

Nori LA

CURRICULUM

SMARTRAMPS



Grades: Primary (K-5)

Strand: STEAM (Science, Technology, Engineering, Art, Math)

Module Title: NoRILLA (Novel Research-based Intelligent Lifelong Learning Apparatus)

Lessons/Instructional Days: XX lessons

Overarching Module Questions:

How can we design a car that will go faster on a ramp?

What kind of features are important for an object to roll faster on a ramp?

How can we use the design process to build cars that can go fast on a ramp?

How can we use the scientific method by helping students predict, observe, and explain the results?

How will students persevere while completing activities?

How will students think flexibly while completing activities?

How will students manage their impulsivity while completing activities?

How will students use precise and clear communication while completing activities?

How to use NoRILLA

NoRILLA is designed to be very easy to set up and use.

To turn on the program, open the door under the table. There is a computer located under the table. Press the POWER button to turn on the computer. After the computer boots up, if you wait 3-4 minutes, the program should automatically start on its own. Turn on the TV/projector connected to the NoRILLA system. When the program starts booting up, you will see a Loading screen on the TV. If you wait for a few minutes, the program will start on the tablet in front of the machine and the TV.

When the program starts automatically, you'll see the EarthShake game run the tablet/screen. In order to switch to the ramps game, you need to press the X button on the upper left corner which will take you to the desktop. Then you can press the SmartRamps icon on the screen to start the ramps game.

You can leave the program running when you leave the class. You can turn off the TV from the remote control. Next time you come in you can start by turning on the projector.

At any time, when you come to the machine, tap on the tablet to see if it's running. If it's not turned on, you can turn on by pressing the POWER button and turning on the TV with the remote control (or using the on/off button on the TV) and repeat the same procedure above.

If there are any problems while the program is running:

- 1) First try clicking ESCAPE button (ESC) on the laptop under the table. After you click ESCAPE and close the program, you will see a **SmartRamps** icon on the tablet. You can start the program again by clicking on that icon.
- 2) If this doesn't work, you can restart the computer under the table. When the computer starts again, if you wait for 3-4 minutes the loading screen should appear on the TV and then the EarthShake game should automatically load both on the TV and the tablet in front of the station. If you want to switch to the SmartRamps game, you can follow the procedure above (press X button and then click the SmartRamps icon on the desktop).

If you have any issues, please contact us.

INTRODUCTION

Lesson plans have been designed for ease of use in primary grades. Below you can find a list of the lessons with corresponding grade levels. These grade levels are just recommendations and you can adapt these lessons to meet the needs of your class. Please use your professional experience and judgement to decide which lessons fit your class best and adapt them to your needs.

Lesson 1: Pre-Assessment (Grades K-5)	5
Lesson 2: Guided Discovery Play Mode (Grades K-3)	6
Lesson 3 and 4: Student Centered Play Mode (Grades K-3)	10
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The worksheets are placed after each lesson.

The pre and post assessments are at the end of the book in the appendix section.

Lesson 1

Lesson 1: Pre-Assessment (Optional) (30 minutes)

Lesson Objectives: 1. Students will complete a pre-assessment.

Materials Needed: Pre-assessment (Worksheet – Test)

Introduction: Let students know that they will begin their lessons using the NoRILLA machine. Today they will complete their pre-assessment to show prior knowledge. (you can find the pre/post assessments in the Appendix section at the end of the book).

- Students complete their pre-assessment.

Closure: Check and discuss the pre-assessment as a whole group, or small groups based off of assessments.

Lesson 2

Lesson 2: Guided Discovery Play Mode (~30-45 minutes: Introduce and Build Vocabulary, Guided Investigation, Share, Closure and Assessment)

- Lesson Objectives:**
1. Students will observe the procedures of NoRILLA.
 2. Students will complete the play mode.
 3. Students will think interdependently (flexible) by working together to complete a task.
 4. Students will manage their impulsivity.
 5. Students will use precise and clear communication skills.

