Core Apprenticeship Library

Apprenticeship Sector: *Life Sciences*

Unit Guide: *Life is a Lab*

LIFE IS A LAB

In the Life is a Laboratory apprenticeship students will explore 6 scientific concepts over 10 weeks while also learning about how scientific concepts apply to their day-to-day lives. The apprenticeship will focus on building students' facility with making scientific observations, building and using instruments, then inferences and conclusions based on data. There will be an additional focus on students' oral presentation skills which they will apply at the WOW! when the class runs a one day science fair where each student will present an experiment from the apprenticeship before an audience of science fair attendees.

Unit Standards and Objectives

21st Century Skill: Oral Communication

21st Century Skill Standard #1: Citizen Schools students will make an effective oral presentation

Lesson Objectives:

- Draw on preparation, reasoning, and reflection to form and clearly express your own ideas
- Make appropriate eye contact, speak at an adequate volume, and use clear pronunciation
- Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally)
- Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information
- Demonstrate command of formal English when presenting an experiment

Content Standard #2: Citizen Schools students will make observations, inferences and draw conclusions from data

Lesson Objectives:

- Record measurements to the nearest centimeter
- In writing, state a conclusion
- Verbally compare and contrast plant and animal cells
- Methodically develop and test hypotheses to answer a question
- Verbally state a hypothesis based on evidence
- Present data in a graph by showing it and verbally describing what the data shows
- Use data to support or refute a claim

Essential Questions

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- How do I make sense of what I observe?
- How can I build hypothesis to support or contrast what I observe?
- How can I effectively communicate what I observe to an audience?

Performance Task Assessment (WOW!)

Students will deliver a presentation of a poster in a science fair setting. They will explain and demonstrate (if possible) a science experiment of their choosing.

Goal: Students share an experiment of their choice, describing the measurements they took, what the data shows, and finally presenting their conclusion.

Role: Students are scientists in a setting that mirrors a professional setting with colleagues.

Audience: Students present to an audience of other science-fair colleagues, fellow presenters and the school community.

Situation: Students have been asked to share their research questions and findings as part of a scientific community.

Product: Students orally share their experiments with the support of a tri-fold or poster board outlining their question, hypothesis, evidence/data, findings and conclusion(s).

Standards: Students will be assessed using the oral communication **rubric** and by the strength of their conclusions based on evidence. Students must demonstrate expression of their own ideas, mastery of presentation skills (eye contact, speaking volume, etc.), use of different kinds of sources (related to their experiment/data), and effective use of their trifold board to support their presentation.

Lesson Plans At-A-Glance

Lesson Plans are available here.

Week	Lesson Objectives	Agenda	Outcomes & Work Products
1	● Differentiate between safe and	● Hook: Meet Your CT	Students will understand the different

	unsafe lab practices ● Name the goals and scope of the apprenticeship	● Introduction to the Apprenticeship ● Activity 1: Goals of Life is a Lab ● Activity 2: What are safe lab practices? ● Assessment: Exit Ticket	experiments, be trained on safe lab procedures and be introduced to the WOW!
2	● Modify the design of an Alka-Seltzer rocket to make it go higher ● Record measurements to the nearest centimeter ● In writing, state a conclusion from data	● Hook: POP! Goes the Rocket ● Introduction to New Material: Pressure & Newton's Third Law ● Activity 1: Baseline Launch ● Activity 2: Redesign ● Activity 3: Test Data ● Assessment: Exit Ticket	Students will make force rockets and have experience measuring and recording data.
3	● Place events in earth's history on a timeline with reasonable accuracy ● Verbally describe how your ideas about earth's history might have changed after seeing the timeline	● Hook: When Did it Happen? ● Introduction to New Material: Models and Scales ● Activity 1: Model Match ● Activity 2: Geologic Timeline ● Activity 3: What Has Changed? ● Assessment: Exit Ticket	Students will place multiple events in Earth's history on a timeline and verbally present what they learn.
4	● State some of the differences between plant and animal cells ● Verbally compare and contrast plant and animal cells	● Hook: Spot the Differences ● Introduction to New Material: Plants vs. Animals ● Activity 1: Plant Cell ● Activity 2: Animal Cell ● Activity 3: Identifying Differences ● Assessment: Exit Ticket	Students will prepare microscope slides and learn to verbally observe the differences between plant and animal cells.
5	● Methodically develop and test hypotheses to answer a question ● Verbally support or refute a hypothesis with evidence collected during an investigation	● Hook: The Moon's Many Looks ● Introduction to New Material: Moon Phases ● Activity 1: Name The Problem ● Activity 2: Hypothesize & Test ● Activity 3: Conclude ● Assessment: Feedback on Conclusion	Students will make a hypothesis, understand the phases of the moon by using Oreos, and draw a conclusion to verbally support or refute that hypothesis.
6	● Determine if an epidemic threshold has been reached ● Support your determination verbally and visually (with data)	● Hook: Why Do We Get Sick? ● Introduction to New Material: Disease Transmission ● Activity 1: Spreading ● Activity 2: Graphing ● Activity 3: Reporting ● Assessment: Feedback on Report	Students will determine if an epidemic threshold has been reached by using data and observations.
7	● Differentiate conventional and non-conventional phases of	● Hook: It's all mixed up ● Introduction to New Material: Non-	Students will determine how properties and characteristics of substances can/may

