





South Dakota 4-H Robotics Getting Started

Christine Wood | SDSU Extension 4-H Science Technology Engineering and Math (STEM) Field Specialist

Updated 2018

Table of Contents

What is a robot?	1
Why SD 4-H Robotics?	1
What is a robotics club/team?	1
Where to start	2
Goals and Objectives	2
Resources	3
Equipment and Materials	4
Available for Checkout from South Dakota 4-H	4
Funding	5
Other Needs	5
How to facilitate a club?	5
Group Management	6
Working with Multi-age Groups	6
Evaluation	6
Additional Information	6
Coaching for a Competition	7
Ideas for Year-Bound Programing	8
Appendix Δ – Bobotics Volunteer Bole Description	۰۵ ۹
Primary Adult Leader Role	۹
	10
Appendix B 4 H Bobotics Curriculum	10 11
	11
	 11
Pahatian Diatforma Track	 11
Appendix C - SD 4-H Robotics Challenge	12
vvnat?	12
VVho?	12
VVhen?	13
	13
Appendix D – Jackrabbit BEST Robotics.	14
What?	14
Who?	14
When?	14
Contact Information	15
Appendix E – <i>FIRST</i> [®]	16
What? & Who?	16
When?	17
Contact Information	17
Appendix F – VEX and VEX IQ Challenges	18
What? & Who?	18
When?	19
Contact Information	19



4-H & Youth

JULY 2018

SOUTH DAKOTA STATE UNIVERSITY® SDSU EXTENSION

South Dakota 4-H Robotics: Getting Started

What is a robot?

When most people picture robots they see something off the big screen from movies like Star Wars, Transformers, and Wall-E. While robots such as these have become wildly popular with youth across the world, science and technology isn't quite ready to produce a robot like C-3PO. However, it has supplied our world with a variety of other types of robots.

Robots are tools that help us achieve things; they have been developed to do work that is too dangerous, precise, dirty, or even boring. Robots work in factories building cars and electronics, explore under the sea and in outer space, serve in our militaries, and work alongside our doctors.

Robots have also found a home within youth development and education. They are ideal tools for teaching youth as robots motivate, excite, and inspire youth in the areas of science, technology, engineering, and math through hands-on application. Through the 4-H Robotics program youth are encouraged to expand their imaginations and develop problem solving, communication, and self-confidence.

Why South Dakota 4-H Robotics?

In South Dakota 4-H Robotics is about much more than the competition. It is about the development of youth through experiential learning. During the program youth are introduced to a variety of science, technology, engineering, and math (STEM) concepts, but also develop a variety of life skills including, but not limited to: problem solving, communication, and teamwork.

The 4-H Robotics program engages both youth and adults through the development of local 4-H Robotics clubs. 4-H Professionals assist volunteers and members with developing a robotics program that fits their individual needs

What is a robotics club/team?

4-H Robotics clubs/teams come in all shapes and sizes. They are comprised of youth from ages 8 to 18 and can be community clubs, special interest groups, afterschool programs, or even a class. They may meet once a month throughout the year or several times a week during their robotics 'season'. Additionally, a robotics club may serve as a learning community comprised of youth from a variety of other 4-H clubs and even other SD counties – in this scenario it may be called



a special interest group rather than a club. Regardless of the composition of these groups, the three things they each have in common is:

- 1. They have an interest in robotics
- 2. Youth have opportunities to take an active role in their learning
- 3. There is a caring adult leader there to provide encouragement, guidance, and resources

Where to start

There is no 'right' place to start – clubs/teams/leaders must assess what they have for resources as well as what their experience and comfort level is. They can then work with their 4-H Youth Program Advisor to determine what curriculum and/or platforms may work best for them.

Some questions to consider when determining where to start:

- What are your goals/objectives?
- What are your current resources
 - o Youth
 - o Adults
 - o Equipment and Materials
 - What are currently used in the community?
 - What type of programing software are you comfortable with? i.e. Drag and drop programing software? Or maybe a C programing language?



- o Facilities
- o Funding
 - What community businesses/stakeholders would be willing to support a youth robotics program?
 - Are there grants that you would be eligible for?

Goals and Objectives

The first step to getting your robotics club/team started is to identify your goals and objectives for starting a robotics club. Consider making both long and short term goals.