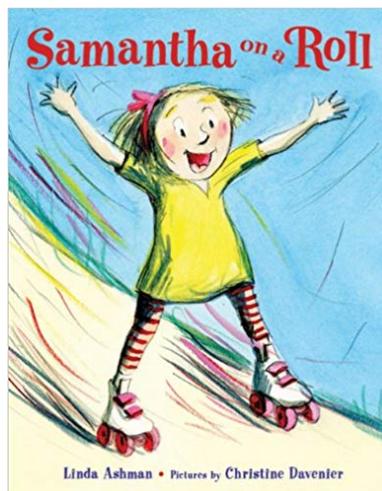
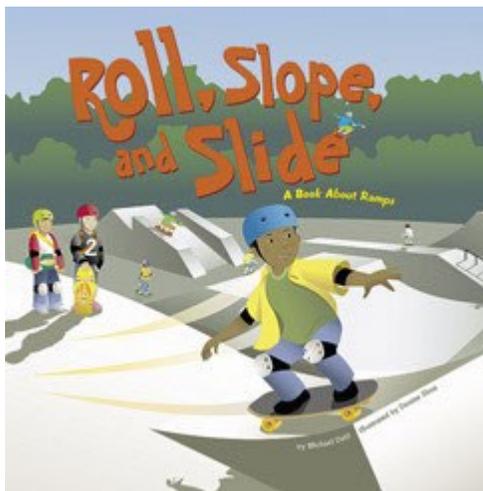
*** Briefly introduce and discuss these objectives setting purpose for the lesson. Students will be expected to implement these objectives during the lesson.

Materials Needed: NoRILLA, SmartRamps and the pre-built cars and objects

Optional Literature:

[Roll, Slope, and Slide: A Book About Ramps](#) (Amazing Science: Simple Machines) by Michael Dahl

[Samantha on a Roll](#) by Linda Ashman



Optional Videos: Ramps videos

Ramps: A Super, Simple Machine!

<https://www.youtube.com/watch?v=3COvm0TtxWg>

Force and Motion for Kids | Ramps | Kids Academy

https://www.youtube.com/watch?v=y6VjHcOX8_o

- **Introduce:**

(Steps 1 through 3 can be completed in the classroom.)

1. Let students know that they will test cars and objects on SmartRamps using NoRILLA and pre-built cars/objects.
2. Start by activating prior knowledge through whole group discussion by asking questions such as:
 - Have you ever been on a ramp/slide or a roller coaster?
 - What happens if you place an object on a ramp/slide and let go?
 - What makes a car/object go faster on a ramp?
3. Choose and show a video listed above.

- **Build Vocabulary: (Achieved through discussion)**

Scientist: A person who designs experiments, makes discoveries and communicates their findings.

Ramp: A ramp is a surface with one end higher than the other.

Friction: the resistance that one surface or object encounters when moving over another.

Mass: A measure of how much matter is in an object or how much an object weighs.

Gravity: the force that attracts a body toward the center of the earth, or toward any other physical body having mass.

Potential Energy: Potential energy is a type of energy an object has because of its position.

Acceleration: increase in the rate or speed of something.

Scientific Method: **Predict:** Make an educated guess.

Observe: Use our senses to carefully watch how something is done.

Explain: use our scientific terms to discuss what we have Observed.

- **Guide Investigation:**

1. Ask students to close their eyes and visualize becoming a scientist.
Let students know that when they open their eyes they will need to think like and be a scientist. Scientists design experiments, make discoveries and communicate their findings.
2. Remind students that all great scientists use their science vocabulary.
You will be listening for this.
3. Pose the question to your scientists “How do you think you can design a car that will go faster?”
4. Teacher demonstrates the process of using the SmartRamps **play mode** (click PLAY on the screen to start the Play Mode. Follow the instructions on the screen to place the matching objects/cars and then make a prediction about which object/car will go faster when the gate is released. Remind the students to explain their predictions before they press the lever to observe the results. Then they will receive feedback from the game if their prediction was correct or not and will be asked to explain the results.



5. Call 2 students to complete 1 round of play mode. (One cycle of predict-observe-explain)
- Find and place objects/cars on the NoRILLA machine.
 - Make their predictions first and then ask the whole class what they predict.
 - Press the lever and observe.
 - Discuss and explain results whole group based on the menu on the screen. Repeat this process until all students have had a turn.
- **Share Results:** 1. Repeat the above question. Have students share their ideas with a partner. Discuss what they have learned as a whole group.