	matter. ● State a conclusion about observations	Newtonian Fluids. ● Activity 1: What if…? ● Activity 2: Dancing ● Assessment: Conclude	change when they interact with each other and gain an understanding about the characteristics of solids, liquids and gases.
8	● Choose a topic to present ● State the evaluation criteria	● Hook: WOW! ● Introduction to New Material: The WOW! ● Activity 1: Evaluation Criteria ● Activity 2: Topic Review ● Assessment: Exit Ticket	Students will learn the criteria of a good presentation and choose an investigation to present at WOW!
9	● Complete a portion of the tri-fold presentation board ● Present a draft version of the presentation	● Activity 1: Board Work ● Activity 2: Presentation ● Activity 3: Feedback	Students will work on their boards, practice their presentations, receive feedback and make adjustments accordingly.
10	● Present a more refined draft version of the presentation	● Activity 1: Poster Presentations & Feedback ● Activity 2: Board/Presentation Revision	Students will have presented their posters in a simulation of the WOW! setting, giving them more practice before the real WOW!

Lesson Elements	
Hook Opening ritual used each week to build excitement	The hook varies from week to week, but usually it is some sort of preview or smaller scale model of what the students will be doing in the activities. For example, in Lesson 2 the students will be constructing "force rockets," so in the hook the CT will give a quick demonstration of them.
Assessment How you will measure student learning (i.e., exit tickets, student writing, student presentations, etc.)	The primary assessment measures are the exit tickets completed by the students at the end of each lesson. The exit tickets will check to see if the students are understanding the basic points and concepts behind their activities. In addition, as the lessons progress, CTs will begin tracking students' oral presentation skills based on in-class evaluations. The point is not to "grade" students but to have information to determine which students need more help and how.
Structure Learning structures, tools or student grouping strategies	The general structure of each lesson begins with a preview of the activities to get students interested (hook), an introduction to the concepts behind the activities, and then activities in which students apply those concepts in hands-on investigations. Finally, students will evaluate their mastery with the exit ticket. The sequence is important and conducive to student learning, giving students time to prepare, learn, apply, and reflect.
Procedure	Each lesson requires teachers to pass out handouts and students to keep the handouts from each

Special procedures used each class (ie handing out folders, rearranging seating, etc.)	lesson (a folder or binder will work). The activity procedures will vary from week to week with different lessons.

Implementation Notes

Supplies

Materials, tools, technology

Lesson 1:

- ❑ Safety goggles (1 pair)
- ❑ Safety gloves (1 pair)
- ❑ Latex gloves (1 pair)
- ❑ 1 Film canister
- ❑ 2 Alka-Seltzer (or similar) tablets
- ❑ About 500 mL water
- ❑ Paper towels
- ❑ "Me As A Scientist" picture of yourself

Lesson 2:

