Before all this talk about the Six Pillars of Character and Character Counts! did you ever realize that helping others showed your character?

Materials & Equipment Needed

- Tables and chairs for each team
- Lego Education NXT Base Set (9797) for each team

Preparation Needed

Separate pieces from the Lego Education NXT Base Set (9797)

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choking hazard.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity	Robotic Arm
Activity POC	
Length of Activity	40 min
Recommended Group Size	
Date of Activity	

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***
☐ Sports, Fitness & Health ☐ Life Skills, Citizenship & Leadership ☐ Arts, Recreation & Leisure ☐ Academic Support, Mentoring & Intervention	☐ 4-H ☐ MWR ☐ BGCA ☐ Other _____ ☐ NAYS ☐ School

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics.
- Character Development; Sharing, Teamwork, Persistence.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

Note: In this activity, the Lego Sets are NOT needed. Instead you will use common household/office materials listed on page two of this activity plan.

1. Break youth into teams of 3-4
2. Provide the teams with the following instructions:
3. Teams of youth are to work together to design and build a robotic arm. Materials are provided for your team, not all materials have to be used but no other materials can be used for construction.

a. The robot arm must be at least 18 inches in length.
b. The robot arm must have at least three degrees of movement.
c. The robot arm must be able to pick up an empty Styrofoam cup.
d. Teams must agree on a design for the arm and identify what materials will be used.
e. Teams must draw a sketch of the agreed upon design prior to construction. *(Note: Part of the teamwork process is sharing ideas and determining which design your team will use.)*
f. Project plan must be 'approved' by the activity leader prior to construction of the robot arm.
g. After receiving approval from the activity leader the teams construct and test their robot arm.
h. Teams have 30 minutes to construct and test their robot arm and they will present it to the larger group demonstrating its ability to pick up a Styrofoam cup.

There is no "right" answer to the problem – each team's creativity will likely generate an arm that is unique from the others designed during the activity.

Processing:

1. Did your team use all the materials in construction process?
2. Were there any difficulties in working as a team to design a robotic arm? Advantages?

3. What are some industries that may use robotic arms in their factories?

Making the Character Connection

Teamwork activities are nothing new. Team projects are common in many schools. Everyone would likely agree that some team projects are successful and some are not. Teamwork, done well, can expand ideas and lighten the work load by distributing it among many hands. It can also be frustrating when everyone is not given the chance to share ideas; someone decides not to do their share of the work; or when one or two team members decide to "take over" by doing all the work and excluding everyone else. Many of the activities you will experience while learning about robots are team activities. There are characteristics of each of the Six Pillars of Character (Trustworthiness, Respect, Responsibility, Fairness, Caring and Citizenship) that can help any team be successful. As a group talk about how the Pillars relate to teamwork. Throughout the rest of the activities anyone who feels a team is not working well together simply can say "Pillar" or name one of the Six Pillars to remind the team to re-group and include everyone in the project.

Materials & Equipment Needed

- 3" wide and approx. 22" long strips of cardboard-- 5 or so
- Binder clips (different sizes)-- 8 or more
- Brads—10-15
- Clothespins—6-10
- Craft sticks--10-15
- Fishing line-- 3-4 feet
- Hangers-- 1 or 2
- Paper clips (diff. Sizes) -- 10-15
- Pencils-- 3-4
- Rubber bands (different sizes)--15
- Tape-- clear and masking (partial rolls should be fine)
- Twine-- 3-4 feet
- Various size scraps of cardboard--10 assorted
- Scissors
- Paper Punch

Preparation Needed

Gather all suggested equipment

Safety Precautions Needed

- Care should be taken with the materials and equipment to ensure youth do not use their creativity to develop missiles, rockets or projectiles.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity	Beginner Robot
Activity POC	
Length of Activity	80 minutes – 2 hours
Recommended Group Size	
Date of Activity	

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***	
☐ Sports, Fitness & Health	☐ 4-H	☐ MWR
☐ Life Skills, Citizenship & Leadership	☐ BGCA	☐ Other _____
☐ Arts, Recreation & Leisure	☐ NAYS	
☐ Academic Support, Mentoring & Intervention	☐ School	

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics.
- Character Development; Sharing, Teamwork, Persistence.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

1. Break into teams of 3-4
2. Create a simple robot following the step-by-step instructions in the booklet found in the box titled "Lego Mindstorm Education 9797".
3. Test the robot following the instructions on page 23.

Note: if this booklet is not in the box you may find the instructions online in a PDF format.

Processing:

1. How did your team work together to build this robot base?
2. Did it take longer or shorter than you thought it would?

Making the Character Connection

Think of another time when you were a part of a team to do a project or accomplish a task – it might have been a school project or an activity at 4-H or Scouts. How did that experience compare with this team building a robot? Thinking about your worst experience, what made it bad? Did everyone participate? Did someone just take over? Did every member of the team have a chance to contribute their ideas without being made fun of or being discredited? It might be hard, but do you think it is possible to have an open discussion about being a better team by using some of the words from the Six Pillars like being respectful of others or caring about others feelings? What other points could you make? [Responsibility (doing your part), Fairness (let everyone have a turn to do something)] Now that you know more about the Six Pillars of Character are you a better team member?

Materials & Equipment Needed

- Tables & chairs for the teams
- Lego Education NXT Base Set (9797) for each team
- High quality batteries

- Paper instruction hand-outs

Preparation Needed

Fresh, powerful batteries are needed to power the brick! (Lithium recommended)
(Install batteries BEFORE robot is built as battery compartment door is not always accessible).