- **Closure:**

1. Share what students found to be interesting, intriguing, even challenging about this lesson. Recap/discuss today's lesson. Let your scientists know that next time they will begin brainstorming and designing their own ramps.

2. Thumbs up/down: Gather students whole group, ask the questions below, have students show a thumbs up if they feel they met that standard today, thumbs down if they did not. Note those that give you thumbs down and have a brief discussion on that standard/question.

OR

Smile/frown face: Draw a smile and a frown on the whiteboard, students point to either one as you ask the questions below.

Showed perseverance today

Worked well with others

Managed impulsivity

Spoke clearly and precise like a civil engineer

- **Assessments:** Observation/Discussion

Lessons 3 and 4

Lesson 3: Student Centered Play Mode (~ Divided into 2 lessons: Introduce and Review Vocabulary, Guided Investigation, Share, Closure and Assessment)

Lesson Objectives:

1. Students will interact with play mode.
2. Students will think interdependently (flexible) by working
3. Students will manage their impulsivity.
4. Students will use precise and clear communication skills.

*** Briefly introduce and discuss these objectives setting purpose for the lesson. Students will be expected to implement these objectives during the lesson.

Materials Needed: NoRILLA/Smart Ramps and the pre built objects/cars, drawing paper, crayons, markers, etc, Building materials such as Legos, paper plates, cardboard, cereal boxes, origami paper, toilet paper rolls, tape etc. Rulers or snap cubes for measurement.

* **Teacher will need to place 1 or more different building materials on each half of the classroom for students.**

- **Introduce:**

1. Whole group read [Roll, Slope and Slide](#) by Michael Dahl

2. Discuss what an engineer does and let students know that they will become engineers today while interacting with the NoRILLA system and designing their own ramps/slides using the design process. Project the Engineering By Design Process document on the board and discuss with students beforehand.



- **Review Vocabulary: (Achieved through discussion)**

Engineer: a person who designs, builds, or maintains engines, machines, or public works.

Design: When you create something on your own.

Speed: How fast an object goes.

Weight: How heavy something is.

Iterate: To make changes to something that was created.

Ramp: A ramp is a surface with one end higher than the other.

Friction: the resistance that one surface or object encounters when moving over another.

Mass: A measure of how much matter is in an object or how much an object weighs.

Potential Energy: Potential energy is a type of energy an object has because of its position.

- **Guide Investigation:**

1. Ask students to close their eyes and visualize becoming an engineer.

Let students know that when they open their eyes they will need to think like and be an engineer.

2. Remind students that all great engineers use their science vocabulary, such as friction, potential energy, mass and weight in back.

You will be listening for this.

3. Pose the question to your engineers “do you think you can design a ramp or slide?”

4. Divide class into 2 groups, 1 group for each building material choice (for example one group works with lego blocks & cereal boxes, the other group works with toilet paper rolls and paper plates). Use teacher discretion when dividing your students into groups. If you prefer, 2 groups may use the same materials. Working with a partner (or partners), the students will design and build a ramp/slide using materials the teacher has available and complete the **Design, Build & Measure Ramp worksheet**. Hand out the worksheets to students. Hand out some building materials to each pair/group of kids as well as snap cubes or rulers for measuring.

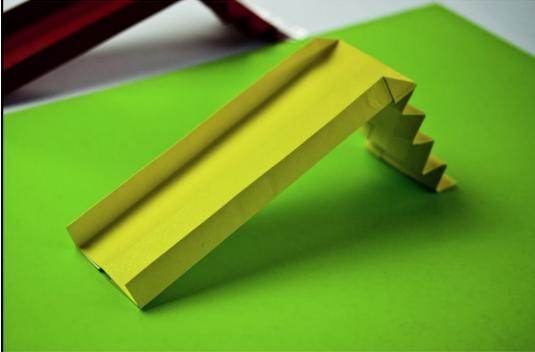
Some examples of ramps using different materials:



Using cereal boxes and lego/mega blocks



Using toilet paper rolls & paper plates & tape



Origami slide: <https://www.youtube.com/watch?v=YVHJhvIWjc4>

Can be suitable for younger kids

As students are working pull 2 students (or max 3) at a time to interact with NoRILLA. Let students know they will have 5 minutes to complete the NoRILLA PLAY mode and should stay at the machine until their time is completed.