- ❑ Alka-Seltzer; at least 7 2-packs per rocket (generic is fine), plus 10 2-packs
- ❑ Water; at least 500 mL per rocket including your demo
- ❑ One film canister per rocket including your demo (number of groups plus one)
- ❑ One plastic bucket (launch pad) per rocket including your demo
- ❑ Two meter sticks per rocket including your demo. Printable meter sticks found here: http://www.freeprintable.com/free-printable-ruler/two-meter-stick
- ❑ Masking tape
- ❑ Cellophane tape
- ❑ Oak tag, or other heavy gauge paper
- ❑ A lot of paper towels
- ❑ Scissors (one per rocket)
- ❑ Goggles

Lesson 3:

- ❑ Tape measure (English and metric units)
- ❑ Rope or string (At least 50 feet)

- ❑ Masking tape
- ❑ Sharpie marker
- ❑ Several kinds of models
- ❑ Globe (or another model that makes something big small)
- ❑ Molecule model (or another model that makes something small big)
- ❑ Heart model (or a model of something else you can't easily manipulate)
- ❑ Clock (or another model of something abstract like time)

Lesson 4:

- ❑ 1 Highlighter or marker per student
- ❑ 1 Bottle Iodine stain
- ❑ 1 Bottle methylene blue stain
- ❑ Aprons for you and each student
- ❑ Goggles for you and each student
- ❑ Latex gloves for you and each student
- ❑ 1 Microscope (if available) OR 1 smartphone and 1 smartphone to microscope adapter (instructions included)
- ❑ 4 Slides
- ❑ 4 Coverslips
- ❑ 1 Pair of tweezers
- ❑ 1 Piece of onion
- ❑ 1 Flat toothpick
- ❑ 2 Eye-droppers

Lesson 5:

- ❑ 1 Hula Hoop
- ❑ 1 Black light bulb
- ❑ 1 Table lamp
- ❑ 1 Tennis ball with a wooden dowel through it. One per 2 students.
- ❑ 8 Oreo cookies per student
- ❑ 1 plastic knife per student
- ❑ NOTE: If a black light is impossible to get, a 150W spot lamp may work instead. If using the spot lamp: replace the tennis balls with Styrofoam balls found in a craft store.

Lesson 6:

- ❑ 5 Paper cups per student
- ❑ Tap water
- ❑ Baking soda & water solution
- ❑ Pure goldenrod colored paper
- ❑ Latex gloves (1 pair per student)
- ❑ Goggles
- ❑ Scissors (1-2 pairs per 3–4 students)
- ❑ *Extension Materials (optional)*
  - ❑ *About a cup of Vinegar*
  - ❑ *Eye dropper*

Lesson 7:

- ❑ 3 Bowls
- ❑ 1 Pound of cornstarch
- ❑ 1 Gallon of water
- ❑ 3 Pie plates
- ❑ Food coloring
- ❑ 3 Spoons
- ❑ 1 Subwoofer.
- ❑ 1 Gram-scale.

Lesson 8:

- ❑ *3* Tri-fold presentation boards
- ❑ Glue Stick (for you)
- ❑ Scissors (for you)
- ❑ Other decorations, as you see fit

Lesson 9 and 10:

- ❑ Printer/copier paper
- ❑ Lined notebook paper
- ❑ Graph Paper
- ❑ Colored Pencils/Markers
- ❑ Post-Its (for you)
- ❑ Glue Sticks (enough to share)
- ❑ Scissors (enough to share)