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choking hazard.
- Never mix different types of batteries in the robots.
- Always remove batteries prior to long-term storage.
- Promptly remove depleted batteries from the robots.
- Only recharge batteries under adult supervision.
- Never attempt to recharge non-rechargeable batteries.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity "Roving Mars"
Activity POC
Length of Activity 60 minutes
Recommended Group Size
Date of Activity

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***
☐ Sports, Fitness & Health ☐ Life Skills, Citizenship & Leadership ☐ Arts, Recreation & Leisure ☐ Academic Support, Mentoring & Intervention	☐ 4-H ☐ MWR ☐ BGCA ☐ Other _____ ☐ NAYS ☐ School

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will observe technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Inferring.
- Character Development; Sharing.
- Life Skills; Job Skills, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

1. Group gathers around big screen to watch (and discuss) "Roving Mars"
2. Watch video
3. Discuss and process the program after

Processing:

1. Do you think you would like to do this kind of work for a living?
2. What kind of education would be required to work at JPL?
3. Did these people appear to enjoy their work?
4. Did the team ever experience problems?
5. Name some of the problems.
6. How did the problems affect the way they worked?
7. What part does "being prepared in advance" play in this job?
8. Who named the robots "Spirit & Opportunity?" (adults?)

Making the Character Connection

This video showed just how amazing advances in technology can be. What great things can happen when those using technology use good character in their decisions! Think how destructive it could be if they made bad choices.

Consider all the ways you use technology in a day. You might download tunes to your computer, text message friends on a smart phone, do research for a school project through the Internet rather than the public library, and stay connected with friends, family and acquaintances through some type of social media. While these forms of technology make life more enjoyable and maybe easier, they can also challenge your character? Have you ever known anyone who: downloaded music illegally or used a copyrighted song in a PowerPoint presentation without asking permission; hurt a friend's feelings by sharing pictures or a confidence through a text message or social media; or plagiarized a paper because "everything on the Internet is legal to use…it is so easy to cut and paste…no one will notice"? Whether you use technology or not, remember, everything you do, every decision you make is a reflection of your character.

Materials & Equipment Needed • Video • Way to play the video • Popcorn	
Preparation Needed Reserve large screen TV for one hour Rent Disney DVD “Roving Mars”	
Safety Precautions Needed None	
Feedback & Notes *(What went well? What didn’t work? What modifications will you make in preparation for the next session?)*	
Prepared by	**Today’s Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity	Sensor Exploration
Activity POC	
Length of Activity	90 minutes
Recommended Group Size	
Date of Activity	

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***	
☐ Sports, Fitness & Health	☐ 4-H	☐ MWR
☐ Life Skills, Citizenship & Leadership	☐ BGCA	☐ Other _____
☐ Arts, Recreation & Leisure	☐ NAYS	
☐ Academic Support, Mentoring & Intervention	☐ School	

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics.
- Character Development; Sharing, Teamwork, Persistence.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

Note: This activity assumes participants have already assembled the basic 3 wheel base robot from the Beginner Robot activity found in "Lego Mindstorms Education 9797" booklet starting on page 8 and going through page 23 that came in the Lego Education NXT Base Set (9797). (If the book is missing, a PDF is available online).

1. Participants should add each of the 4 sensors as extensions to the robot base.

The Sensors are:

- Light (pg 32-35)
- Sound (pg 24-27)
- Ultra-Sonic (pg 28-31), and
- Touch (pg 40-45).

2. Each sensor arm instruction ends with a simple, five-step NXT rbt program that allows participants to demonstrate how the robot "reacts" with that particular sensor (Pgs 35, 27, 31 & 45). Have youth use the 4 buttons on the front of the intelligent brick to input the programs.

Note: If you have completed the Basic 2D and Advanced 3D Obstacle Course activities (see following activities), youth may test these sensors on those courses. If not, they should improvise on the floor or a table to run and test the programs.

3. Youth should save and name the programs, "light," "sound," and so on, to the brick memory, using the buttons on the brick to find the "save-to-disk" icon.

Processing:

1. Compare your builds with those of teams at other tables. How do they compare?
2. What can you do to improve your robot "reactions?"

3. What can you add to the given programs to make the robot actions more complex or interesting?
4. How are robot sensors like senses in the human body?
5. How did your robot react to external triggers?
6. Name human sense(s) that these robots can't replicate?

Making the Character Connection

Wouldn't it be fun to have an intelligent brick that could be programmed with behavior that would be consistent with the Six Pillars of Character? Just think, right before the argument with a sibling starts you could push the button for Caring and you would behave as a caring person and there would be no argument. Do you have a favorite Pillar – you know, the "go to" Pillar you tend to use most? It could be the number one button on the intelligent brick. Share with the group your favorite Pillar and why.

Materials & Equipment Needed

- Tables & chairs for the teams
- Lego Education NXT Base Set (9797) for each team
- High quality batteries

Preparation Needed

Fresh, powerful batteries are needed to power the brick! (Lithium recommended)
(Install batteries BEFORE robot is built as battery compartment door is not always accessible).

