PREFACE

"Study the science of art. Study the art of science."

Leonardo Da Vinci

STEAM is an educational discipline that aims to spark an interest and lifelong love of the arts and sciences in children from an early age. Science, Technology, Engineering, the Arts and Math are similar fields of study in that they all involve creative processes and none uses just one method for inquiry and investigation. Teaching relevant, in-demand skills that will prepare students to become innovators in an ever-evolving world is paramount, not only for the future of the students themselves but for the future of the world.

STEAM empowers teachers to employ project-based learning that crosses each of the five disciplines and fosters an inclusive learning environment in which all students are able to engage and contribute. As opposed to traditional models of teaching, educators using the STEAM framework bring the disciplines together, leveraging the synergy between the modeling process and math and science content, for example, in order to blur the boundaries between modeling techniques and scientific/mathematical thinking. Through this holistic approach, students are able to exercise both sides of their brain at once.

An important part of this educational approach is that students who are taught under a STEAM framework are not just taught the subject matter but they are taught how to learn, how to ask questions, how to experiment and how to create.

The goal of this guide is to provide instructional tools in line with the National Curriculum of Pakistan, and it will be useful for teachers of students in all grades. It presents a teaching approach that encourages the active participation and involvement of students in the learning process, with an appropriate balance between thinking and hands-on activities. Sometimes students will be engaged in discussion, and if teachers use questioning effectively, it can improve their students' thinking and communication skills.

To make the guide user-friendly, simple step by step instructions are provided.

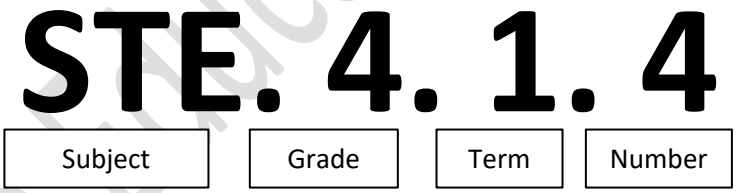
A total number of periods is also suggested for each unit, but the amount of time needed to complete each unit or activity may vary according to its degree of difficulty and the abilities and skills of the students. Teachers can adjust the times to suit their particular needs and context. Advanced preparation and clear instructions by teachers will help to minimize classroom management problems.

All materials suggested for the activities should be easily available at low/no cost: alternative materials can be substituted if necessary.

HOW TO USE THIS GUIDE

Following the simple guidelines can help you get most out of these lesson plans. However, as all teachers know, in order to deliver the best lessons, you should be thoroughly familiar with the subject matter before you plan your lessons.

1. Always read the lesson plans thoroughly before the class to maximize confidence and command over your teaching. It will also enable you to modify in advance the plans to suit the needs of your particular students.
2. Collect and test all the materials listed in the plan before the lesson in order to obtain the required results. This will also minimize classroom management problems.
3. Instead of giving your input directly, introduce the key vocabulary using the glossary or dictionary. Involve the students in exploring the meanings of the key vocabulary using the glossary and if any meaning is not there, ask them to look up the meanings in a dictionary. You can also prepare flash cards for the new terms and display them on the walls. Before starting your lesson, ask the students to read these words aloud and share their meanings. This will help your students improve the pronunciation of the new scientific terms and their fluency in using these terms in discussion of the topics.
4. Before any activity, give clear instructions about what, how, and why they are going to do it.
5. Each additional worksheet has been coded according to the following criteria.



The concept of STEAM education is new for everyone. If a child takes longer time than you had anticipated, adjust accordingly. Always be appreciative of the work done in class.

We hope that this guide will prove useful in making the learning and teaching something to be looked forward to and enjoyed by teachers and students alike.

IQRA ZAHID

DEPARTMENT OF ACADEMICS

THE NEXT SCHOOL

THE NEXT SCHOOL

DAILY LESSON PLAN

Class: 4 **Term 2** **Lesson 1 and 2**

Project: Combining engineering and science to learn about germination of a seed: **Sprout House**	Duration 70 min

Learning Objectives: At the end of the lesson, students will be able to

- Explain that seeds need certain conditions to grow and not all seeds need the same conditions.
- Understand the basic requirements for plant growth.