	❑ Other decorations as you see fit. ❑ *Students should bring in their own tri-fold poster boards **unless** you are able to provide them.*
Budget	The Total Cost of the apprenticeship is variable; however, according to a very intensive cost reduction, it can be performed for $209.80 assuming that some basic paper materials will be free or donated .
Location Tables/desks, or classroom, gym, kitchen, outside, etc.	This apprenticeship requires a classroom space with desks that can be easily moved around in order to accommodate the different set-ups that different investigations will require.
Choice and Voice Key decisions students make	Students will have the option of completing a project board for any of the six investigations of the apprenticeship. Students may petition to conduct an additional investigation related to one of the original six, but it must be based on a question raised during the original investigation. No additional class time will be given for additional investigations. Students will review the six investigations and choose the one they would like to present. More than one student may demonstrate the same investigation, but each student must work independently on their WOW! presentation and project board.
Modifications for Student Needs Supports and changes to help meet the needs of all learners	Life is a Lab is very flexible and we want to be able to include students of all needs. General accommodating modifications can include: -Adjusting student groups to balance out skill levels within each group. -Giving special attention when necessary during individual work time (using an alternative teaching structure). -Adapting assignments to meet student needs and to provide additional support. -Modifying students' participation in labs if students have behavioral challenges that would make full participation unsafe.
Student Background Knowledge and Skills Needed Academic skills, social emotional skills or developmental milestones needed	Important academic skills, social emotional skills or developmental milestones students will need to have met in order to participate in this curriculum as written: -Students are likely to struggle if they are unable to work in groups due to the heavy group based work in this apprenticeship. -Students who are extremely shy are likely to struggle, as one of the standards of this lesson is oral presentation.
College and Career Readiness	College Connection: This apprenticeship exposes students to scientific content, including Newton's Third Law, the characteristics of plant and animal cells, and many other scientific concepts. It will

Connections to college and career	shows them the practical applicability of these concepts to their lives which will hopefully spark curiosity in science and experimentation, perhaps inspiring them to pursue STEM majors and work in research in college. Career Connections: Related career fields/pathways include biology, chemistry and engineering. These fields require study of scientific concepts and effective oral presentation in order to be successful. These fields should be introduced to students over the course of the apprenticeship to help students make connections between their work and the opportunities they could seek out in the future.
Co-Teaching Roles Recommendations for co-teaching and planning	The majority of the lessons in this apprenticeship can be taught with the "Team Teaching" strategy detailed in the Co-teaching Structures guide, because most investigations are conducted with group work. Each lesson plan includes a very specific co-teaching plan with 3-5 key decisions that the co-teaching team must make together. We recommend going over these decisions together before each lesson establishing a co-teaching strategy to follow throughout the lesson, and reviewing what this strategy entails,and making sure it is clear which teacher is responsible for what. In special cases (e.g. there is a high-needs student), the Co-teaching Structures guide should be consulted for the most effective teaching method.
Special Resources Field trips, excursions, guest speakers	There are no built-in field excursions or special guest speakers/teachers in this apprenticeship. Field excursions are unlikely due to the hands-on work of each lesson. However, if you happen to find someone who you think would be a valuable resource for the students (e.g. a biologist or researcher who regularly studies plant or animal cells), consider asking them to come in. Note that because all the lessons are run on a tight schedule, you will have to modify lessons to accommodate extra time spent by a guest speaker. A sample outreach email to guest speakers could look like this: Hi _____ , My name is _____ , and I am a teacher for an organization called Citizen Schools which has partnered with (name of your school) to offer mandatory after school enrichment classes for students. I teach a class called "Life is a Laboratory," which introduces students to scientific concepts through hands-on activities that show practical applications of these concepts. We are always looking for guest speakers whose work could show students the possibilities available to them, and I think you would be an excellent guest speaker because _____ . Our class meets every _____ from _____ to _____ and we would love it if you could join us on _____. Please let me know what you

	think! Thanks, _____
Road Map to WOW! Visual overview for students of their 10 week apprenticeship	Note to CT/TL: Create a poster-sized visual of the information listed below, display and reference it weekly in your classroom. Visual overview for students of their 10 week apprenticeship: Week 1: Product or practice that prepares students for the WOW! Week 2: Force Rockets Week 3: Models and Scale Week 4: Plant and Animal Cells Week 5: The Moon Week 6: Epidemiology Week 7: Non-Newtonian Fluids Week 8: Preparation for WOW!: Topic Review, Project Selection & Evaluation Criteria Week 9: Preparation for WOW!: Making & Rehearsing Week 10: Preparation for WOW!: Dress Rehearsal WOW!