- **Group 1, Step 1:** Choose a building material (e.g. lego blocks & cereal boxes), have students use the drawing materials to design a ramp/slide. Explain why you designed your ramp this way on the **Design, Build & Measure Ramps worksheet**.
- **Group 1, Step 2:** Students will use the chosen building material to build their design. They will also measure the height of their structures and record on the worksheet. Option: take a picture of completed structure.

- **Group 2, Step 1:** Choose a building material (different material than Group 1, e.g. toilet paper rolls & paper plates), have students use the drawing materials to design a ramp/slide. Explain why you designed your ramp this way on the **Design, Build & Measure Ramps worksheet**.
- **Group 2, Step 2:** Students will use the chosen building material to build their design. They will also measure the height of their structures and record on the worksheet. Option: take a picture of completed structure.

- **Extra groups could be added if needed using different materials or technology options as listed below:**
- **Technology options:** Have students interact with Phet Simulations: Energy Skate Park to explore concepts of potential energy, mass, friction (suitable for Grades 2-5): <https://phet.colorado.edu/en/simulation/energy-skate-park-basics>.

- **Students pulled:** Using NoRILLA Play Mode, teacher will pull 2 students at a time to discover what makes an object/car go faster and explain their discoveries using concepts of friction, potential energy, shape, and more weight in the back. For older grades, you can give them the **SmartRamps Inquiry Worksheet** so they can record their answers as they interact with NoRILLA. After 5 minutes the students at the NoRILLA station will rotate and other students will come.



- **Share Results:** 1. Repeat the above question. Have students share their ideas with a partner. Discuss what they have learned as a whole group and share their drawing if time permits.

- **Closure:**

1. Share what students found to be interesting, intriguing, even challenging about this lesson. Recap/discuss today's lesson. Let your civil engineers know that next time they will explore test my tower mode.
2. Thumbs up/down: Gather students whole group, ask the questions below, have students show a thumbs up if they feel they met that standard today, thumbs down if they did not. Note those that give you thumbs down and have a brief discussion on that standard/question.

OR

Smile/frown face: Draw a smile and a frown on the whiteboard, students point to either one as you ask the questions below.

Showed perseverance today
Worked well with others
Managed impulsivity
Spoke clearly and precise like a civil engineer

- **Assessments:** Observation/Discussion

Lesson 4 (Continuation from Lesson 3): Student Centered Play Mode (~Divided into 2 lessons: Introduce and Review Vocabulary, Guided Investigation, Share, Closure and Assessment)

- Lesson Objectives:**
1. Students will interact with play mode.
 2. Students will think interdependently (flexible) by working
 3. Students will manage their impulsivity.
 4. Students will use precise and clear communication skills.

*** Briefly introduce and discuss these objectives setting purpose for the lesson.

Students will be expected to implement these objectives during the lesson.

Materials Needed: NoRILLA/Smart Ramps and the pre built objects/cars, drawing paper, crayons, markers, etc, Building materials such as Legos, paper plates, cardboard, cereal boxes, origami paper, toilet paper rolls, tape etc.

* **Teacher will need to place 1 or more different building materials on each half of the classroom for students (similar to the previous lesson).**

- **Introduce:**

1. Review lesson 3 with students and let them know they will follow the same procedure but build with different materials.
2. Groups will switch sides of the room to design and build. Students that did not interact with NoRILLA will do so today.
3. Project and review the Engineering By Design Process document on the board and discuss with students beforehand.



- **Review Vocabulary: (Achieved through discussion)**

Engineer: a person who designs, builds, or maintains engines, machines, or public works.

Design: When you create something on your own.

Speed: How fast an object goes.

Weight: How heavy something is.

Iterate: To make changes to something that was created.

Ramp: A ramp is a surface with one end higher than the other.