Teaching Objectives: Teacher will

- Develop questions to test the students for a scientific experiment.
- make sure all of their required material is set out and available to them.

Skills involved:

Thinking skills · Problem Solving · Observation skills · Self-management

Resources required:

4 plain sponges, Scissors, Toothpicks, Hot glue gun {optional but makes construction quick}, Plate
Seeds {wheat berries, chia, or alfalfa seeds sprout quickly}
https://www.youtube.com/watch?v=JSe_VUMymjo

Instructions:

Warm up: Ask students, do you think each seed will grow into a new plant? How about acorns falling off an oak tree? What about the key fruit (the seed-containing fruits) of a maple tree? What would happen if every seed ever produced sprouted into a new plant? Would that be beneficial to our environment? Ask them to list the benefits and challenges of 100% germination.

Activity: Build a Sprout House and plant the seeds!

Step 1: To make the spout house, first gather the supplies for each house.
Step 2: Take out a green sponge to look like grass. Then cut a second sponge in half to form 2 walls.
Step 3: To make the other walls, cut the third sponge in half. Then, cut one of those halves in half again.
Step 4: For the roof, cut the last sponge in half. Now put them all together.
Step 5: To hold up the walls, insert two toothpicks in the bottom and sides of each wall with about 1/2 inch of toothpick sticking out. (If walls still seem a little wobbly, use a little hot glue to hold them together)
Step 6: For the roof, use toothpicks as connectors again, but it is pretty tricky to secure the roof to the walls and each other. And try to end up just using the hot glue gun to hold on the roof.
Step 7: Once the house is built, it is time to cover it with seeds. Try to use wheat berries for the bottom because it grows wheat grass.
Step 8: Now mix some gram seeds for the roof, put about a tablespoon of seeds in a little dish and mix in a little water to make a seed slurry. Try to use those seeds which absorb a lot of water and become kind of gummy. Therefore, it actually helps make spreading the seeds on the roof a whole lot easier.
Step 9: Once the seeds were “planted” all there was left to do was water and wait. Poured water in the plate and allowed the sponge to absorb the water to moisten the wheat berries.

Step 10: Ask the students to put their sprout house in a lab and water it twice for two days.

Step 11: Within two days the wheat berries began to sprout tiny roots.

Step 12: Show them in the next class but water the house daily so that students get amazed to see the seeds are germinated.

Step 13: Now explain the whole process of germination and how a house will affect our environment.

Step 14: Now take out the group leader from each group and ask him/her to present the project in front of class. (Help them in their presentation skills as well)

Evaluation/Reflection:

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Signature of the teacher Signature of the Head/Coordinator

THE NEXT SCHOOL

DAILY LESSON PLAN

Class: 4 Term 2 Lesson 3 and 4

Project: Build a car with help of square wheel that actually rolls: **Building a car**	Duration 70 min

Learning Objectives: At the end of the lesson, students will be able to

- Generate ideas for possible solutions
- Apply age-appropriate mathematics and science skills

Teaching Objectives: Teacher will

- Appreciate the importance of planning and brainstorming when they are designing the solution
- Briefly explain the major steps in the design process

Skills involved:
Thinking skills · Problem Solving · Communication · Self-management

Resources required:
16 cardboard toilet paper tubes, poster board, cardboard, or matboard to serve as the base, glue sticks or glue gun

Instructions:
Warm up: Ask the student to guess square wheels on a car? That's crazy, right? A car can't roll on square wheels. Or can it?! What would happen if you put square wheels on a car?"
Say: As it turns out, round wheels aren't the only type of wheel that can get a car moving. Sometimes, square wheels are exactly what you need by showing them this video below:
https://youtu.be/CIN8Q_4iaxU

Challenge: Build our own cars with square wheels.