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choke hazard.
- Never mix different types of batteries in the robot.
- Always remove batteries prior to long-term storage.
- Promptly remove depleted batteries from the robot.
- Only recharge batteries under adult supervision.
- Never attempt to recharge non-rechargeable batteries.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity Basic Obstacle Course (2D) for Light Sensor
Activity POC
Length of Activity 90 minutes (see note below)
Recommended Group Size
Date of Activity

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***	
☐ Sports, Fitness & Health	☐ 4-H	☐ MWR
☐ Life Skills, Citizenship & Leadership	☐ BGCA	☐ Other _____
☐ Arts, Recreation & Leisure	☐ NAYS	
☐ Academic Support, Mentoring & Intervention	☐ School	

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics.
- Character Development; Sharing, Persistence, Communication.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

In this activity youth will construct a basic two-dimensional (2D) obstacle course to challenge and test the base three-wheel robot (Beginner Robot) with light sensor (only), attached facing down.

At the end of this activity plan you will find an example of a poster that comes with the Lego NXT Mindstorms Retail Set (8527) called “Test Pad”. This pad has the minimum features needed to for a basic 2D obstacle course. If you have access to a sheet printer or plotter then you may enlarge and print this pad onto paper. Glossy paper is recommended over matte paper for better rubber tire traction! Or you may use standard matte paper glued to cardboard or plywood and add slick black electrical tape to increase the traction surface.

If you will be making your own Basic Obstacle Course the course should be no smaller than 3 x 4 foot rectangle. It may be as large as you like. You may choose to place it on the floor or on a table.

You should decide up-front how much time to devote to this activity. The youth may decide to build a very elaborate platform/challenge table from plywood and lumber, or they may build the simple cardboard one shown on following pages that may be folded and put away for later use.

The important thing to remember is to make the black and white color contrast HIGH so the robot sensor can easily sense the difference. Also, use a surface that will allow the robot wheels to have good traction resistance. Duct tape or electrical can help improve the traction on the course. Allow the participants to decorate the obstacle course with fun signs and obstacles. Let them be creative!

Allow the youth to test their robots and light sensor on the course to make sure the design will work.

Note: If you use the Test Pad on page 37, 60-90 minutes is plenty of time to test the robots. If you are constructing your own course you will need to plan for more time.

A perfect alternate robot for this Pad/Course activity can be found at http://www.nxtprograms.com/line_follower/index.html. This robot varies from the BASIC 3-wheel build in Activity 4 in ways that make it ideal to be a "line follower."

Processing:

1. What challenges were there to make this obstacle course?
2. How did different team members contribute to the project?

Making the Character Connection

Obstacle courses can be elaborate or simple. Some can be maneuvered easily while others can cause problems at every turn. Sometimes when running a difficult obstacle course that has caused you lots of trouble even the simple things like the decorations on the course can be a distraction from the real job at hand. How did your team work through the challenges of the course?

We all run obstacle courses – some hard, some easy – every day. Of course, they aren't called obstacle courses instead we know them as decisions or just making up your mind. It might be preparing for and taking a really important test at school, dealing with a particularly difficult situation at home; or deciding to go with friends to get ice cream instead of going home to mow the lawn. Think about a decision you made lately. (someone might want to share) How did you prepare for that particular obstacle course? Did you list the pros and cons, ask yourself what your parents would want you to do; or just make decisions with little thought. Keep in mind, unimportant things can be a distraction that can get you off course. Having a plan for making daily decisions is even more important than having a plan for maneuvering the basic obstacle course. Don't let the little things get in the way of making the right decision. Remember that character really does count.

Materials & Equipment Needed

Tables & chairs for the teams
High quality batteries
Cardboard base (or plywood), no smaller than 3x4 ft rectangle
Duct tape with high traction rubber surface
Electrical tape with high traction rubber surface
Decorative stickers to enhance the course design

