======== SPIRIT Teachers Registered for the Showcase ========

Dear SPIRIT Teachers Attending the Showcase,

We are VERY excited that you will be participating with a team of students in the SPIRIT Showcase as part of the Nebraska Robotics Expo on January 30th at the Strategic Air and Space Museum in Ashland. As part of that event, and as discussed earlier, we are asking that you have your team take three short assessments before the Showcase, and to bring them with you to the event. The three assessments include an attitude assessment, a career interest questionnaire, and a short content test. These short assessments should be given as soon as possible, since they represent a kind of "pretest" on aspects of how this event (and future events) might potentially help students to be engaged in STEM learning. Together, the assessments should take a total of about 40 minutes of student time. You will note that there are some questions on the assessments that the students may not yet relate to directly, such as programming, but that is perfectly fine, since we are doing a long range assessment effort in the SPIRIT project, and such content may well be covered in a variety of future events, lessons and activities. This is a baseline assessment endeavor.

Thank-you for having the students do the three assessments as soon as possible, and to bring them with you to the Showcase.

We really appreciate it!
Neal

P.S. These assessments relate to IRB approvals of 519-09-EX and 443-09-EX (UNO) and 2005-05-341 EX (UNL)

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UNIVERSITY OF Nebraska Omaha

Parental Consent Form

IRB #443-09-EX

Title: Evaluating the Silicon Prairie Initiative for Robotics in Information Technology (SPIRIT 2.0)

Dear parent,

We are inviting your child to participate in a showcase of robotics activities to be undertaken at the Strategic Air and Space Museum on January 30th, facilitated by their teacher. This event should help students to learn specific concepts in mathematics and science, and to build their interest in these important disciplines. The showcase robotics activities are being undertaken by a group of master teachers. Your child's teacher is a member of this select group of teachers and has volunteered to participate at the January 30th event with your child. We are interested in seeing how this event will help students to learn concepts in mathematics and science, as well as to increase their interests in science, technology, engineering, and mathematics.

This educational robotics study will involve several hours of your student's time. About 30 minutes or so will be spent in taking several short pretests and posttests. For these short tests, your student will be asked to complete multiple-choice questions related to mathematics and science concepts, as well as to answer questions on their academic interests and attitudes. These questions have been developed jointly by the University of Nebraska at Lincoln and the University of Nebraska at Omaha. Your child's responses to these questions will be completely confidential; and their answers will not be shared. We will publish a summary of all the student's responses, but their identity and individual responses will be totally confidential.

Being in the study, and participating in the educational robotics showcase on January 30th may help your child to learn about educational robotics, as well as important concepts in science and mathematics. It may also help their interests in

Parent's Initials: _____

these important disciplines. We are asking parents for their permission to allow us to collect data in this lesson evaluation study related to student conceptual understanding and interests. Participation in the study is completely optional, and you can decide to remove your child or your child's data at any time.

If you have any questions at any time, please ask the researcher below. You will be given a copy of this form.
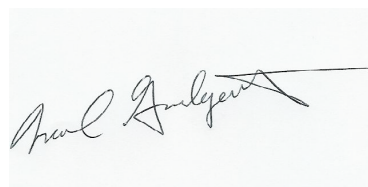

_____   _____
Signature of Child   Date

_____   _____
Signature of Parent   Date

Signature of Investigator: <u>December 15, 2009</u>

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If you have any questions or concerns about this study, please contact Dr. Neal Grandgenett (ngrandgenett@unomaha.edu) at the University of Nebraska at Omaha College of Education (Phone: 402-554-2690). If you have additional questions or concerns regarding your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact, anonymously if you wish, the Institutional Review Board at the University of Nebraska at Omaha by phone at 402-559-6463 or by e-mail to irbora@unmc.edu.

Parent's Initials: _____

Robotics Workplace Skills Youth Questionnaire (Pre)

Name: _____ Date: _____

Club or School:_____ Gender (circle one)   Male   Female

We want to know how well the robotics activities help you to develop certain skills. **Please respond to the items below in terms of how you can contribute to your team in undertaking the robotics activities or in preparing the team project and documentation for the Robotics Showcase.** It should take you about 5 to 10 minutes to fill out this survey. The results will help us to learn how you are benefiting from this educational program and if we need to make any changes.

Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. I am able to brainstorm (come up with) a number of possible strategies to accomplish the robotics challenge.	5	4	3	2	1
2. I am able to determine how mistakes in programming the robot can lead to a problem with other parts of the design and build process.	5	4	3	2	1
3. I am able to evaluate solutions suggested by my teammates and predict which of them might work.	5	4	3	2	1
4. I am able to identify and ask questions that will lead to a better team solution.	5	4	3	2	1
5. I am able to explain my ideas and findings to my team.	5	4	3	2	1
6. I am comfortable presenting results produced by my team to the judges.	5	4	3	2	1
7. I am able to interact professionally with the contest officials.	5	4	3	2	1
8. I am able to come up with creative ideas to help solve problems.	5	4	3	2	1
9. I am able to evaluate alternative ideas and solutions in order to improve the robot's computer program.	5	4	3	2	1
10. I am patient with my teammates.	5	4	3	2	1
11. In the competition I realize that it is often necessary to work with different people.	5	4	3	2	1
12. I am open to ideas from other team members.	5	4	3	2	1
13. I am able to help my team to accomplish the task within the allocated time frame.	5	4	3	2	1
14. Compromising with other team members is sometimes necessary to accomplish our goals.	5	4	3	2	1
15. I am able to share responsibility with my teammates.	5	4	3	2	1

16. Whatever my role in the competition I am able to follow through on the tasks needed to help to complete our team activity.	5	4	3	2	1
17. I am able to work with the team to help to prioritize, plan and manage the work to achieve the desired results.	5	4	3	2	1
18. I am an active participant in our team.	5	4	3	2	1
19. I am able to evaluate alternative ideas and solutions in order to improve the team project.	5	4	3	2	1
20. I am able to demonstrate leadership on selected tasks to help support my team.	5	4	3	2	1
21. Other team members are able to count on me to get something done.	5	4	3	2	1

Nebraska 4-H Robotics and GPS/GIS and SPIRIT Project

4-H Robotics and GPS/GIS and SPIRIT Interest Questionnaire - Pre

Name: _____ State _____

Leader Name: _____

Age: _____   Gender (circle one): Male   Female

Ethnicity (circle one):

| African American | American Indian | Asian or Pacific Islander | Hispanic | White (non Hispanic) | Other_____ |

We are interested in learning about your attitudes towards science, technology, engineering, and mathematics. We particularly want to get your reaction to learning about robotics, which involves the building and programming of small robots. We also are interested in your attitudes about GPS (Global Positioning Systems) and GIS (Geographical Imaging Systems). GPS helps us record and use satellite data to understand geographical location and mapping concepts. GIS is a computer tool you can use to develop, analyze, and display geographic maps.

Read the statements below and circle your opinion.

Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. It is important for me to learn how to conduct a scientific investigation.	5	4	3	2	1
2. It is important for me to learn about robotics.	5	4	3	2	1
3. It is important for me to learn how to use appropriate tools and techniques to gather, analyze and interpret data.	5	4	3	2	1
4. It is important for me to learn about GIS.	5	4	3	2	1
5. It is important for me to learn how to use mathematical formulas to help solve practical problems.	5	4	3	2	1
6. It is important for me to learn how to make accurate measurements to help solve mathematical problems.	5	4	3	2	1
7. It is important for me to be able to record measurements and calculations into tables and charts.	5	4	3	2	1
8. It is important for me to learn how to collect and interpret data to verify a prediction or hypothesis.	5	4	3	2	1
9. It is important for me to understand basic engineering concepts (e.g. design tradeoffs, speed, torque) related to building and moving a robot.	5	4	3	2	1
10. It is important for me to learn how to program a robot to carry out commands.	5	4	3	2	1
11. It is important for me to learn about GPS.	5	4	3	2	1
12. I like learning new technologies such as robotics.	5	4	3	2	1