Step 1: From a piece of cardboard about 8 x 10 inches (20 x 25 cm) in size you will be cutting a rectangle for the car base that measures 2 x 5 inches (5 x 12 cm) and four-square wheels approximately 2 x 2 inches (5 x 5 cm).
Step 2: Use hot glue (or double-sided tape) to attach the cardboard tubes to a piece of cardboard, cut to approximately 4-6 inches (10-15 cm) wide and 28-30 inches (70-75 cm) long.

Step 3: Do not leave any gaps between the tubes as you glue them on. The side of one tube should be touching the side of the next tube.

Step 4: Measure the diameter of your cardboard toilet paper tubes. Cut four square wheels of the appropriate size.

Step 5: Use a pencil and ruler to draw two diagonal lines on your square so they cross in the middle.

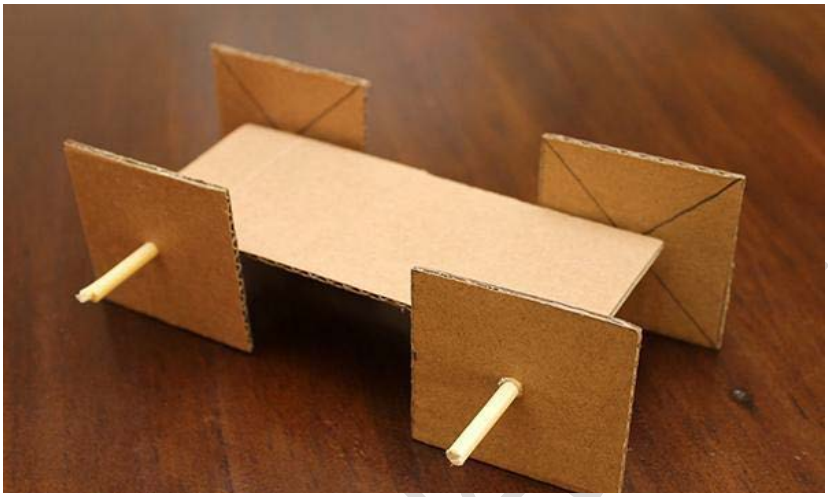
Step 6: Use a pushpin to poke a small hole where the lines meet, which should be the center of your wheel.

Step 7: Cut a rectangle out of cardboard, that is 2 x 5 inches (5 x 12 cm). Draw two lines across the body of the car that are 3/8 inch (1 cm) from each end.

Step 8: Use scissors to cut two separate 2-inch (5 cm) pieces of straw. Use the hot glue gun to attach the straw pieces to the bottom of the car along the lines you drew that are 3/8 inch (1 cm) from each end.

Step 9: Use a ruler to measure 5 inches (12 cm) from the pointed end of each skewer, and make a mark with your pencil.

Step 10: Cut the skewers along the marks so you have two pieces with a point that are 5 inches (12 cm) long. These will be the axles of your car. (Note that an adult may need to use a knife to cut the skewers).



Step 11: Slide one of the square wheels onto the pointed end of the skewer until it rests about 3/4 inch (2 cm) from the other end.

Step 12: Slide the pointed end through one of the axles on your car, then slide the second wheel into place. Adjust the wheels as needed to ensure they are fairly close to the car. Test the wheel-and-axle assembly to be sure it can rotate smoothly and freely.

Step 13: Assemble the second wheel-and-axle set in the same manner as the first.

Step 14: Now you are ready to take your car for a test drive.

Evaluation/Reflection:

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Signature of the teacher Signature of the Head/Coordinator

THE NEXT SCHOOL

DAILY LESSON PLAN

Class: 4 Term 2 Lesson 5 and 6

Project: How do wheel-and axle systems work: **Working with wheels and axel**	Duration
	70 min

Learning Objectives: At the end of the lesson, students will be able to

- Understand the common uses of wheels and axles and how wheels and axles can be used to move objects.
- Distinguishing between the wheel and the axle.

Teaching Objectives: Teacher will

- Help students to understand the principles of the simple machine in focus through hands-on experience before they move on to construct the main models.
- Help in identifying examples of simple machines (wheel-and-axles) in everyday objects.