Co-Teaching Structures Guide

Teaching Model	Description	Why should we use it?	When should we use it?
Parallel Teaching 	Class is split into two (or more) small teams. Same content is taught to each team.	·Low student-teacher ratio ·Greater proximity to high-risk students ·Co-teachers have equal presence and responsibility in the classroom	·We can plan effectively together to ensure we teach the same content to each group well. ·Classroom's physical structure permits it. ·Lessons with heavy independent work ·Need to provide a lot of individual attention
Station Teaching	Class is split into two (or more) small teams.	·Low student-teacher ratio ·Co-teachers have equal presence	·When a lesson can be split into two mutually exclusive and equally timed

	Different material taught to each group simultaneously and then teams switch or teachers switch.	and responsibility in the classroom. ·More variety in teaching methods for teachers and students	parts (e.g. using a camera/critiquing a photo, chopping vegetables/measuring ingredients) ·Classroom's physical structure permits it ·Lessons with a lot of knowledge or skill-building
Team Teaching 	Both teachers actively teach the material taking turns during the lesson to lead teach. While one teacher is lead teaching the other goes around to groups or individual students.	·One teacher can pay attention to high-risks students while one teacher leads the full class. ·Co-teachers have equal presence and responsibility in the classroom.	·When it's difficult to effectively split a lesson into two stations ·When a lesson has lectures and independent practice time ·If most SPED students can follow whole-group instruction ·Best with well-developed co-teaching relationship ·Lessons with a lot of group work
Alternative Teaching 	One teacher remediates a small group of students (pre-teach, re-teach, supplement, or enrich) and catches them up for the main lesson being taught by the other teacher.	·Low student-teacher ratio. ·To remediate in class for a small group of students. ·To catch students up who may not have understood/missed previous lesson	·When the benefits from a few minutes of remediation/ pre-teaching will pre-empt greater misunderstandings for the lesson. ·Classroom's physical structure permits small group in one part of the room. (CTs should not be left alone in the classroom with students.)
One Teach, One Assist 	One teacher lead teaches the whole lesson and the other teacher works with individual students.	To redirect behavior from an especially low functioning student. To pay greater attention to a student who needs one-on-one interaction in order to keep up	·If there is a particularly high-needs student(s) in the classroom that need specific support. ·During direct-teach sections of the lesson

The Pitch

In this apprenticeship students will be using science to investigate real word questions. Lesson 1 is essentially a full blown pitch for the entire apprenticeship. Internalize this concept before making your pitch to students as the ideas and principles will be the same, only in a shortened version.

Introduce yourself. Share your name, what you do, the company/organization you work for, and how it relates to science. Students may not be able to make a connection between what you do and science as they've experienced it in school, so be sure to talk about how you investigate phenomenon to try and solve problems and/or answer questions. Also mention how you communicate your research with others. Be sure to mention public speaking and visual representations.

Say: "What do rockets, corrosive acids, and zombies all have in common? Have you ever wondered just how small the smallest thing is? How big the biggest thing is? Have you ever looked up at the night sky and wondered "Why does it look like that?" Me too. There is one clear and foolproof way to investigate these questions: Science!

In this apprenticeship we're going to experiment with six different topics, in six different ways, to investigate six different questions. We'll use engineering to investigate how high rockets can go. We'll use models to examine where today fits into a time line from the beginning of time to now.

How will we do this? We'll use laboratory tools to look at the differences between plants and animals. We'll use the powers of observation and manipulation to figure out why, exactly, the moon looks different from night to night. We'll use acids and bases to illustrate how diseases spread and what makes some diseases more dangerous than others. And while we're on the topic of acids, we'll look at antacids, see how they work, and which brands are best. At the same time we'll look at advertisements and how science can help us tell the difference between what products *actually* do and what the people that sell us those products *want us to think* they can do.

Materials Needed for Pitch Day

1. Two Tabloid size banners with the Title of the Apprenticeship, and two images.
2. Microscope, or similar observation instrument.
3. One of the models used in lesson 3 to illustrate models and scales.
4. One stethoscope, or similar instrument.

Apprenticeship in Action

Coming soon!

Apprenticeship Description for WOW! Communications

In the Life is a Laboratory apprenticeship students explore six scientific concepts and learn about the practical applicability of scientific concepts to their day-to-day lives. The apprenticeship builds students' ability to make scientific observations, use

instruments, and make inferences and conclusions based on data. There is an additional focus on students' oral presentation skills which they will apply at the WOW! when the class runs a one-day science fair where each student will present an experiment from the apprenticeship before an audience of science fair attendees.