Friction: the resistance that one surface or object encounters when moving over another.

Mass: A measure of how much matter is in an object or how much an object weighs.

Potential Energy: Potential energy is a type of energy an object has because of its position.

- **Guide Investigation:**

1. Ask students to close their eyes and visualize becoming an engineer.

Let students know that when they open their eyes they will need to think like and be an engineer.

2. Remind students that all great engineers use their science vocabulary, such as friction, potential energy, mass and weight in back. You will be listening for this.

3. Pose the question to your engineers “do you think you can design a ramp/slide?”

4. Divide class into 2 groups, 1 group for each building material choice. ***The groups will work with a different material than they have interacted with in Lesson 3 if they have finished their ramps from Lesson 3 (if not they can continue with their ramps from Lesson 3 to finish them). (For example if they interacted with lego blocks and cereal boxes before, now they can interact with paper plates and toilet paper rolls or vice versa).*** Similar to last time, working with a partner (or group of 3), the students will design and build a ramp using materials the teacher has available and complete the **Design, Build & Measure Ramps worksheet**. (One worksheet per pair). Hand out the worksheets to students. Hand out some building materials to each pair of kids.

As students are working, pull 2 students (or max 3) at a time to interact with NoRILLA. Let students know they will have 5 minutes to complete the NoRILLA PLAY mode and should stay at the machine until their time is completed.

- **Group 1, Step 1:** Choose a building material (e.g. lego blocks & cereal boxes), have students use the drawing materials to design a ramp/slide. Explain why you designed your ramp this way on the **Design, Build & Measure Ramps worksheet**.

- **Group 1, Step 2:** Students will use the chosen building material to build their design. They will also measure the height of their structures and record on the worksheet. Option: take a picture of completed structure.
- **Group 2, Step 1:** Choose a building material (different material than Group 1, e.g. toilet paper rolls & paper plates), have students use the drawing materials to design a ramp/slide. Explain why you designed your ramp this way on the **Design, Build & Measure Ramps worksheet**.
- **Group 2, Step 2:** Students will use the chosen building material to build their design. They will also measure the height of their structures and record on the worksheet. Option: take a picture of completed structure.
- **Extra groups could be added if needed using different materials or technology options as listed below:**
 - **Technology options:** Have students interact with Phet Simulations: Energy Skate Park to explore concepts of potential energy, mass, friction (suitable for Grades 2-5): <https://phet.colorado.edu/en/simulation/energy-skate-park-basics>.
 - **Students pulled:** Using NoRILLA Play Mode, teacher will pull 2 students at a time to discover what makes an object/car go faster and explain their discoveries using concepts of friction, potential energy, shape, and more weight in the back.



- **Share Results:** 1. Repeat the above question. Have students share their ideas with a partner. Discuss what they have learned as a whole group.
- **Closure:**
 1. Share what students found to be interesting, intriguing, even challenging about this lesson. Recap/discuss today's lesson. Let your civil engineers know that next time they will explore test my tower mode.

2. Thumbs up/down: Gather students whole group, ask the questions below, have students show a thumbs up if they feel they met that standard today, thumbs down if they did not. Note those that give you thumbs down and have a brief discussion on that standard/question.

OR

Smile/frown face: Draw a smile and a frown on the whiteboard, students point to either one as you ask the questions below.

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- **Assessments:** Observation/Discussion

Lesson 5

Lesson 5: Guided Discovery COMPETE (~30-45 minutes: Introduce and Review Vocabulary, Guided Investigation, Share, Closure and Assessment)

- Lesson Objectives:**
1. Students will observe the procedures of NoRILLA SmartRamps.
 2. Students will complete COMPETE mode in SmartRamps.
 3. Students will think interdependently (flexible) by working together to complete a task.
 4. Students will manage their impulsivity.
 5. Students will use precise and clear communication skills.

*** Briefly introduce and discuss these objectives setting purpose for the lesson.

Students will be expected to implement these objectives during the lesson.