Some of the overall goals of the 4-H Robotics program are to:

- Engage youth in science, engineering, technology, and math
- Increase youth understanding of basic science concepts related to robotics
- Teach youth to apply the processes of scientific inquiry and engineering design
- Build youth skills in science, engineering and technology
- Use the tools of technology to enhance youth learning
- Provide youth opportunity to explore robotics and related careers

These goals can be achieved by providing robotics programing in a number of different settings:

- In the classroom
- In an afterschool program
- In a club setting
- By following curriculum
- By participating in competitions

Once you have determined your goals and objectives, you can proceed to identify what you currently have and what you will need for resources. You will most likely revisit your goals and objectives throughout the development of your club. As you add youth and other volunteers, it is important to include them in the development of these goals and objectives. Providing youth with the opportunity to help set goals for the group, gives them ownership of the program and will enhance their engagement.

Resources

Youth

Youth may either be present or absent at the beginning of your journey. Some groups start as a few educators/parents wanting to start something new, while others start as a group of youth interested in getting a program going.

Regardless of which scenario you may be in, there are a variety of things that you can do to help gauge robotics interest in your community and recruit youth to your program. Some ideas are:

- Host a workshop or day camp
- Post fliers in locations frequented by youth
- Send informational packets home from school
- Have interested youth recruit their friends

Knowing how many youth are interested, your target club

size, and age ranges of youth is important for determining the quantity and type of other resources needed.

If you already have your youth identified, allow them to take ownership in the program and help to set goals. Get their input on what they would like to do and guide them to make both long and short term goals.

Adults

Regardless of education or background, **any caring adult CAN lead youth in robotics**. What it takes to be a 4-H Volunteer/Club Leader for Robotics, is a passion for helping youth learn life skills and discover science, technology, and engineering.

Robotics club volunteers and leaders **do NOT need to have a technical background to lead a youth robotics program**. They DO need to be able to ask questions and

guide youth through the process of finding answers. They also need to be okay with a little bit of mess – experiential learning and youth creativity can at times be chaotic.

Professional development opportunities are available to help leaders find the answers they need or to provide them with training or other program assistance needed. For more information or assistance contact your county's SDSU Extension 4-H Youth Program Advisor (<u>http://igrow.org/about/our-experts/</u>) or the SDSU Extension 4-H Science Technology Engineering and Math (STEM) Field Specialist, Christine Wood, Christine.Wood@sdstate.edu.

More information about volunteer roles can be found in Appendix A.





Equipment and Materials

Depending on your goals and audience, the type of equipment you will need will vary. Below is a list of curriculum and robotics platforms that can be used for a robotics club.

Robotics Curriculum and Platforms	Age	Computer/ Software	Programing	Autonomous/ Remote	More Information
4-H Robotics Curriculum					
Junk Drawer Robotics	8-18	No/No			
Robotics Platforms	8-18	Yes/Yes			
LEGO [®] WeDo™	7+	Yes/Yes	Drag & Drop Icons	Autonomous	
LEGO [®] MINDSTORMS [®] NXT	8+	Vac (Vac	Drag & Drop	Autonomous	or
LEGO [®] MINDSTORMS [®] EV3	10+	Yes/Yes	C languages	Autonomous	http://www.legoeudcation.us/
TETRIX®	13-18	Yes/Yes	Drag & Drop Icons or C languages	Autonomous and Remote	
VEX IQ	7-14		Drag & Drop	Autonomous	http://www.education.rec.ri.cmu.edu/
VEX	10-18	Yes/Yes	lcons or C languages	and Remote	or http://www.vexrobotics.com/

Robotics Curriculum and Platforms

This list represents a few resources used within some 4-H robotics programs. It is not intended to be a complete list of available curriculum and platforms.

Available for Checkout from South Dakota 4-H

If you are in need of robotics materials to do promotional programs or to gather interest and support before you begin purchasing materials, check with your county 4-H office to see if they have supplies available. Robotics supplies are also available to check out from the State 4-H program:

For your use there are:

- 4-H Robotics Curriculum
 - o Junk Drawer Robotics
 - o Robotics Platforms
- LEGO[®] MINDSTORMS[®] NXT
- LEGO[®] MINDSTORMS[®] EV3 and Software
- LEGO[®] WeDo[™]
- Ozobots
- Junk Drawer Robotics Kits

For information on utilizing these resources please contact: Christine Wood – 4-H Science, Technology, Engineering, and Math Specialist; Christine.Wood@sdstate.edu; 605-782-3290.