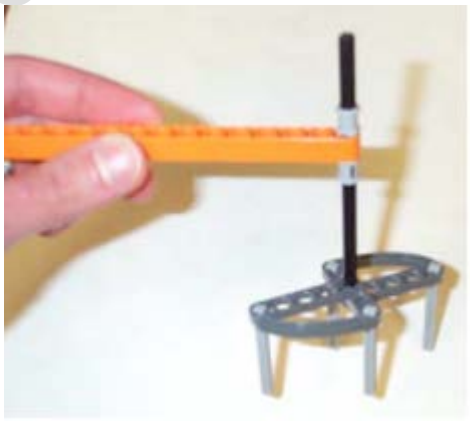
Skills involved: Thinking skills · Problem Solving · Communication · Self-management

Resources required: Lego education simple powered machine
https://www.youtube.com/watch?v=DcdTuwqyg1U

Instructions:

Warm up: To warm up for the investigations, direct students to answer the exploration question: what is the difference between "rolling" wheels and wheel-and-axle systems? Different students define the wheel-and-axle simple machine in different ways. Draw two pictures on the board with wheel and wheel-and-axle. Then explain with examples to understand both definitions. Give them different real time examples from everyday life how we are using wheels and axles.

Activity: work independently to build an example of a wheel-and-axle system (Food Mixer)!



Step 1: Put a LEGO handle on the axle and slide it down so that the axle sticks out.
Step 2: Put the 5- or 15-hole rounded beam onto the axle and peg on the handle.
Step 3: Attach another peg to the end of the beam!
Step 4: Hold the long beam and turn the handle or axle!
Step 5: One person tests the mixer while the other holds the bowl in place! What distance are we saying is shortest, medium, or longest? How big a circle you have to turn the top of the mixer.
Step 6: The axle and handles make differently sized circles! Pick the handle that needs the most force and fill in its distance box with a lot.

Evaluation/Reflection:

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Signature of the teacher Signature of the Head/Coordinator

THE NEXT SCHOOL

DAILY LESSON PLAN

Class: 4 Term 2 Lesson 7 and 8

Project: How machines help people to move? **Machines that move people up and over**	Duration
	70 min

Learning Objectives: At the end of the lesson, students will be able to

- Explain how the wheel and axle work as a simple machine.
- Understand the common uses of wheels and axles and how wheels and axles can be used to move objects.

Teaching Objectives: Teacher will

- Define engineering design as the process of creating solutions to human problems.
- Introduced to the design challenge of building people movers, machines that move people up and over.

Skills involved:
Thinking skills · Problem Solving · Communication · Self-management

Resources required:
Lego education simple powered machine

Instructions:

Warm up: Ask students to brainstorm machines that lift humans UP, and machines that move humans OVER, as well as the pluses and minuses of each machine. They should discuss their ideas with their partner and then write their ideas. After two to three minutes of brainstorming, ask some students to share their examples. Students use different examples like for up: elevator, escalator, stairs for across: moving walkway, conveyor belt, slide.

Say: Today we will begin working on their simple machines' unit, which involves building a complex machine to move a LEGO person and its luggage.

Activity: Design and build your own machines which can be used to move up a Lego person.

Step 1: Make a scenario and explain that, for this unit, students are consultants or professional advisers for an airport. The airport wants a new way to move people up and across surfaces simply and quickly. Ask them to think and draw the model on a paper.

Step 2: Now ask them to build a complex machine that they draw on paper which moves a LEGO person up or down and across a surface, just like machines are used to help humans move. Students should keep this challenge in mind as they investigate each simple machine. They should keep asking, "How might this simple machine play a role in my people's mover machine?"

Step 3: If they are facing a problem in designing that complex machine, then it will not only be challenged to move the LEGO person with their complex machine, but an optimal solution will move the LEGO person's luggage, in the form of a weight.

Step 4: Allow students a few minutes to brainstorm what machines they might use to move the LEGO person up and over. **Step 5:** Now ask them to build their own machine. **Step 6:** If time allows, have some students share their project with the class and present his/her own new invention by using simple machines.
Evaluation/Reflection:

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Signature of the teacher Signature of the Head/Coordinator