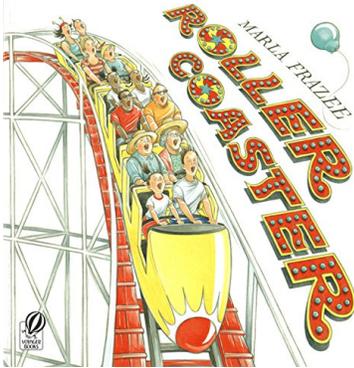
Materials Needed: NoRILLA and Cars/Objects

Optional Video: YouTube video The Car and the Ramp

<https://www.youtube.com/watch?v=0TbR22ot6As>

Optional Literature:

Roller Coaster by Marla Frazee



- **Introduce:**

1. Let students know that they explore another mode using the NoRILLA.
2. Choose and show a building video listed above.
3. Teacher demonstrates the process of using the SmartRamps **COMPETE mode** (click **COMPETE** on the screen to start the **COMPETE mode**. Follow the instructions on the screen to build and test two cars on the SmartRamps. Press the lever on the ramp to observe the results with feedback from the game.



- **Guided Investigation:**

1. Ask students to close their eyes and visualize becoming an engineer. Let students know that when they open their eyes they will need to think like and be an engineer.
2. Remind students that all great engineers use their science vocabulary. You will be listening for this.

3. Pose the question to your engineers “how do you build a car that will go faster on the ramp?” let students know that they need to observe what is happening with their cars/objects so that they can apply their observations in future lessons. Make sure you don’t give away the answers, but help students discover on their own.

4. Divide class into 2 teams. As 2 students (one from each team) complete 1 round of COMPETE. Repeat this process until all students have had a turn. **As 2 students build their cars, the whole class can discuss and predict if their car will go faster, why or why not.**

- **Share Results:** 1. Repeat the above question. Have students share their ideas with a partner. Discuss what they have learned as a whole group.

- **Closure:** 1. Share what students found to be interesting, engineers know that next time they will begin brainstorming and designing their own cars.

2. Thumbs up/down: Gather students whole group, ask the questions below, have students show a thumbs up if they feel they met that standard today, thumbs down if they did not. Note those that give you thumbs down and have a brief discussion on that standard/question.

OR

Smile/frown face: Draw a smile and a frown on the whiteboard, students point to either one as you ask the questions below.

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Spoke clearly and precise like a civil engineer

- **Assessments:** Observation/Discussion

Lessons 6 and 7

Lesson 6: Student Centered COMPETE (40 minute lesson: Review COMPETE/Introduce Design, Predict and Build Car Worksheet, Partner Investigation, Share, Closure and Assessment)

- Lesson Objectives:**
1. Students will review the procedures of NoRILLA.
 2. Students will rotate through COMPETE mode in SmartRamps.
 4. Students will test their own cars and test them the ramps.
 5. Students will think interdependently (flexible) by working together to complete a task.
 6. Students will manage their impulsivity.
 7. Students will use precise and clear communication skills.

*** Briefly introduce and discuss these objectives setting purpose for the lesson.

Students will be expected to implement these objectives during the lesson.

Materials Needed: NoRILLA, building materials such as Lego cars (provided), K'nex, Vex IQ cars, CDs for wheels, Cereal boxes, Pringles cans, ***Design, Predict and Build Cars*** worksheet, foam board or cardboard ramp (provided)

● **Introduce:**

1. Let students know they will explore speed, ramps and weight with their partner, as well as interact with NoRILLA.
2. Let students know they will be using building materials provided to build a car to test on the SmartRamps.
3. Discuss what speed, ramp and weight mean and why cars may or may not go fast on a ramp (e.g. more weight on the back). Give examples (student to teacher).

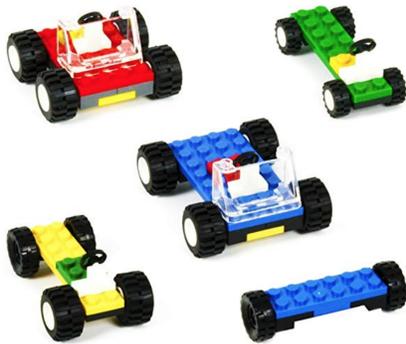
Samples of cars using different materials:

Cereal box or pringles can car with CD/DVD wheels



<https://www.youtube.com/watch?v=ZfiV1oTF-ks>
https://www.youtube.com/watch?v=wIshvC_ntrA