Funding

Given the costs involved, teams/clubs may choose to seek sponsorship from local businesses. There are also a variety of grants and awards for which groups can apply. Some websites to get you started on your search for funding are:

- South Dakota Space Grant Consortium Dan Swets Robotics Award <u>http://sdspacegrant.sdsmt.</u> <u>edu/DanSwetsRoboticsAward.html</u>
- LEGO[®] Education Grants <u>https://education.lego.com/en-us/grants</u>
- Robotics Education Team Grants <u>http://www.roboticseducation.org/for-participants/team-grants/</u>

For additional ideas for fundraising help go to Fundraiser Help www.fundraiserhelp.com

When applying for grants or asking for sponsorship, be sure to provide the specific goals and outcomes for your program.

Other Needs

Depending on what you choose to use for curriculum or platform, be sure to do a full analysis of all the things that they require. For example, you may choose to use LEGO® MINDSTORMS® EV3 for your club as they are easily available to you. However, you need to make sure that you have the corresponding software and a computer that can be used for programing. You also want to check with the manufacturer to make sure that it is still a supported product.

A location for meeting is also a very valuable resource. You want to have a place that accommodates your group size and encourages youth to be active and creative. Consider a location that has internet capabilities in case you need to do some researching/troubleshooting during your meetings. A secure location to store your materials is a must as well.

How to facilitate a club?



The most effective robotics leaders, approach their role as a facilitator rather than as a teacher. Facilitation is the act of engaging youth through non-directive leadership. This type of leadership provides youth with opportunities to make their own decisions which have the potential for real consequences. Additionally, it makes the youth responsible for their own learning and development.

Facilitators are masters at asking questions that direct

youth in the process and activities needed to find a solution. By doing this, they are supporting youth's development of practical knowledge, creative thinking, problem solving, teamwork, and a multitude of other life skills.

The ultimate goal of 4-H programs is positive youth development. 4-H Robotics club facilitators are responsible for ensuring that their program meets the essential elements of youth development:

- Youth develop a sense of belonging within a positive group,
- Youth cultivate independence and have an opportunity to see oneself as an active participant in the future;
- Youth have an opportunity to gain mastery and overcome challenges; and
- Youth learn to share the spirit of generosity towards others.

Sometimes obstacles or situations can arise that hinder the efforts of providing these essential elements; but with a little pre-planning or program alterations they can be overcome.

Group Management

Experiential learning can be loud and messy which can present a variety of challenges for a facilitator. As a facilitator, it is important that you can keep the chaos controlled and positive. This controlled environment can be achieved through goal setting, scheduling, effective working space, and above all being flexible and prepared for anything.

Regardless of how controlled you are able to keep your program, you will most likely still encounter some problem behaviors due to individual differences.

Working with multi-age groups

Facilitating robotics with a multitude of ages can be more challenging than working with a group that is at the same developmental stage. While it may be a challenge and require a little more assistance, it can be a very rewarding experience for all involved. Some ways in which you can embrace this situation:

- Utilize the one-room schoolhouse philosophy older youth assist younger youth
- Be flexible
- Provide age appropriate activities for older and younger youth to participate in simultaneously
- Ensure that you have equipment to support the various age ranges i.e. LEGO[®] WeDo[™] for the youngest members and MINDSTORMS[®] or TETRIX[®] for older youth

Evaluation

Evaluation is an important portion of facilitating your group. It allows you to assess the effectiveness of the program as well as determine where additional resources or possible improvements are needed. Depending on the way the robotics program is delivered and the requirements of stakeholders, evaluation methods can vary. Possible evaluation points are: membership records (did you maintain or grow membership); club participation (are youth coming back time after time); number of meeting times per year (are you meeting often enough to be effective); goals



reached; and youth skills (teamwork skills, problem solving abilities, and programing skills). Evaluations can be conducted via surveys, observations, and competition results.

Additional Information

As you start navigating your way through 4-H Robotics and Youth Development there are several resources available to you:

- Your local SDSU Extension 4-H Youth Program Advisor
- The SDSU Extension 4-H Field Specialists
- Other SDSU Extension 4-H Robotics Leaders
- The Facebook group, SDSU Extension 4-H Robotics (<u>https://www.facebook.com/</u> <u>groups/213765102128769/</u>) - a Robotics Learning Community that exists to help facilitate conversations about robotics programing

Coaching for a Competition

Your group has decided to enter into a competition or challenge – making you not only the club facilitator but also the club coach. Competitive robotics clubs can have a very different dynamic as they are often more focused on the end results rather than the process. While the end results may be motivational to the youth, it is important for coaches to continue to emphasize the importance of the process used to get the end result.