Nebraska 4-H Robotics and GPS/GIS and SPIRIT Project

Statement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
13. I like using the scientific method to solve problems.	5	4	3	2	1
14. I like using mathematical formulas and calculations to solve problems.	5	4	3	2	1
15. I like learning new technologies like GPS.	5	4	3	2	1
16. I use a step by step process to solve problems.	5	4	3	2	1
17. I make a plan before I start to solve a problem.	5	4	3	2	1
18. I am confident that I can program a robot to move forward two wheel rotations (i.e. 720 degrees) and then stop.	5	4	3	2	1
19. I try new methods to solve a problem when one does not work.	5	4	3	2	1
20. I carefully analyze a problem before I begin to develop a solution.	5	4	3	2	1
21. In order to solve a complex problem, I break it down into smaller steps.	5	4	3	2	1
22. I am certain that I can build a robot by following design instructions.	5	4	3	2	1
23. I am certain that I can fix the software program for a robot that does not behave as expected.	5	4	3	2	1
24. I am certain that I can log locations of a series of waypoints within a GPS unit.	5	4	3	2	1
25. I am confident that I can program a robot to follow a black line using a light sensor.	5	4	3	2	1
26. I am confident that I can read and understand maps.	5	4	3	2	1
27. I am confident that I can make a digital map.	5	4	3	2	1
28. I am confident that I can use GPS technologies to get to places that I have never been before.	5	4	3	2	1
29. I like listening to others when trying to decide how to approach a task or problem.	5	4	3	2	1
30. I like being part of a team that is trying to solve a problem.	5	4	3	2	1
31. When working in teams, I ask my teammates for help when I run into a problem or don't understand something.	5	4	3	2	1
32. I like to work with others to complete projects.	5	4	3	2	1
33. I like learning new technologies such as GIS.	5	4	3	2	1

Nebraska 4-H Robotics and GPS/GIS and SPIRIT Project

How interested are you in each of the jobs below for possible future careers?

Job	Very Interested	Somewhat Interested	Neither Interested nor Uninterested	Somewhat Uninterested	Very Uninterested
1. Scientist	5	4	3	2	1
2. Engineer	5	4	3	2	1
3. Mathematician	5	4	3	2	1
4. Computer or Technology Specialist	5	4	3	2	1
5. Job involving GPS/GIS	5	4	3	2	1

Pretest Questions - 4-H Robotics and GPS/GIS and SPIRIT Content Quiz - Pre

Name: _____ State _____

Leader Name: _____

Age: _____ Gender (circle one): Male Female

Multiple Choice: For each of the following questions, circle the letter of the answer that best answers the question.

1. In order to follow a delayed sequence of set movements, without direct user control, a robot must be _____
   A. controlled by a remote.
   B. computerized.
   C. programmed.
   D. trained.

2. A programming "loop" does which of the following?
   A. Starts the program code
   B. Stops the program code
   C. Performs multiple functions
   D. Repeats a section of program code

3. A computer program consists of _____ that tells the computer to do something.
   A. sensors
   B. code
   C. lights
   D. robots

4. Which of the following enables a robot to investigate and react to its environment?
   A. Tires
   B. Sensors
   C. LCD panels
   D. Mechanical arms

5. What is a computer program?
   A. Computer generated text
   B. The hardware that controls a computer
   C. Instructions written in a language a computer understands
   D. Language that is built into a robot

6. Which of the following is a wireless connection?
   A. Bluetooth
   B. RCX
   C. USB
   D. Serial port

7. When programming your robot, a switch block or if/else/then statement is used to _____
   A. ask a question.
   B. stop the program.
   C. speed up the program.
   D. repeat the code.

8. Which of the following is an example of multi-tasking?
    A. Having your robot move forward on a table
    B. Having your robot turn to the left for 2 seconds
    C. Having your robot measure a distance as it identifies an object to lift
    D. Having your robot use its light sensor

9. The process of refining an instrument, like your robot, so that it is as accurate as possible by collecting information about how far your robot will travel in a given amount of time and using the information to estimate how long it will take the robot to go a given distance is called _____
    A. a ratio.
    B. the Pythagorean Theorem.
    C. a threshold value.
    D. calibration.

Amie and Cody are engineers working to design a robot that will be able to plant trees in a fruit production orchard with apples, apricots, oranges and/or peaches. They need your help to apply the steps of the Engineering Design Process. Answer the questions below to provide your assistance.

Image of an apple orchard from Kelowna Land and Orchard Company Ltd. (KLO) in British Columbia, Canada. Image from http://media-cdn.tripadvisor.com/media/photos/00/11/f9/0a/orchard-at-kelowna-land.jpg used without permission.

10. Which of the following would not be part of the problem that Amie and Cody need to solve in order to begin designing their robot?
    A. The robot must be able to travel in standing water.
    B. The robot must be able to avoid obstacles such as large rocks and existing trees.
    C. The robot must be able to go to a specific location, using GPS.
   D. The robot must be able to dig a hole.