Lego cars



https://www.amazon.com/Brickyard-Building-Blocks-Wheels-Tires/dp/B01G9QYBE4/ref=sr_1_14?keywords=lego%2Bcar%2Bkit&qid=1563842009&s=gateway&sr=8-14&th=1

K'nex cars

https://www.amazon.com/KNEX-Building-Construction-Education-Exclusive/dp/B00I2UZYZW/ref=sr_1_2_sspa?keywords=knex&qid=1563899281&s=gateway&sr=8-2-spons&psc=1



<https://www.youtube.com/watch?v=pW7HV7gaUoE>

Vex IQ cars

https://www.robotshop.com/en/vex-iq-foundation-motion-add-on-kit.html?gclid=Cj0KCQjwvdXpBRCoARIsAMJSKqJMpqIPyWqpr1mmAkeGvAfP578eIGcQQoiX33qbvVCa5wRcAXAmI3oaAI0MEALw_wcB

- **Guide Investigation:**

1. Pose the question to your engineers “how do you think the design and weight of your car affects how quickly it rolls down the ramp?”

2. Divide the class into 2 groups, 1 group for each building material choice (could be Lego cars, K’nex cars, Vex IQ cars, recycled material cars using cereal/pringles box and CDs as explained above). Working in groups of 2 or 4, the students will design, predict and build a car using materials the teacher has available and complete the **Design, Predict & Build Cars worksheet**. (One worksheet per group, can complete second design/building if time permits). Hand out the worksheets to students. Hand out some building materials to each group of kids.

3. Discuss how they will rotate through their day. Students will be given a **Design, Predict and Build Worksheet** where they will be given materials to use. Partners draw and then build their car. Once the car is created allow students to place car on the ramp. (they can also build their own ramp from books, etc. or use an existing ramp at the school).

4. While students are working through their construction, teacher will choose partners (either 2 or 4 kids at a time) to work through the COMPETE mode in NoRILLA for 5-7 minutes. Students will compete with each other by building any structure/car they want using NoRILLA cars and observing whose car goes down the SmartRamp the fastest with interactive feedback from the system. If four kids are interacting at the same time, they will get into two groups that build together and compete against the other group. Once completed these students return to the *Designing Cars Activity* with **Design, Predict & Build Cars Worksheet** and two new students rotate to the NoRILLA station.



5. After they've competed on NoRILLA and completed their car designs, students can test their designs on a ramp (either one of the ramps that were designed in the previous lesson or a foam board/cardboard ramp as shown below or an existing ramp at the school).



6. Allow time to discuss what happened with their car, go back to the worksheet and iterate. Discuss concepts such as speed, weight, weight on the back (makes a car go faster due to potential energy), weight in front (makes a car go slower). Collect worksheets to hand back for use in Lesson 7.

7. Not all students will get to NoRILLA in this lesson. Let students know that they will get a turn in lesson 6.

- **Share Results:** 1. Repeat the above question. Have students share their ideas with a partner. Discuss what they have learned as a whole group.
- **Closure:** 1. Share what students found to be interesting, intriguing, even challenging about this lesson. Recap/discuss today's lesson. Let your civil engineers know that next time they will begin brainstorming and designing their own cars to move quickly down a ramp.

2. Thumbs up/down: Gather students whole group, ask the questions below, have students show a thumbs up if they feel they met that standard today, thumbs down if they did not. Note those that give you thumbs down and have a brief discussion on that standard/question.

OR

Smile/frown face: Draw a smile and a frown on the whiteboard, students point to either one as you ask the questions below.

Showed perseverance today
Worked well with others
Managed impulsivity
Spoke clearly and precise like a civil engineer

- **Assessments:** Observation/Discussion

Lesson 7 (Continuation from Lesson 6): Student Centered COMPETE (40 minute lesson: Review COMPETE/Design, Predict and Build Car Worksheet, Partner Investigation, Share, Closure and Assessment)

- Lesson Objectives:**
1. Students will review the procedures of NoRILLA.
 2. Students will rotate through COMPETE mode in SmartRamps.
 4. Students will test their own cars and test them the ramps.
 5. Students will think interdependently (flexible) by working together to complete a task.
 6. Students will manage their impulsivity.
 7. Students will use precise and clear communication skills.