In order to continue to actively engage youth in a more competitive group, it may be important



to alter group dynamics. Depending on your club's size and the type of competition you are entering into, you may have to divide your group into multiple teams. These team divisions can be made based upon age groups or based upon individual characteristics.

While it is important for all youth to participate in each aspect for competition preparation, teams often divide up and assign roles for the day of competition based on each team member's strength. Some example roles are:

- **Project Manager** responsible for making sure that the team stays on task and keeps on schedule. He or she will also be in charge of assisting with any other roles necessary.
- o **Designer/Builder** –responsible for fixing, maintaining, and improving the robot as necessary. It is their responsibility to ensure that the robot is ready for every test. They are also responsible for making sure that the batteries are charged and that spare parts are on hand.
- **Programmer** This youth is responsible for programing the robot as well as making sure the computer and software is ready to go.
- o **Tester/Troubleshooter** –responsible for the operation of the robot. They will run the robot on the course and provide the builder/programmer with feedback on any changes that need to be made and then help the builder/programmer make those changes.
- o **Reporter/Technical Writer** –responsible for recording what happens at every meeting. He/she will record the various builds tried as well as adjustments made to the program. It will then be his/her responsibility to look back through the records to help troubleshoot programs and builds.

One of the most important things you can do as a coach is to keep the atmosphere fun and remain positive. Youth that are having fun are more likely to be continually engaged in the program and even STEM outside of robotics. If they get hung up or frustrated about something, encourage them to take a break and come back to it later. Do not let them get disheartened by mistakes, but teach them to learn from them and recapture a positive attitude.

Ideas for Year-Round Programing

Once you have youth and volunteers engaged in your program, you want to keep them engaged.

You may spend the majority of your meetings building, programing, and testing; but consider mixing it up and adding some additional activities to help enrich the experience:

- > Go on field trips to places that use science and technology
 - Manufacturing facilities
 - Hospitals
- Have youth do a presentation at club/team meetings or a 4-H event
 - Demonstrate how to build/program a robot
 - Present an illustrated talk
 - Research a STEM topic and put together a Project 'Why'
- > Exhibit an educational display or poster
- Develop your own challenge
 - Exhibit it at fair
 - Arrange a friendly competition with other local robotics groups
- > Participate in the State 4-H Robotics Challenge Appendix C
- > Go to an afterschool program or other organization and teach them about robotics
- > Have a workshop on public speaking, record keeping (robotics notebooks), or other skills
- ➤ Follow a robotics curriculum
 - 4-H Junk Drawer Robotics
 - 4-H Robotics Curriculum
 - VEX Curriculum
 - LEGO® Education Curriculum
- ➤ Arrange for a guest speaker
- > Do community service projects
- Establish relationships with science based businesses within your community and have them mentor the team/club
- > Participate in challenges/competitions
 - South Dakota 4-H Robotics Challenge Appendix C
 - National 4-H Engineering Challenge <u>http://www.4hengineering.org/</u>
 - Jackrabbit BEST Robotics Appendix D
 - FIRST[®] Appendix E
 - VEX Appendix F

Regardless of your decision to include a competition, keep in mind that 4-H, FIRST[®], BEST, and VEX are partners within South Dakota – we are NOT competing organizations. Youth can participate in one or multiple competitions. All of these programs are about positive youth development and empowering young people in the areas of science, technology, engineering, and math.



Appendix A – Robotics Volunteer Role Description

Primary Adult Leader Role

Adult leaders are a key component of the 4-H Robotics program. Each robotics program requires a significant investment of time and support by adults to ensure a quality experience and safe environment for youth. This role can be shared among multiple adults.

