Curriculum for Middle Grades Aquaponics Course

Aaron Kinty

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Introduction

This intent of this document is to set out a semester-long curriculum map, with lessons and assessments for a middle grades agricultural course relating to aquaponics.

This course is designed to provide instruction that develops competencies in the areas of agricultural literacy, importance of agriculture, the role of science, math, reading, writing, geography, history, and technology in agriculture, plants and animals, and sources of consumer goods from agriculture.

Simply put, aquaponics is the combination of aquaculture (the raising of fish or other aquatic lifeforms for human consumption or use) with hydroponics (the rearing of plants in a soilless environment using nutrient solutions).

Recent decades have seen much interest in aquaponics as one potentially viable method to provide for the food requirements of a global population expected to exceed 9 billion by 2050. The method is especially attractive for urban environments where it can provide locally sourced food but requiring a relatively small land footprint and energy inputs. It is also attractive in water and other resource scarce regions as the water and nutrient inputs required for significant caloric outputs are far lower than traditional agricultural methods due to water and nutrient cycling within a closed system (1,4).

Aquaponics is likely not going to be a panacea for a global food crisis. It is not a replacement for large scale agricultural production. It is not intended for the cultivation of grains or fruit. Even fruiting vegetables like peppers or tomatoes are not ideal and far less efficient in these systems than the cultivation of leafy vegetables. However, aquaponics most certainly holds much promise to be at least part of the solution, if not even a major part.

The System

An aquaponics system consists of three major components: The main fish tank, the biofilter, and the hydroponics area. Minor components such as aerators, circulation pumps, automatic feeders etc., are specific to the individual set up as to size, numbers, locations etc. and will be installed according to the individual needs of each system. The specifics of all these components in regards to sizing, flows and specific construction methods will be explored in greater depth within the specific lessons of the course, but a brief overview will be discussed in this introduction.

The Tank

When sizing the fish tank, a rule of thumb has been determined to be 0.5 lbs of fish weight / 1 gallon of water (11). It is important to keep in mind that often there is a minimum purchase amount required for delivery of fingerlings from a breeder. If we estimate that number to be 100, and keep in mind that most cultured channel catfish sold for food are harvested at 340 to 680 grams (0.75–1.5 lbs) in body weight (12), keeping in mind the time frame of a school year at 9 months, it would be logical to assume a final harvest weight of approximately 1 lb. Therefore, a minimum tank size to grow out 100 fingerlings would be approximately 200 gallons. If budget and area allotments allow, the system can be expanded accordingly at a rate of 200 gallons/100 fingerlings (assuming a harvest weight of 1 lb/fish).

The Biofilter

Fish produce ammonia (NH_3) as a waste product. Ammonia is both toxic to the fish and unusable by the plants in the growing area. Conversion of ammonia to nitrate (NO_3) occurs through the biofiltration process utilizing nitrifying bacteria, which occur naturally. The two most common species of nitrifying bacteria are *Nitrosomonas sp*. and *Nitrobacter sp*. *Nitrosomonas sp*. converts ammonia (NH_3) to nitrite (NO_2) while *Nitrobacter sp*. use nitrites for their energy source during its conversion to nitrate (NO_3). Nitrogen in nitrate form is then absorbed and used as a nutrient by plants. It can take a significant amount of time for these bacteria to grow in a system, so ideally the system should 'primed' or allowed to flow for a period of time prior to the addition of the fish. Ideally, two weeks should be allotted prior to fish introduction (2).

The biofilter itself is relatively simple to design and build. The basic requirements are a sizeable container, fitted to allow for water in and outflow, and filled with high surface area material as a medium upon which the bacteria can grow. The higher the surface area, the greater the size of the bacteria colony. The container and the bacterial growth medium should be chemically inert. Common growth media are highly porous lava rock, or even furnace filter material.