*** Briefly introduce and discuss these objectives setting purpose for the lesson.

Students will be expected to implement these objectives during the lesson.

Materials Needed: NoRILLA, building materials such as Lego cars (provided), K'nex, Vex IQ cars, CDs for wheels, Cereal boxes, Pringles cans, **Design, Predict and Build Cars** worksheet, foam board or cardboard ramp (provided).

● **Introduce:**

1. Let students know they will explore speed, ramps and weight with their partner, as well as interact with NoRILLA.
2. Let students know they will be using building materials provided to build a car to test on the SmartRamps.
3. Discuss what speed, ramp and weight mean and why cars may or may not go fast on a ramp (e.g. more weight on the back). Give examples (student to teacher).

● **Guided Investigation:**

1. Pose the question to your engineers "how do you think the design and weight of your car affects how quickly it rolls down the ramp?"
2. Use the same groups from Lesson 6 and hand out the worksheets from Lesson 6. Working in groups of 2 or 4, the students will design, predict and build a car using Legos the teacher has available and complete Page 2 of **Design, Predict & Build Cars worksheet**. They will be given a challenge of making their car taller than XX snap cubes/legos. So they will have to decide how they distribute the weight on the car. (One worksheet per group, can complete second design/building if time permits). Hand out some building materials/legos to each group of kids.

3. Discuss how they will rotate through their day, similar to Lesson 6. Partners draw and then build their car using the worksheet given.

4. While students are working through their construction, teacher will choose partners (either 2 or 4 kids at a time) to work through the COMPETE mode in NoRILLA for 5-7 minutes. This will be a continuation from Lesson 6 - groups that didn't get a chance in Lesson 6 will get a chance to interact with NoRILLA SmartRamps in this lesson. Students will compete with each other by building any structure/car they want using NoRILLA cars and observing whose car goes down the SmartRamp the fastest with interactive feedback from the system. If four kids are interacting at the same time, they will get into two groups that build together and compete against the other group. Once completed these students return to the *Designing Cars Activity* with **Design, Predict & Build Cars Worksheet** and two new students rotate to the NoRILLA station.



5. After they've competed on NoRILLA and completed their car designs, students can test their designs on a ramp (either one of the ramps that were designed in the previous lesson or a foam board/cardboard ramp as shown below or an existing ramp at the school).



6. Allow time to discuss what happened with their car, go back to the worksheet and iterate. Discuss concepts such as speed, weight, weight on the back (makes a car go faster due to potential energy), weight in front (makes a car go slower).

- **Share Results:** 1. How did the team activity in lesson 4 help you design your building? What did you observe about how the height and base of your tower affected whether it stood or fell over? Have students share their ideas with a partner. Discuss what they have learned as a whole group.

- **Closure:** 1. Share what students found to be interesting, intriguing, even challenging about this lesson. Recap/discuss today's lesson. Let your civil engineers know that next time they will begin brainstorming and designing their own structures to withstand an earthquake.

2. Thumbs up/down: Gather students whole group, ask the questions below, have students show a thumbs up if they feel they met that standard today, thumbs down if they did not. Note those that give you thumbs down and have a brief discussion on that standard/question.

OR

Smile/frown face: Draw a smile and a frown on the whiteboard, students point to either one as you ask the questions below.

Showed perseverance today

Worked well with others

Managed impulsivity

Spoke clearly and precise like an engineer

- **Assessments:** Observation/Discussion

Lesson 8: Post-Assessment (Optional) (30 minutes)

Lesson Objectives: 1. Students will complete a pre-assessment.

Materials Needed: Post-assessment (Worksheet – Test)

Introduction: Let students know that they will begin their lessons using the NoRILLA machine. Today they will complete their post-assessment to show prior knowledge. (you can find the pre/post assessments in the Appendix section at the end of the book).

- Students complete their post-assessment.

Closure: Check and discuss the pre-assessment as a whole group, or small groups based off of assessments.