PURPOSE	 Provide support and guidance to a group of youth as the explore engineering and robotics.
QUALITIES THAT	Some who cares about youth and their success
MATTER TO YOUTH	Someone who is patient
	Someone who is organized
	 Someone who youth can go to with questions
	Someone who will give youth support and advice
AN EFFECTIVE	Builds a strong relationship through regular communication and face-to-face time
ADULT MENTOR IS	 Is encouraging and provides support for youth as they solve their own problems
SOMEONE WHO	Helps coach youth through situations in which they feel stuck and guides them in
	finding answers to their questions
	 Empowers youth to take responsibility for their robotics program
	• Creates a safe place for youth to be creative, take risks, try new things, and make
	mistakes
	Can keep things fun
RESPONSIBILITIES	• Complete screening and training as is required to become a 4-H volunteer and any
	additional training needed for individual robotics competitions
	 Assist youth with defining both short and long term goals for their program
	 Provide motivation and problem solving strategies to youth
	 Reflect and debrief with youth on a regular basis
	 Assist in collection of evaluation and project completion data
	 Offer appreciation and recognition to youth
	 Communicate needs of group to 4-H and SDSU Extension staff
	 Prepare for meetings; review what the club accomplished at previous meeting
	and prepare to assist them with picking up where they left off
	Encourage cooperation and questions
	Connect youth with resources
	 Assist youth with goal setting and help them review and evaluate as they
	progress

Multiple Volunteers

Serving as a leader for a robotics club can be demanding and require you to wear multiple hats, or reach out to additional volunteers/ and parents to help you out. By engaging additional volunteers and parents in the program you not only can share the workload, but you have the potential to form a Learning Community made up of a diverse group of adults that value the importance robotics programing has for youth. As you work to recruit volunteers to your program, you may find that there is a need to define the roles of these volunteers. Here are a few potential robotics volunteer role descriptions provided by the National 4-H Program:

Programing Mentor:

- Be an advisor, guide and mentor
- Provide expertise in programing robots
- Encourage youth to create their own solutions
- Participate in volunteer training

Robotics Project Manager:

- Develop caring relationships with members
- Encourage members in planning a yearly activity calendar
- Maintain organization
- Assist with establishing goals and timelines
- Help youth find resources to support their project
- Participate in volunteer training

Club Communications Manager:

- Encourage participation of all youth and their families
- Provide club management and communication
- Complete forms and other paperwork required of the club
- Participate in volunteer training

Note not all of these are required volunteer positions, but examples of roles you may have within your program.

Appendix B – 4-H Robotics Curriculum

Overview

The 4-H Robotics Curriculum – *Engineering for Today and Tomorrow* – engages youth through the use of robotics. It utilizes a variety of mediums to engage youth and challenge them in the areas of science, engineering, and technology.

Unlike most robotics curriculums, the 4-H Robotics curriculum uses several delivery systems and is compatible with multiple platforms. *Engineering for Today and Tomorrow* allows youth to:

- Gain understanding of basic science concepts
- Learn about and utilize scientific inquiry and engineering design
- Use tools and technology to enhance their learning
- Explore a variety of STEM careers

The curriculum is separated into different segments in order to meet the needs of a diverse audience comprise of clubs, afterschool programs, classrooms, and individuals. Each segment of the curriculum has a youth notebook in addition to the facilitators guide.

Junk Drawer Robotics

Through the Junk Drawer Robotics track, youth will be challenged to build robots from everyday items. You will learn about the science, physics, mechanics, and electronics behind robotics. The track focuses on developing knowledge and skills in addition to the application.

Robotics Platforms

With this portion of the curriculum, youth will be able to learn about robotics platforms (commercial robotics kits) of their choice. The track can be used with a variety of platforms including: MINDSTORMS[®], TETRIX[®], CEENBot, and VEX. Through each module of the curriculum youth will gain knowledge and understanding that will allow them to master the engineering design as well as the programing required to complete challenges. Each level builds upon the previous allowing youth to deepen their understanding of their robot and how to control it. Additional curriculum units have also been added specifically for the LEGO[®] MINDSTORMS[®] EV3 robot.

Where can I get it?

The robotics curriculum can be purchased from the National 4-H Mall (http://www.4-hmall.org).

The South Dakota 4-H program also has some curriculum that can be checked out as well as some LEGO[®] MINDSTORMS[®] NXT and EV3 robots, LEGO[®] WeDo[™] robots, and Junk Drawer materials available. For information on these contact your SDSU Extension 4-H Youth Program Advisor or the SDSU Extension 4-H Science Technology Engineering and Math (STEM) Field Specialist, Christine Wood; Christine.Wood@sdstate.edu; 605-782-3290.

Information adapted from materials available at: <u>http://www.4-h.org/resource-library/curriculum/4-h-robotics/</u>

Appendix C – South Dakota 4-H Robotics Challenge

What?