Preparation Needed

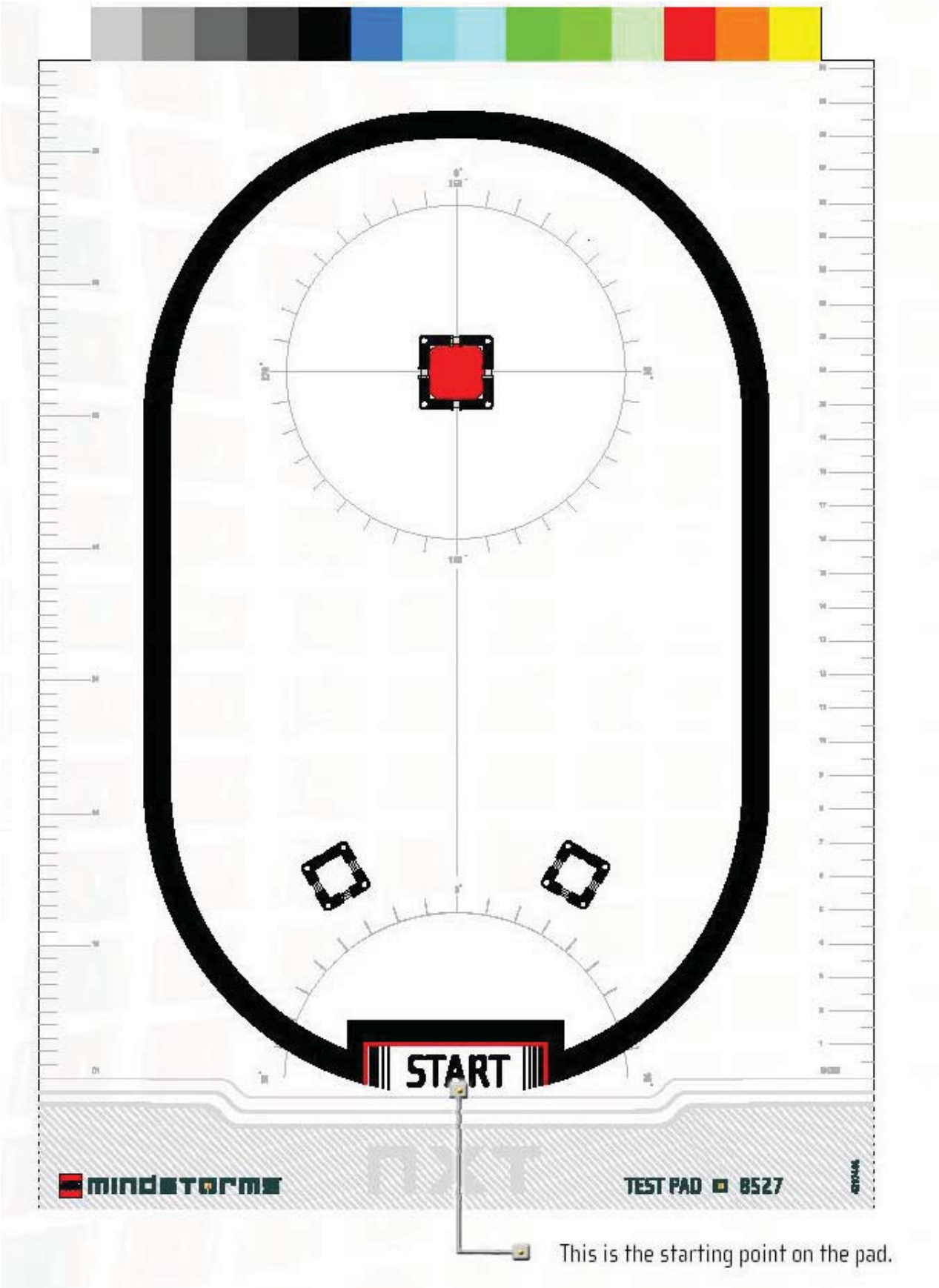
Fresh, powerful batteries are needed to power the brick! (Lithium recommended)
(Install batteries BEFORE robot is built as battery compartment door is not always accessible).

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choking hazard.
- Never mix different types of batteries in the robots.
- Always remove batteries prior to long-term storage.
- Promptly remove depleted batteries from the robots.
- Only recharge batteries under adult supervision.
- Never attempt to recharge non-rechargeable batteries.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**



Sample Test Pad

Example of Cardboard Obstacle Course

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity Advanced Obstacle Course (3D)
Activity POC
Length of Activity **9**0 minutes (see Note below)
Recommended Group Size
Date of Activity

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***
☐ Sports, Fitness & Health ☐ Life Skills, Citizenship & Leadership ☐ Arts, Recreation & Leisure ☐ Academic Support, Mentoring & Intervention	☐ 4-H ☐ MWR ☐ BGCA ☐ Other _____ ☐ NAYS ☐ School

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics.
- Character Development; Sharing, Persistence, Communication.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

The Basic (2D) Light Sensor Obstacle Course offered a way to test your robot using only the light sensor.

This activity has you add to and improve the Basic Obstacle Course by adding three dimensional obstacles. The "basic" course only included obstacles to challenge the Light Sensor, which caused the robot to turn under certain conditions on the track. We will now add additional obstacles for the other sensors: Touch, Ultra-sonic and Sound.

Consider the design at the end of this activity plan as an example of minimum obstacles to start with.

As was stated in the Basic Obstacle Course activity plan, you should decide up-front how much time to put into this construction project, or how complex you wish the result. You may keep it fairly "two dimensional" on a piece of stiff cardboard, or you may go for help at the on-post wood shop and construct a complex finished table with ramps, solid walls and beautiful landscaping.

Keep the following "best practices" in mind:

The light sensor reacts to "extreme" color contrast! So what ever colors youth put in the design, make sure they are as different as black and white. As a mater of fact, black and white may be the best choice so the robot "knows" when to react to a color change. Bottom line: Test the course colors with actual robots to determine the best design.

Allow the youth to be creative! Loud noises such as clapping can be used to cause the robot to react to the sound sensor. Use heavy books to make a bumping wall. Experience has shown that something like a "foosball" table with a 3-4 inch parameter wall is helpful to keep the robots from falling off and breaking into pieces on the floor.

The more effort and planning participants put into this, the more often the course will be stowed away and used again in future programs.

Allow the youth to test their robots and sensors on the course to make sure the design will work with the sensors.

Note: Depending on the amount of time you spend developing a more advance obstacle course, you may need more than 60-90 minutes and should plan accordingly.

Processing:

1. What were some challenges to adding to an existing design?
2. How did individual members contribute uniquely to the project?

Making the Character Connection

As you prepared for the advanced obstacle course it was suggested that you keep "best practices" in mind. It's always a good idea to learn from others, use their best techniques and benefit from their mistakes. For the obstacle course "best practices" came from others who have worked with the same course. As you make decisions throughout the day it is often a good idea to use "best practices" or "lessons learned" as well as those that might come from some of your past experiences, from parents, teachers or trusted friends. When there are big decisions to make – which college to attend, whether to play sports or participate on an academic team or how to patch-up an argument with a good friend – it's a good idea to stop and think about the consequences, consider all the facts and talk with those you trust and know will give you good advice. Can you think of three people you would talk with when making a big decision?