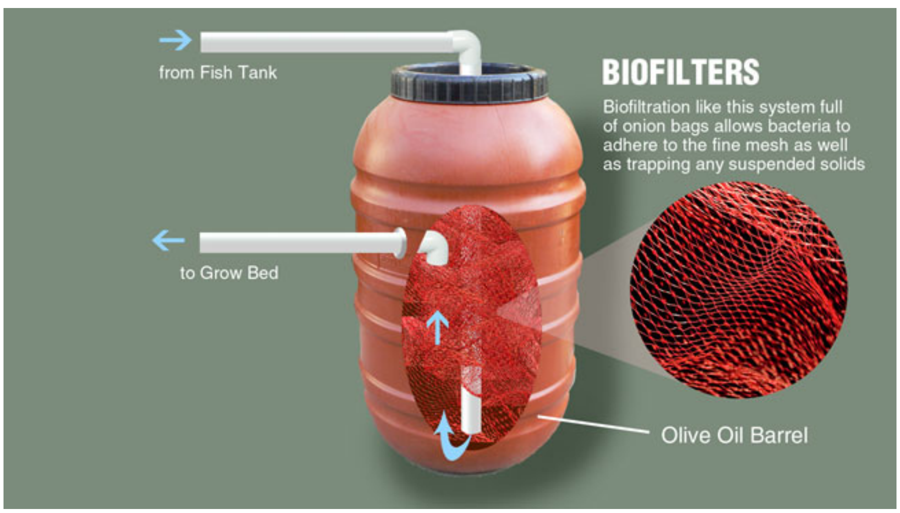

Figure 1. Basic biofilter design (13).

Hydroponics

The nitrate rich water from the biofilter is then directed through plant growth area. There are 6 basic types of hydroponic systems; Wick, Water Culture, Ebb and Flow (Flood & Drain), Drip (recovery or non-recovery), N.F.T. (Nutrient Film Technique) and Aeroponic. There are hundreds of variations on these basic types of systems, but all hydroponic methods are a variation (or combination) of these six (18). Methods where the roots are completely embedded in a medium, such as the wick and ebb and flow systems, require more labor-intensive cleaning of the beds to prevent sedimentation and algal contamination (17).

The method recommended in this curriculum is a hybrid system in which the plants will be rooted in shallow cups filled with medium while the root structures will be suspended below in constant flow of nutrient film.

Fig. 2 Student Constructed Aquaponics System at Yearling Middle School, Okeechobee, FL

Fig 3. Yearling Middle School Aquaponics system between cycles. Systems is awaiting cleaning/preparation/restocking

Curriculum Map:

This course is designed to function as a semester-long middle school vocational course with the dual purpose of providing students with both the hands-on operational experience of a functioning aquaponics systems, while at the same time covering applicable state standards in middle grades math, science and writing.

The course is designed to cover an 18 week semester comprised of five, 50 minute periods per week. The assumption is made that the course will be evenly divided with 50% of the time spent conducting on-site operational tasks on the system itself and 50% being spent in classroom lessons and research. This curriculum map is intended to be an overview of the material covered during the classroom portion of any given class period. For each week, a brief description of the content covered, topic titles and a links to sample lessons is provided. Educators choosing to utilize this curriculum outline may simply use the sample lessons as they are, adjust them to meet their individual needs, or design their own lessons. Educators will decide how they feel best to deliver and assess their students. For example, some lessons may be more suited to a lecture and note taking format, other topics may be better presented as a discussion with guiding questions, while others may work best as a hands-on task or self-guided research lesson. Many of the sample lessons may require the educator to adjust the content to fit the needs or levels or their students as they are intended to be examples. However, many educators may find many of the samples to be adequate.

Many of the links are tied to larger lesson plan data bases and through some exploration of these links, teachers will find access to vast resources of information and lessons already in place. Assessments are left to the individual educator as the format and specific details covered will vary enormously depending on site specificity, student grade and ability levels, etc. However, most of the daily lesson samples contain assessment questions ready-made. Some lessons are presented as research assignments in which students will research and determine the answers to real-world questions which must be addressed as part of operating a successful aquaponics system. Some lessons are presented as articles to be read and responded to by students. The method of responding to the text will determined by the teacher. The amount of material available to be covered here could easily comprise a semester, a year, or even a multiple years long curriculum to continue between grade levels, or basic course and advanced courses. Many of the individual lessons presented in this curriculum outline could easily be week (or longer) units in themselves. The individual instructor will ultimately have the discretion as to how in-depth to take each topic.