The South Dakota 4-H Robotics Challenge is an opportunity for youth who have been learning about robotics to demonstrate their learning, celebrate their accomplishments, and interact with others who share an interest in robotics.

The South Dakota 4-H Robotics Challenge is divided into the following divisions:

Novice Division

This division is a non-competitive real time challenge for youth who are new to robotics. While it does require pre-registration it does NOT require any previous robotics experience. Teams will construct a robot. Using the instruction manual and software tutorials, they will program the robot to complete a short course released at the challenge. Throughout the process 4-H staff and volunteers are available to assist and coach.

Advanced Division (Autonomous)

This division is a non-competitive modified real time challenge for youth who have minimal experience with autonomous robot platforms (LEGO® MINDSTORMS®, TETRIX®, VEX, etc.). In this division, youth will design and build an autonomous robot that can accomplish a specific set of tasks.

Advanced Division (Junk Drawer)

This non-competitive challenge does not use a robotics platform, rather it requires youth to engineer a robot from a 'trunk of junk' in order to complete a given challenge.

Competitive Division

This division is a modified real time challenge for youth who have experience with autonomous robot platforms (LEGO® MINDSTORMS®, TETRIX®, VEX, etc.). The division is set up to allow teams to not only exhibit their skills, but also compete against other 4-H robotics teams.

The competitive division will be divided into two age groups: Junior (ages 8-13) and Senior (ages 14-18); and two parts:

Part 1: Autonomous robotics challenge requires the team to design and build a robot to complete the given task.

Part 2: Junk drawer robotics challenge requires youth to engineer a robot from a 'trunk of junk' in order to complete a given challenge.

Who?

South Dakota 4-H welcomes youth robotics teams (ages 8-18) to attend the State 4-H Robotics Challenge to exhibit their skills and meet other robotics teams from across the state. These teams can be *FIRST*[®], BEST, or VEX teams looking to practice their skills during their offseason.





To be eligible:

- Teams must register by the designated State Fair deadline
- Each team must contain one enrolled 4-H member
- All team members must be at least 8 years old by, but not have turned 19 prior to January 1
- Teams must have 3, but no more than 5 members

The Challenge is open to the public; spectators, parents, grandparents, friends, classmates, industry professionals, and educators.

When?

Feb/March: Challenge Release Aug: Registration Deadline Aug/Sept: Challenge: The State 4-H Robotics Challenge is held in Huron, SD during the State Fair.

Contact Information

Christine Wood – 4-H Robotics Committee Advisor, SDSU Extension 4-H Science Technology Engineering and Math (STEM) Field Specialist • Christine.Wood@sdstate.edu • 605-782-3290

4-Hers participate in the 4-H Robotics Challenge



4-Hers measure the success of their Junk Drawer Robo-Cup



4-Hers troubleshoot the program of their LEGO® MINDSTORMS® NXT Robot



4-Hers test their VEX Robot and program while other teams watch



A 4-Her in the Novice Division is mentored by a 4-H Youth Council member

Appendix D – Jackrabbit BEST Robotics

What?

BEST (Boosting Engineering, Science, and Technology) is a robotics program whose mission is to engage and excite students about engineering, science, and technology.

nd

BEST teams work to complete a challenge with miscellaneous hardware and a VEX robot platform. The program is free to teams. There is no registration

fee, and all materials are supplied by Jackrabbit BEST through sponsors. The only costs incurred are for travel, lodging, and meals.



Photo Courtesy of Jackrabbit BEST

BEST has two parallel competitions:

1. Robotics Game: Teams compete in a series of three-minute, round-robin matches.

2. BEST Competition: The BEST award is presented to the team that best embodies the concept of "Boosting Engineering, Science, and Technology." Elements include the Robotics Game, Project Engineering Notebook, Marketing Presentation, Exhibit & Interview, and Spirit & Sportsmanship.

Teams have six weeks to develop a presentation, design a website and video, as well as develop CAD designs of

their project. During this time, they will also design, build, and test their remote controlled robot which they will use to compete head to head against other robot teams. The game objectives and competition field change every year and are revealed to teams on Kick-Off Day. Each team is provided with identical kits of parts and software to take back to their school.

Who?

The BEST competition is for both middle and high school teams. Teams are required to have some school association and work with the guidance of educators and mentors. While there is no limit on the number of students on a team, there is only one team allowed per school. A school administrator must authorize team participation.