Materials & Equipment Needed

Tables & chairs for the teams
High quality batteries
Basic Obstacle Course
Additional materials such as plywood, nails, glue, colorful stickers, paint, tape, framing wood, etc. to allow youth to prepare a course to meet the needs to of all sensors.
Work with your Army Garrison woodwork shop to develop a more specific list.

Preparation Needed

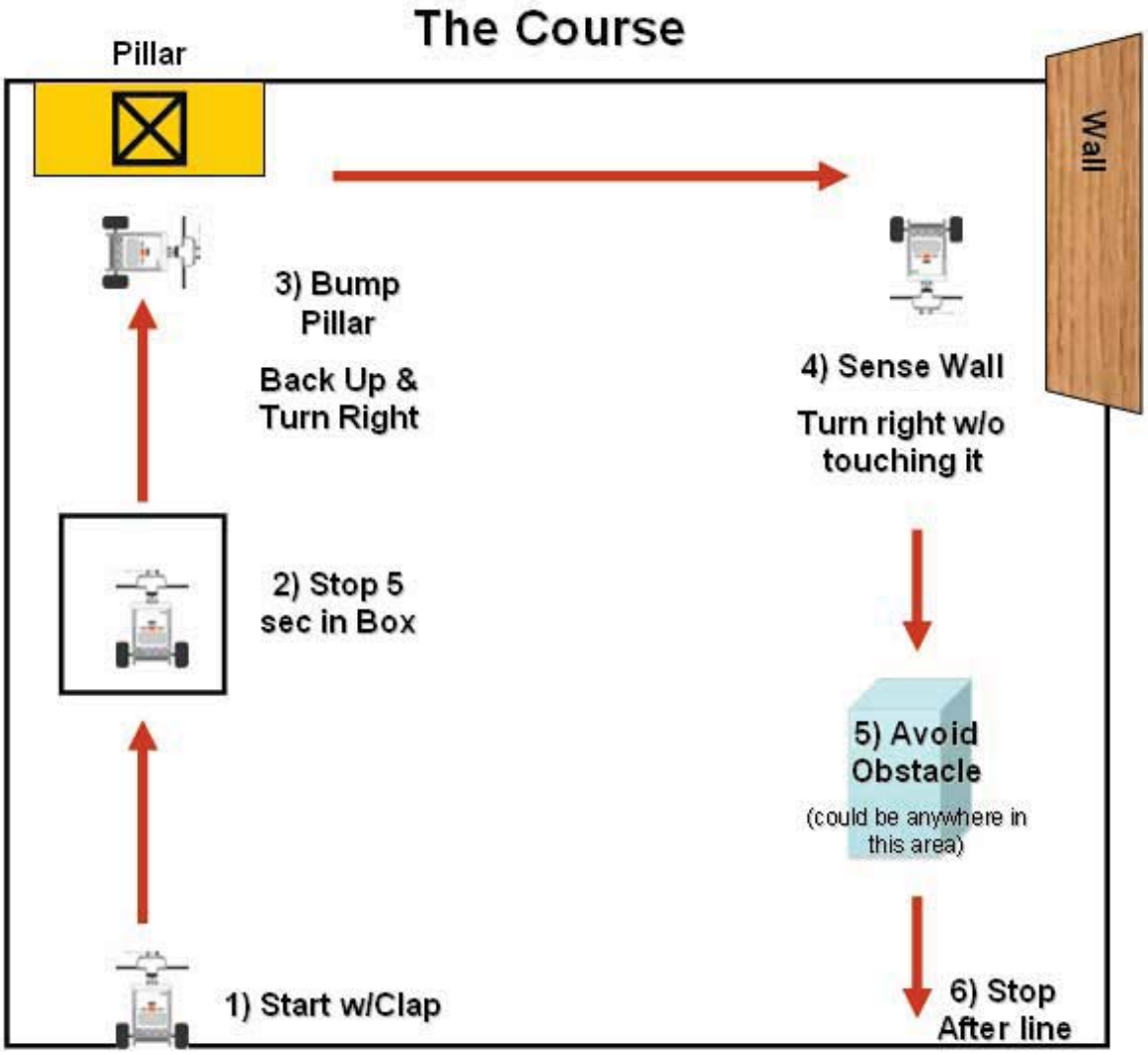
Fresh, powerful batteries are needed to power the brick! (Lithium recommended)
(Install batteries BEFORE robot is built as battery compartment door is not always accessible).

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choking hazard.
- Never mix different types of batteries in the robot.
- Always remove batteries prior to long-term storage.
- Promptly remove depleted batteries from the robot.
- Only recharge batteries under adult supervision.
- Never attempt to recharge non-rechargeable batteries.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**



Advanced Obstacle Course Diagram

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity Field Trip
Activity POC
Length of Activity 1.5-3 hours
Recommended Group Size
Date of Activity

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***	
☐ Sports, Fitness & Health	☐ 4-H	☐ MWR
☐ Life Skills, Citizenship & Leadership	☐ BGCA	☐ Other _____
☐ Arts, Recreation & Leisure	☐ NAYS	
☐ Academic Support, Mentoring & Intervention	☐ School	

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will observe technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Inferring.
- Character Development; Sharing.
- Life Skills; Job Skills, Workforce Preparation, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

1. Allow youth to search for possible field trip locations. This will need to be done well in advance of the activity and could be done in the Youth Technology Lab.
    a. Use the Internet in the YTL to locate possible locations in your area for a field trip.
    b. Determine the date of the field trip and narrow choices made by youth
    c. Help youth prioritize the list of possible locations.
    d. Program lead contacts locations to coordinate possible field trip date and time
2. Possible field trip topics and locations –
    a. Army Unit which uses robots to disable bombs or IEDs
    b. Army engineering unit that uses robots for other purposes
    c. Local college/university that may offer classes in Robotics
    d. Local Manufacturer that may use Robotics
        i. Spot and electric arc welding
        ii. "Pick & place" industrial operations
        iii. Assembly line, auto/electronics/furniture, mounting circuits
        iv. Paint spray finishing
        v. Precision and laser cutting of sheet metal, tool & dye
    e. Some medical/surgical facilities use robotics for health care applications
    f. Service Robots more for humans than Industry (Call your local "Roomba" dealer.)
3. Listen as host describes robots in the manufacturing process.
4. Ask questions when given the opportunity.

