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# AN INTRODUCTION TO ROBOTICS WITH NAO

A STEM INTEGRATED,  
PROJECT BASED APPROACH  
TO LEARNING ROBOTICS AND  
COMPUTER SCIENCE

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Aligned to the Common Core  
State Standards Initiative





Welcome to NAO.

I hope that you will find working with the NAO robot platform as interesting as my students have. Many of you may have worked with robots in the past, Robots such as Lego Mindstorms™ or FIRST™ Robotics. I think you will find this a completely different experience.

NAO is humanoid, two arms, two legs, eyes, ears, he can walk and talk. Notice how I said “He”, if you are like my students you will find yourself personifying your NAO immediately. We named ours “Pablito”, and for us as we created the artificial intelligence, and developed behaviors for our robot he took on the personality of his programmers. I believe it is this “humanness” that makes working with NAO so fascinating, because it can do so much that you can do, the possibilities of what you can do with the robot are limitless.

After only a few short weeks of working with this curriculum you will have your robot, walking, talking, listening, and interacting with the environment around it. Once you do that I am sure that you will come up with hundreds of uses that we could never have dreamed. Your creativity and imagination are the only things that limit what you can do with NAO, from a service robot to help children, or the elderly, the police, or fireman, to an entertainer dancing, singing and chatting with its audience.

Post your videos on YouTube® so you can share your experiences with the NAO community. We would love to see your videos!

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# INTRODUCTION

# FOR TEACHERS

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Welcome to NAO.

This curriculum has been designed to allow you to develop interesting, challenging and fun projects with your robot. I have been teaching computer science for the last 20 years. I began in the days of the first PCs and I currently teach computer science to Grades 9 and 11 at a Comprehensive Career and Technical School, and as an adjunct professor of Computer Science at two Universities. Over the years I have taught with many types of technologies: Robotic arms, Lego Mindstorms, PLC's and all different types of computers. I believe this is the most exciting curriculum I have ever been involved with.

When our school district first purchased the NAO robots I was unsure about the cost versus benefit of these platforms. What I have found is that the humanoid robot generates and unparalleled interest from students. My traditional computer science students are driven to program the robot to do everything from dance to fold laundry. But it is not the traditional students that really surprised me so much as the overwhelming response to the robot from non-traditional students: I had students from our nursing and carpentry programs beating down my door for an opportunity to work with the NAO. These students were captivated by the humanoid robot in a way that traditional robotics platforms and computer software simply could not duplicate.

This curriculum has been developed with a number of goals. First and foremost it is engaging for the students. As you look at the modules I do not believe you will find a single thing that will cause students to roll their eyes and say "Do we have to do that?". Second, and just as important, is that it is project-based and aligned to the Core STEM standards as laid out in the Common Core Standards. Each module covers a set of objectives specific to learning robotics, but also includes objectives, standards, and lesson plans that cover a wide variety of academic core standards in Math and English. As a general rule you should start with Module 1 and work foreword, but other than the first module you could really pick and choose modules to fit your needs.

I hope that you will find this curriculum to be an exciting and useful addition to your Computer science or robotics classroom. I am confident that your students will find that this is one of the most enjoyable and interesting ways they have ever learned.

# HOW TO USE THIS CURRICULUM

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As a general rule each module is independent. In each module you will find a set of robotics/computer science objectives, as well as related academic STEM objectives.

Both sets of objectives will identify the common core standards addressed in that module.

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This curriculum has been done with the 1.12.0 version of Choregraphe, our programming software. The screenshot of the software included in this curriculum may be different depending the version of Choregraphe you have.

# SUGGESTED TEACHING PRACTICES

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## 1/ HAVE STUDENTS PRE-READ THE MODULE. YOU MAY WANT TO USE THE KWL READING STRATEGY\*

→ Prior to reading

- \* have students prepare a list of what they already Know about the subject
- \* Then create a series (1-3) questions of what they want to know.

→ After reading

- \* Have student list what they Learned from the reading

## 2/ PLAN PLAN PLAN

→ have students present a short algorithm or step by step instruction set for each module

→ ask them to include safety and best practices for keeping the NAO safe

## 3/ COMPLETE THE MODULE QUESTIONS AT THE END OF EACH MODULE

## 4/ COMPLETE THE MODULE

→ Have students complete the module with the NAO and demonstrate the completed behaviors

→ You may consider having students do a Lab Report of the module

A. Title

*The title states what the module covered*

B. Introduction / Purpose

*A paragraph that explains the objectives and purpose of the module*

C. Materials

*List everything needed to complete the module*

D. Methods

*Very similar to your prior algorithm a list of steps required in order to complete the module.*

E. Data / Observations

*What actually happened while you complete module. (record both expected and unexpected results)*

F. Results

*A conclusion paragraph that states what you learned from the module*

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\* Valmont, W | 2003 | *Technology for literacy teaching and learning* | New York: Houghton Mifflin Company.  
Allington, R. and Cunningham, P | 2003 | *Classrooms that work* | Boston: Allyn and Bacon.  
Padak, N. and Rasinski, T | 2004 | *Effective reading strategies: teaching children who find reading difficult* | New Jersey: Pearson Education, Inc.  
Buehl, D | 2006 | *Classroom strategies for interactive learning* | Delaware: International Reading Association.