When?

Oct/Nov: Registration Opens:

Registration for the next season opens the day after Game-Day competition.



Photo Courtesy of Jackrabbit BEST

Space is limited. Teams are accepted on a first-come-first-served basis. If space fills, teams will be placed on a waitlist. If there is no room, waitlisted teams will be on the top of the list for the following year's season.

Sept: Kick-Off Day: The playing field and game are revealed for the first time. Teams learn the game objectives, receive the kits for their robot, and can attend training sessions.

Oct: Practice Day: This is an optional opportunity for teams to practice with their robot on the actual competition playing field, scope out the competition, and make robot changes.

Oct/Nov: Game Day: Teams are rewarded for six weeks of hard work with a fun day competing with their robot and are also judged on their Engineering Notebook, Exhibit & Interview, Marketing Presentation, and Spirit & Sportsmanship. Winners move on to Northern Plains Regional in Fargo, ND.

The game theme changes yearly and game details remain top secret until Kick-Off, but teams can view "teaser" videos at <u>www.bestinc.org</u>.





Photo Courtesy of Jackrabbit BEST

Photo Courtesy of Jackrabbit BEST

Contact Information

Becky Pistulka – Jackrabbit BEST Robotics Hub Director becky.pistulka@sdstate.edu • 605-688-6792

Find out more at Jackrabbit BEST: <u>https://www.sdstate.edu/jerome-j-lohr-engineering/jackrabbit-best-robotics</u>

Information is adapted from and more material is available on the national BEST site: <u>http://www.</u> <u>bestinc.org/</u>

Appendix E – FIRST®

What? & Who?

FIRST® (For Inspiration and Recognition of Science and Technology) is a not-for-profit organization that seeks to inspire and to encourage young people's exploration in science, technology, and mathematics through robotics. To do this, FIRST® offers youth opportunities to compete in annual robotics challenges. Unlike 4-H programing, which is year-round, *FIRST*® programs occur during a season like sporting events.

Many of the organization's core values, such as promoting teamwork, engaging in experiential learning, sharing with others, good sportsmanship, and empowering youth, fall in line with the



Photo Courtesy of South Dakota Robotics Association (SDRA)

goals of 4-H. For this reason many 4-H Robotics clubs choose to participate in *FIRST*[®] events. Youth can participate in increasingly difficult competitive events through *FIRST*[®]:

Jr. FIRST® LEGO® League (Jr.FLL®)

Jr.FLL® provides youth ages 6 to 9 with a hands-on program that features a real-world challenge. To complete the challenge youth are required to explore scientific concepts while working as a team to design and build a challenge related model. The challenge is made up of two parts: a model comprised of simple machines and motorized parts, and a poster.



Photo Courtesy of South Dakota Robotics Association (SDRA)

FIRST® Tech Challenge (FTC®)

FIRST[®] LEGO[®] League (FLL[®])

FLL® is open to youth ages 9 to 14 and is comprised of three major elements: the Robot Game, the Project, and Core Values. During the Robot Game, youth program and autonomous robot to complete a mission. The Project portion of the competition requires the team to research a real world problem and design and develop an innovative solution. The Core Values portion is all about how the team completes their work and interacts with others.

FTC[®] is a high school competition requiring students to design, build, and program their robots to compete. FTC[®] utilizes the TETRIX[®] platform that can be programmed in a variety of ways including C languages. Unlike FLL[®], FTC[®] is focused more on the robot game, and there is no research project.

FIRST[®] Robotics Challenge (FRC[®])

FRC[®] is a competition for youth ages 14-18 that requires teams to complete a series of tasks with limited resources and time. Youth get to work alongside real world professionals and gain multiple professional skills. Teams fabricate their own robots from an FRC[®] kit, but can also fabricate their own parts.

When?

Aug: Challenge Release: The playing field and game are revealed for the first time. Nov - Dec: Regional Qualifiers: Qualifying events are held throughout the state. Jan/Feb: State Championship: Teams that qualify compete in the State Championship. April/May: National/International Competitions



Photo Courtesy of South Dakota Robotics Association (SDRA)



Photo Courtesy of South Dakota Robotics Association (SDRA)

Contact Information

FIRST[®]LEGO[®] League (FLL[®]) Jeremy Haugen – EmBe *FIRST*[®] LEGO[®] League Coordinator/FLL[®] Operational Partner jhaugen@embe.org • 605-336-3662

Find out more about FLL[®] in South Dakota please visit www.embe.org and look under youth programs: <u>http://www.embe.org/Secondary_Navigation/Youth_at_EmBe/FIRST_LEGO_League_administered_by_EmBe.htm</u>

Information is adapted from and more material is available at the national FIRST[®] site: <u>www.usfirst.org</u>

Appendix F – VEX and VEX IQ Challenges

What? & Who?