Week 1: Aquaponics Overview

This week will be an introduction to the course and the key concepts and vocabulary that will be dealt. The intention is to provide a historical context for the development and current uses of the techniques and technology involved in aquaponics.

Day 1: What is Aquaculture? History and development. Current practices globally

http://teacheratsea.noaa.gov/2011/LessonPlans/Mortimer/LessonPlanforTAS-fisheriesandaquacultureMortimer.pdf

Day 2: What is Hydroponics? History and development. Current practices globally

http://www.conference.ifas.ufl.edu/aitc/presentations/Session%204/Hydroponics%20in%20the%20Classroom/Hydroponics%20in%20the%20Classroom%20PowerPoint%20Presentation.pdf

Day 3: What is Aquaponics? Benefits and applications for global agriculture

http://www.aces.edu/dept/fisheries/education/documents/Module_1_A_Determining_the_nature_of_aquaculture.pdf

Day 4: System types and designs – Pros and Cons of varieties

- Students research various systems and their requirements for successful operation

http://www.aces.edu/dept/fisheries/education/documents/Aquacultureproductionsystemworksheet_000.pdf

https://www.ctahr.hawaii.edu/sustainag/workshop/downloads/Aquaponics-Classroom/Horner_HAPAfarms.pdf

Day 5: Choosing the best system for your school

- Site, space and budget availability

Teacher led discussion and exploration of available sites, resources etc. Site specific.

Standards addressed:

SC.68.CS-CS.1.4, MAFS.7.G.2.6

Week 2: Aquaponics Overview cont.

This week continues the introduction to the course, and the site-specific system either being constructed or already in use at the school site.

Day 1: Component and materials lists, measurements, sourcing and costs

*** It is at this point where a program without an operational system deviates from the coursework schedule and focuses on actual construction. The system should have been designed and material procured prior to the beginning of the course. Students would then participate in the assembly and construction of the system.

In schools with an operational system already in place, students will take actual measurements of the existing system, compile a components list – then source and price all materials then establish a realistic construction schedule.

Days 2-4: Slope and Flow rates

- Rise/Run. Its importance within an aquaponics system
- Volume calculations

https://www.wallingford.k12.ct.us/uploaded/Curriculum/SCIENCE_K-8/SCI_GRADE_4/4_Land_and_Water_curr_guide_DEC_2007.pdf

Day 5: Quiz 1 – Overview of aquaponics, system components and their function

Standards addressed: MAFS.7.G.1.1, MAFS.7.G.2.6, MAFS.K12.MP.6.1

Week 3: The Biofilter

This week introduces basic chemistry concepts and their relation to the physical processes occurring within an aquaponics system.

Day 1: Basic Chemistry

- **The atom, molecule and ion**

http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson1

Day 2: N – Ammonia, nitrite and nitrate

http://csip.cornell.edu/Curriculum_Resources/CEIRP/Aquaponics.htm

Day 3: Microbial activity in agriculture introduction

https://www.asm.org/images/Education/K-12/mda-symbioticrelationshipsbwpdf.final.pdf

Day 4: Nitrifying bacteria in the biofilter

https://cals.arizona.edu/azaqua/ista/ISTA7/RecircWorkshop/Workshop%20PP%20%20&%20Misc%20Papers%20Adobe%202006/7%20Biofiltration/Nitrification-Biofiltration/Biofiltration-Nitrification%20Design%20Overview.pdf

Day 5: Biofilter design

- Surface area calculations

http://fisheries.tamu.edu/files/2013/09/SRAC-Publication-No.-4502-How-to-Start-a-Biofilter.pdf

Standards addressed: SC.7.L.17.2, MAFS.7.G.2.6, MAFS.K12.MP.6.1

Week 4: The Biofilter/Chemistry cont.

This week will continue the analysis of the biofilter, its purpose, components and how they work together, as well as a basic overview of pH.

Day 1: Biofilter materials selection, sourcing, pricing

Research lesson: This should be a site-specific discussion of the biofilter design chosen. Students will analyze the components of the specific system, research how to source the components and determine the costs.