Processing:

1. Would you consider doing this kind of work for a living?
2. How often do you suppose these machines need maintenance?
3. Would you rather be the robot creator or maintenance person?

Making the Character Connection

Say:

As we prepare for the field trip we need to remember that Character Counts everywhere…all the time. Those we meet will remember us by how we act, how well we pay attention and the types of questions we ask. There are many ways that the Six Pillars relate to the field trip. Here are just a few:

Trustworthiness - Be reliable. If you make a commitment to go on the field trip be ready on time.

Respect – Use good manners and be considerate of others. Those that are hosting us have taken time from their schedules to help us learn more about robotics.

Responsibility– Work together as a group to be on time for appointments and have relevant questions ready to ask.

Fairness – Be sure that everyone has a chance to ask questions and see what is going on.

Materials & Equipment Needed

Youth Technology Lab

Preparation Needed

Planning of the field trip needs to be done well in advance of the activity.
Find a location
Parent Permission Forms
Transportation
Food if needed
Water, First Aid Kit, etc. from SOP for Field Trips
Understanding of the safety rules the business may have for the youth during the visit

Safety Precautions Needed

- Youth should have a clear understanding of the rules specified by the business management.
- Safety is an important consideration for this field trip. It is important that youth carefully follow guidelines of the host regarding safety procedures and behavior.
- Field Trip SOP should be followed.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity Advanced or Expert Robot
Activity POC
Length of Activity 60-90 minutes
Recommended Group Size
Date of Activity

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***	
☐ Sports, Fitness & Health	☐ 4-H	☐ MWR
☐ Life Skills, Citizenship & Leadership	☐ BGCA	☐ Other _____
☐ Arts, Recreation & Leisure	☐ NAYS	
☐ Academic Support, Mentoring & Intervention	☐ School	

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication.
- Character Development; Sharing, Teamwork, Persistence.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

1. Break participants into teams of 3-4.
2. Build your choice of any "Advanced" or "Expert" Robots at www.NXTPrograms.com

   Link to review all Projects by type:
   http://www.nxtprograms.com/projects1.html

   Link to Projects by Building Difficulty:
   http://www.nxtprograms.com/projects1.html#ProjectsByBuilding

   Link to Projects by Program Complexity:
   http://www.nxtprograms.com/projects1.html#ProjectsByProgram

3. Not only can you find instructions to build a particular robot, you may also download the NXT "rbt" program that makes the robot function in a certain way, and transfer that file via USB (or Bluetooth) from the NXT software application to the robot.
4. The instructions below are an example of the process:

   1. Point Internet browser to URL: http://www.nxtprograms.com/line_follower/index.html
   2. Click the "Building Instructions" link.
   3. Print the web site building instructions (optional).
   4. Follow the NXT Programs step-by-step building instructions.
   5. After building robot, download the ".RBT" program file from: http://www.nxtprograms.com/programs/Line_Follow.rbt (Save this file to your desktop or folder of your choice).
   6. Connect the USB cable from the Computer to the NXT brick.
   7. Open the Lego NXT Software on the YTL Computer.
   8. Run the ".RBT" Program downloaded for this robot.

9. Test/Play the program actions and adjust as desired.

Processing:

1. Have you seen this design in a “real life” application?
2. Could this robot design be used in a “real life” application?
3. Does this design have any weakness?
4. What can we do to improve this design next time?
5. Did you find ways to improve the website program?

Making the Character Connection

Mention during the activity:

We are nearing the end of the robotics activities. Through each activity we have talked about the importance of teamwork and character. As you think back over each activity, think specifically about teamwork and character. What are three things you learned; what are two things you will use after this experience and what one thing will you always remember? Share your list with the group. Are there some common words used? Make a poster to share with others at the Center that shows how much fun you had learning about robotics and what you learned about teamwork and character.

Materials & Equipment Needed

- Tables & chairs for the teams
- Lego Education NXT Base Set (9797) and Education Resource Set (9648) for each team (Use 9648 as needed for extra or unique parts not found in 9797.)
- High quality batteries
- Paper instruction hand-outs.
- Computer with Internet access.

Preparation Needed

Prepare handout instructions from http://www.nxtprograms.com/

Fresh, powerful batteries are needed to power the brick! Lithium recommended)

(Install batteries BEFORE robot is built, as battery compartment door is not always accessible after).

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choking hazard.
- Never mix different types of batteries in the robot.
- Always remove batteries prior to long-term storage.
- Promptly remove depleted batteries from the robot.
- Only recharge batteries under adult supervision.
- Never attempt to recharge non-rechargeable batteries.