11. As a part of the design process, Amie and Cody visit an engineering library to look at existing patents. Which step in the Engineering Design Process are they doing?
   A. Identify the problem
   B. Research the problem
   C. Select a solution
   D. Construct a prototype

12. Amie and Cody are reviewing the possible solutions to select one to test by building a prototype. Which of the solutions below do you think is **most** important to the project?
   A. The robot should operate quietly to lessen the disturbance to wildlife in the area.
   B. The robot should be on tracks to cover diverse terrains.
   C. The robot should have a camera so the operators can see what it is doing from anywhere with an Internet connection.
   D. The robot should have a robotic arm that can do tasks such as dig the hole, place the tree and replace the soil.

13. Which of the following strategies would be important to evaluating Amie and Cody's solution?
   A. Testing the prototype by planting trees in different orchard settings or environments
   B. Asking other engineers on your team to review their design and prototype
   C. Check the design with specialized computer software to find potential flaws
   D. All of the above

Technology – Robotic Programming

Use the obstacle course shown to answer the robot programming questions below. The dashed line(s) shows the path of the robot. The solid line is a black electrical tape one inch wide
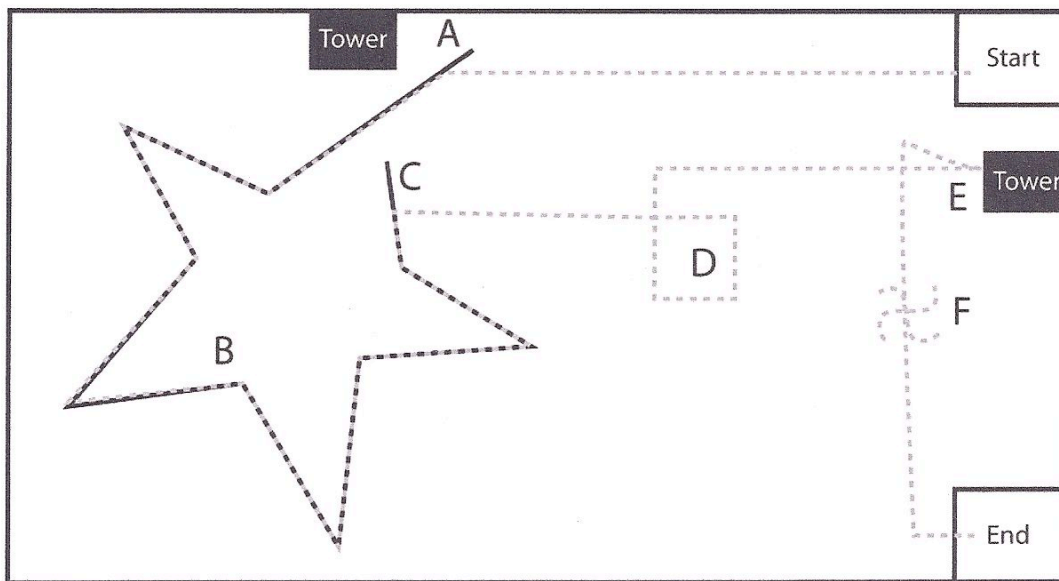
14. Which sensor is most likely used to navigate the robot between points A and C?
   A. Light
   B. Sound
   C. Touch
   D. Ultrasonic

15. Which of the marked points on the image above corresponds to the pseudocode shown here:

    Loop 4 times – Forward one tire rotation, Turn ninety degrees right
    A. Point B
    B. Point D
    C. Point E
    D. Point F

16. At point F, the robot spins counterclockwise for at least 1080 degrees. Which pseudocode line would cause the robot to turn 1080 degree?
    A. Forward, left motor 10 rotations
    B. Forward, right motor 10 rotations
    C. Forward turning to the left, left and right motors 10 rotations
    D. Forward turning to the right, left and right motors 10 rotations

17. Which of the marked points in the image above corresponds to the pseudocode shown here:

    Wait until touch, reverse two wheel (720 degrees) rotations
    A. B
    B. D
    C. E
    D. F

18. Which of the sensors listed would most likely not be used to complete this challenge?
    A. Light
    B. Sound
    C. Touch
    D. Rotation

19. Which pseudocode is the most reliable way to program the robot at point C (find the tower and then turn, using an ultrasonic sensor) in the image above?
    A. Forward 2.3 wheel rotations to the tower
    B. Forward 828 degrees to the tower
    C. Forward 1.6 seconds to the tower
    D. Forward until 15 inches from the tower