Day 2: Ph introduction

http://www.cpalms.org/Public/PreviewResourceLesson/Preview/19549

http://www.coaleducation.org/lessons/primary/properties/ph.pdf

Day 3: Using a scientific calculator

http://www.doe.virginia.gov/instruction/mathematics/middle/scientific_calculator_lessons.pdf

Day 4: Ph and review calculations

See day 2

Day 5: Quiz 2 – Biofilter and chemistry

Standards addressed: SC.7.L.17.2, MAFS.7.G.2.6, MAFS.K12.MP.6.1

Week 5: Fish

This week's focus is based on the characteristics of the two most common aquaponics fish crops in Florida (and potentially nationwide): Tilapia and Channel Catfish. These lessons are an introduction to the two species and their suitability in aquaculture. Students will also engage in a research lesson to determine which species is best suited for their system. Also, feeding and general care is covered.

Day 1: Tilapia intro

http://www.aces.edu/dept/fisheries/education/documents/SpeciesModuleTilapia.pdf

Day 2: Catfish intro

http://www.aces.edu/dept/fisheries/education/CatfishLessonPlans.php

Day 3: Species selection for the system

Research lesson: Students discuss and choose fish variety based on environmental and economic factors, site specific.

Day 4: Feed types

- Determine most suitable feed type
- Source and price

http://www.aces.edu/dept/fisheries/education/documents/SRACFeedingcatfishincommercialponds.pdf

Day 5: Determine feed rates based on weight

- Understanding percentages

http://www.aces.edu/dept/fisheries/education/documents/SRACFeedingcatfishincommercialponds.pdf

Standards addressed: MAFS.K12.MP.1.1, MAFS.K12.MP.2.1, MAFS.K12.MP.5.1

Week 6: Fish cont.

This week's focus will be centered on the biological processes of the fish and understanding the nutritional value of fish as a food source compared to other sources.

Day 1: Biological processes of Fish growth

http://www.aces.edu/dept/fisheries/education/documents/CompleteCatfishBiologyLessonPlanwithreading.pdf

Day 2-4: Fish as food

- Nutritional value of fish
- Importance of fish to global agriculture
- Economics of fisheries
- Relationship of fish to global economy

http://www.fao.org/focus/e/fisheries/nutr.htm

Day 5: Quiz 3 – Fish

Standards addressed: MAFS.K12.MP.1.1, MAFS.K12.MP.2.1, MAFS.K12.MP.5.1

Week 7: Hydroponics

Day 1: Intro to general hydroponics

http://tlc.peoriaud.k12.az.us/Enviromental%20and%20Agricultural/Hydroponics/lesson1.htm

Day 2: Intro to various hydroponic systems

http://tlc.peoriaud.k12.az.us/Enviromental%20and%20Agricultural/Hydroponics/lesson2.htm

Day 3-5: Research of site suitable hydroponic systems

Research lesson: Students will research and decide which systems would work at their particular school and then design, source components and price a system.

Standards addressed: LAFS.7.SL.2.4, LAFS.7.W.3.8, SC.68.CS-CS.2.11, SC.68.CS-CS.2.2

Week 8: Vegetables

This week is dedicated to the plants to be grown in an aquoponics/hydroponics system. Aside from species evaluation and selection, students are also introduced to the basics of plant physiology.

Day 1: Suitable varieties for a hydroponic system

https://akfoodpolicycouncil.files.wordpress.com/2013/07/teaching-modules.docx

Day 2: Intro to plant biology

http://www.ngsslifescience.com/science.php?/biology/lessonplans/C405/

Day 3-4: Intro to root systems and physiology

https://www.lessonplanet.com/lesson-plans/plant-physiology

Day 5: Quiz 4 – Hydroponics and plants

Standards addressed: SC.7.L.17.1, SC.7.L.17.2

Week 9: Plant selection and growth

This week is dedicated to variety selection growing their selected crops from seed. Students will research the varieties best suited to their system and site. They will also be introduced to the basic physiology of seeds and the processes of preparation, germination and growth.

Day 1-2: Variety selection

Research Lesson: Students research the vegetable varieties suitable for their system and site

- Source and price

Day 3-5: Intro to seeds – physiology, germination and growth

http://afghanag.ucdavis.edu/educational-materials/principles-of-horticulture/edhortafgpurdueunitclesson1plantphysiologylp.pdf/view

Standards addressed: LAFS.7.SL.2.4, LAFS.7.W.3.8, SC.68.CS-CS.2.11, SC.68.CS-CS.2.2

Week 10: Plant growth cont.