Feedback & Notes *(What went well? What didn’t work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today’s Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity Videoing your Robot Build
Activity POC
Length of Activity 90 minutes
Recommended Group Size
Date of Activity

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***
☐ Sports, Fitness & Health ☐ Life Skills, Citizenship & Leadership ☐ Arts, Recreation & Leisure ☐ Academic Support, Mentoring & Intervention	☐ 4-H ☐ MWR ☐ BGCA ☐ Other _____ ☐ NAYS ☐ School

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Participants will employ technology in the development of strategies for solving problems in the real world.
- Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining.
- Math Process Skills; Problem Solving, Reasoning, Communication.
- Character Development; Sharing, Teamwork, Persistence.
- Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking, Public Speaking.

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

This activity has the group working as a large team to video the building of an advanced robot. Use the 3,2,1…Action! videography materials available on the CYS Professional website as a resource for delivering this activity.

1. As a large group decide which robot to build and video.
2. Help participants decide which role they will fill.
3. Create a storyboard for the video.
4. Shoot the video.
5. Edit the video.
6. Show the video to other youth in the program.

Processing:

1. What did you learn while making this video?
2. How does this video show what we learned about robotics?
3. What is our target audience for this video?

Making the Character Connection

It's always fun to share what you have learned with others. Making a video is a great way to show how to build a robot. Remember, you have learned lots of other things too. Consider making brief comments or show the importance of teamwork and decision making and maybe you could add something about character too. In fact, working in groups of 2-3, each group select one of the Pillars of Character and develop a 30 – 60 second statement or commercial about that Pillar. Then you will already have something prepared for the video.

Materials & Equipment Needed

- Tables & chairs for participants
- 3,2,1…Action! videography guide
- Storyboard samples

- Video cameras
- YTL Computers and YTL video editing software
- Computer with internet access
- Lego Education NXT Base Set (9797)
- High quality batteries
- Paper instruction hand-outs.

Preparation Needed

Fresh, powerful batteries are needed to power the brick! (Lithium recommended)
(Install batteries BEFORE robot is built, as battery compartment door is not always accessible after).

Safety Precautions Needed

- If working with younger children, take care with small parts, which can be a potential choking hazard.
- Never mix different types of batteries in the robot.
- Always remove batteries prior to long-term storage.
- Promptly remove depleted batteries from the robot.
- Only recharge batteries under adult supervision.
- Never attempt to recharge non-rechargeable batteries.

Feedback & Notes *(What went well? What didn't work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today's Date**

U.S. Army Child, Youth & School Services

Youth Activity Plan

Name of Activity	Processing the Robotics Experience
Activity POC	
Length of Activity	15 minutes
Recommended Group Size	
Date of Activity	

Check the Service-Learning Areas that apply to this activity:	***Check applicable partnerships:***
☐ Sports, Fitness & Health ☐ Life Skills, Citizenship & Leadership ☐ Arts, Recreation & Leisure ☐ Academic Support, Mentoring & Intervention	☐ 4-H ☐ MWR ☐ BGCA ☐ Other _____ ☐ NAYS ☐ School

Developmental Outcomes *(What impact will be made on the physical, social, intellectual and emotional development of youth?)*

- Science Process Skills; Observing, Communicating, Measuring, Inferring
- Math Process Skills; Problem Solving, Reasoning, Communication
- Character Development
- Life Skills; Decision Making, Critical Thinking

Activity Process *(Please provide a step-by-step description of how you will implement this activity. Highlight how partner clubs, curriculum materials, and programs beyond the gate are being integrated.)*

This activity is used to allow participants and facilitator to process the entire Robotics Experience.

Have an informal discussion with participants in teen lounge or similar setting.

1. What were some of your favorite experiences during the program/camp?
2. What were some of your least favorite experiences during the program/camp?
3. What are some of the things you learned about robotics?
4. How can robotics help us today and in the future?
5. What are some things the group can do to reach more people with this program?
    1) Teach Senior Citizens about robots.
    2) Offer this program to youth in the community with out access to robotics kits.
    3) Hold a family night to share things learned from CYSTEKWARE - Robotics.
    4) Work with younger youth to teach them how to build robots.

Processing:
See above

Making the Character Connection
Say:
After every activity this week we have taken a few minutes to talk about how character connects to what we have been doing.

On the piece of paper provided jot down one important thing you have learned about character this week. When you are finished writing, wad the paper up and throw it (*either in the center of the circle or to the front of the room depending on the room set-up*). *[When everyone's paper has been thrown to the designated spot say:]* Now everyone grab one of the pieces of paper. [*Either have people volunteer to read what is on the paper or if time allows have everyone read what has been written and then ask for any additional comments.]*

Wrap-Up
Remember, “Character Counts everywhere…all the time.” It’s not enough to be a person of character when we are making “big” decisions like whether or not to cheat on a test or quit a job without giving proper notice. We need to remember that our character shows with every decision we make – big and small. The Character Connection time this week has shown a number of ways to show others that CHARACTER COUNTS!