The Robotics Education & Competition (REC) Foundation's mission is to increase student interest and involvement in science, technology, engineering, and mathematics (STEM) by engaging students in handson, affordable and sustainable robotics engineering programs.

The REC Foundation serves over 20,000 student-led teams from elementary school through college to engage them in educational robotics opportunities throughout the U.S. and across 50 countries. The REC Foundation works in close partnership with VEX Robotics, Inc., creator of the robotics kits and educational tools used by students, educators and mentors. Each year, the two organizations unveil new engineering game challenges for the VEX IQ Challenge and the VEX Robotics Competition. Students, led by their teachers and mentors, form teams and design, build, and program a robot for competition. The REC Foundation supports the success of students and their teams



Photo Courtesy of REC Foundation

with a vibrant competition experience that challenges their creativity, encourages teamwork and communication, and values hands-on engineering and programming experience. Creating a workforce prepared to solve our future problems depends on our ability to harness students' natural curiosity, engage them in meaningful learning opportunities to incite passion and expand their interest in a variety of subjects. The VEX Competition experience provides just that type of environment, ensuring we have lifelong learners, excited to contribute to their future and ours.

The REC Foundation presents challenges that task youth with designing, building, and programming a robot to play against other teams from around the country and the world in game-based engineering challenges at local, regional, national, and world levels:

VEX IQ Challenge – The VEX IQ Challenge is offered to students in elementary and middle school to design, build, and program a robot to solve an engineering challenge with guidance from their teachers and mentors. Teams compete at local, state, and regional events with robots they built as they seek to qualify for the VEX Robotics World Championship, the culminating event of the season that draws hundreds of the best teams from around the globe to crown World Champions. Students build robots using VEX IQ, a robotics platform offered by VEX Robotics, which provides free curriculum mapped to national education standards. This challenge is broken down into:



Photo Courtesy of REC Foundation

- Teamwork Challenge: Two teams work together to maximize their scores
- Robot Skills Challenge: One robot & driver compete against the clock
- Programing Skills Challenge: One robot uses sensors to run autonomously
- STEM Research Project: Research and present on a STEM theme

VEX Robotics Competition – The VEX Robotics Competition is offered to students in middle school and high school and it has quickly become one of the largest and fastest growing robotics engineering programs in the world. Each year, student design, build, and program a robot to address a new engineering challenge that is presented in the form of a game. Teams compete throughout the year at a series of local, state, and regional events, seeking to qualify for the VEX Robotics World Championship. Students gain valuable life skills in addition to learning engineering and design principles related to STEM. Students build robots using VEX EDR,



Photo Courtesy of REC Foundation

a robotics platform offered by VEX Robotics which also provides a number of curriculum resources to integrate the program into the school day. The components that make up the competition are:

- Standard Matches: Two alliances of two teams playing against each other
- Robot Skills Challenge: One robot & driver compete against the clock
- Programing Skills Challenge: One robot uses sensors to run autonomously
- Online Challenges: Unique contests using CAD, animation, essays, and more
- STEM Research Project: Research and present on a STEM theme

The VEX Robotics Competition is both autonomous and driver-controlled. Teams must program their robots to obtain the most points possible in fifteen seconds. Once an autonomous winner is announced, teams proceed with an additional one minute forty-five second driver controlled period.

When?

April: Game Rules Released
Sept: Online Challenges Open
Nov-March: Various Qualifiers
Jan: Online Challenge Submissions Due
March: South Dakota State VEX Robotics Tournament
April: VEX Robotics World Championship

Contact Information

Bill Ryno • bill_ryno@roboticseducation.org • 920-915-2763

Information is adapted from and more material is available at <u>www.vexrobotics.com</u>



Photo Courtesy of REC Foundation

SDSU Extension is an equal opportunity provider and employer in accordance with the nondiscrimination policies of South Dakota State University, the South Dakota Board of Regents and the United States Department of Agriculture.

Learn more at iGrow.org.