Materials & Equipment Needed

1. Note taker
2. Flip chart
3. Markers
4. Paper and Pens

Preparation Needed

Safety Precautions Needed

Feedback & Notes *(What went well? What didn’t work? What modifications will you make in preparation for the next session?)*

Prepared by	**Today’s Date**

Youth Program Plan

YP Staff Proponent – YTL Program Lead

Program Name	Program Purpose	Program Length	Program Frequency	Program Location
CYSTEKWARE – CORE Robotics	***Learn about basic robot construction, programming and testing.***	***9 hours***	***1 hour Daily or Weekly***	***YTL and various locations***

Session Date	Session Date	Session Date	Session Date	Session Date
CORE 1	***CORE 1***	***CORE 2***	***CORE 3***	***CORE 3***
Activity Name	***Activity Name***	***Activity Name***	***Activity Name***	***Activity Name***
Hand me that "What-cha-ma-call-it!" (30 minutes)	Build a Car Challenge (30 minutes)	Beginner Robot (60 minutes)	Beginner Robot *(continued)* (30 minutes)	Sensor Exploration (30 minutes)
Developmental Objectives	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*
Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

The Four Service Areas Are: Sports, Fitness & Health; Life Skills, Citizenship & Leadership; Arts, Recreation & Leisure; Academic Support, Mentoring & Intervention

Army CYS Services Tech Program/Camp –
CORE Youth Program Plan Page 2 of 3

Session Date	**Session Date**	**Session Date**	**Session Date**	**Session Date**
CORE 4	***CORE 5***	***CORE 6***	***CORE 6***	***CORE 7***
Activity Name	***Activity Name***	***Activity Name***	***Activity Name***	***Activity Name***
Sensor Exploration *(continued)* (60 minutes)	Basic Obstacle Course (2D) for Light Sensor (60 minutes)	Basic Obstacle Course (2D) for Light Sensor *(continued)* (30 minutes)	Advanced Obstacle Course (3D) (30 minutes)	Advanced Obstacle Course (3D) *(continued)* (60 minutes)
Developmental Objectives	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*
Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Persistence, communication. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Persistence, communication. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Persistence, communication. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Persistence, communication. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.

The Four Service Areas Are: Sports, Fitness & Health; Life Skills, Citizenship & Leadership; Arts, Recreation & Leisure; Academic Support, Mentoring & Intervention

Session Date	Session Date	Session Date	Session Date	Session Date
CORE 8	**CORE 9**	**CORE 9**		
Activity Name	**Activity Name**	**Activity Name**	**Activity Name**	**Activity Name**
Advance or Expert Robot (60 minutes)	Advance or Expert Robot *(continued)* (45 minutes)	Processing the Robotics Experience (15 minutes)		
Developmental Objectives	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*
Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Science Process Skills; Observing, Communicating, Measuring, Inferring Math Process Skills; Problem Solving, Reasoning, Communication Character Development Life Skills; Decision Making, Critical Thinking		

The Four Service Areas Are: Sports, Fitness & Health; Life Skills, Citizenship & Leadership; Arts, Recreation & Leisure; Academic Support, Mentoring & Intervention

U.S. Army Child, Youth & School Services

Youth Program Plan

YP Staff Proponent – YTL Program Lead

Program Name	Program Purpose	Program Length	Program Frequency	Program Location
CYSTEKWARE – Camp Robotics	***Learn about basic robot construction, programming and testing.***	***15 hours***	***3 hour sessions either Weekly or Daily***	***YTL and various locations***

Session Date	***Session Date***	***Session Date***	***Session Date***	***Session Date***
Day 1	***Day 1***	***Day 1***	***Day 1***	***Day 2***
Activity Name	***Activity Name***	***Activity Name***	***Activity Name***	***Activity Name***
Hand me that "What-cha-ma-call-it!" (30 minutes)	Build a Car Challenge (30 minutes)	Robotic Arm (40 minutes)	Beginner Robot (80 minutes)	"Roving Mars" (60 minutes)
Developmental Objectives	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*
Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will observe technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Inferring. Character Development; Sharing,. Life Skills; Job Skills, Decision Making, Critical Thinking.

The Four Service Areas Are: Sports, Fitness & Health; Life Skills, Citizenship & Leadership; Arts, Recreation & Leisure; Academic Support, Mentoring & Intervention

Session Date	Session Date	Session Date	Session Date	Session Date
Day 2	Day 2	Day 3	Day 3	Day 4
Activity Name	**Activity Name**	**Activity Name**	**Activity Name**	**Activity Name**
Beginner Robot (continued) (30 minutes)	Sensor Exploration (90 minutes)	Basic Obstacle Course (2D) for Light Sensor (90 minutes)	Advanced Obstacle Course (3D) (90 minutes)	Field Trip (3 hours)
Developmental Objectives	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*
Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Persistence, communication. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Application of computer software to Robotics. Character Development; Sharing, Persistence, communication. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will observe technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Inferring. Character Development; Sharing,. Life Skills; Job Skills, Workforce Preparation, Decision Making, Critical Thinking.

The Four Service Areas Are: Sports, Fitness & Health; Life Skills, Citizenship & Leadership; Arts, Recreation & Leisure; Academic Support, Mentoring & Intervention

Session Date	Session Date	Session Date	Session Date	Session Date
Day 5	Day 5	Day 5		
Activity Name	**Activity Name**	**Activity Name**	**Activity Name**	**Activity Name**
Advance or Expert Robot (90 minutes)	Videoing your Robot Build (90 minutes)	Processing the Robotics Experience (15 minutes)		
Developmental Objectives	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*	*Developmental Objectives*
Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking.	Participants will employ technology in the development of strategies for solving problems in the real world. Science Process Skills; Observing, Communicating, Measuring, Inferring, Refining. Math Process Skills; Problem Solving, Reasoning, Communication; Character Development; Sharing, Teamwork, Persistence. Life Skills; Teamwork, Problem Solving, Decision Making, Critical Thinking, Public Speaking.	Science Process Skills; Observing, Communicating, Measuring, Inferring Math Process Skills; Problem Solving, Reasoning, Communication Character Development Life Skills; Decision Making, Critical Thinking		