This week will focus on the end result of the growth cycle: Harvest. Students will be introduced to the economic values of their crops and some factors necessary for maximum yields.

Day 1-2: Harvest calculations

Research Lesson: Students research and estimate yields from the different varieties chosen

- Calculate economic value of crops

Day 3: Intro to Macronutrients

https://www.lessonplanet.com/lesson-plans/plant-physiology

Day 4: The N Cycle in aquaponics

http://csip.cornell.edu/Curriculum_Resources/CEIRP/Aquaponics.pdf

Day 5: Quiz 5 – Plant selection, growth and nutrients

Standards addressed: LAFS.7.SL.2.4, LAFS.7.W.3.8, SC.68.CS-CS.2.11, SC.68.CS-CS.2.2

Week 10: Environmental Variables on Crops

Continuing the prior lessons, this week moves more into the specifics requirements for maximizing crop yields beyond nutrient requirements.

Day 1: Light use

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4242396/

Day 2: Site placement

https://dese.mo.gov/sites/default/files/aged-Greenhouse%20Mngmnt%20Instructor%20Guide.pdf

Day 3: Temperature

https://cropwatch.unl.edu/Irrigation%20Mgmt%20Lesson.pdf

Day 4-5: Water usage of crops

Research lesson: Referring to the week's articles, students will research water usage of various crops over the growing season

Standards addressed: MAFS.7.G.2.6, MAFS.7.G.1.1, SC.68.CS-CP.2.1

Week 11: Environmental Variables cont.

Continuing to focus on environmental factors affecting crop yields, this week's lessons will focus on combining the above covered factors and their effects. For example, how does temperature and light exposure affect water usage and ET?

Day 1: Evaporation

https://www.lessonplanet.com/lesson-plans/response-to-stimuli

Day 2: Evaporation calculations

- Students will calculate evaporation rates considering variables such as temp, wind etc

https://www.lessonplanet.com/lesson-plans/response-to-stimuli

Day 3: Crop evapotranspiration

http://extension.unl.edu/statewide/fillmore/Irrigation%20Mgmt%20Lesson.pdf

Day 4: ET calculations

http://extension.unl.edu/statewide/fillmore/Irrigation%20Mgmt%20Lesson.pdf

Day 5: Quiz 6 – Environmental Variables

Standards addressed: MAFS.7.G.2.6, MAFS.7.G.1.1, SC.68.CS-CP.2.1

Week 12: Economics

The curriculum now moves into a focus on the economics of agricultural production in general, and eventually to aquaponics specifically.

Day 1: Intro to Gross and Net Profit

https://www.treasurydirect.gov/indiv/tools/tools_moneymathtaxes.pdf

Day 2: Itemization of costs for a commercial ag operation

https://www.cteonline.org/curriculum/outline/agricultural-business-model/YNiiR4

Day 3: Site system crop cycle cost estimates

https://www.cteonline.org/curriculum/outline/agricultural-business-model/YNiiR4

- Analyze provided site specific costs

Day 4-5: Market value

Research lesson: Students will analyze USDA terminal market reports and calculate profitability of various aquaponic crops

https://www.ams.usda.gov/market-news/fruit-and-vegetable-terminal-markets-standard-reports

Standards addressed: LAFS.7.SL.2.4, LAFS.7.W.3.8, MAFS.K12.MP.2.1

Week 13: Economics cont.

This week's lessons continue the economic focus on agricultural production. Through various research lessons, students will apply information from previous lessons to their own system analyzing for efficiency and determine real world values for their produce.

Day 1-2: Efficiency vs Inefficiency

Research lesson: Students will analyze hypothetical or actual local agricultural operations and determine inefficiencies

Day 3-4: Find a market

Research lesson: Students will research local markets for their crops and determine crop value

Day 5: Quiz 7 – Ag and Aquaponics Economics

Standards addressed: LAFS.7.SL.2.4, LAFS.7.W.3.8, MAFS.K12.MP.2.1

Week 14: Social Impacts of Aquaculture

This week continues the focus on economics while addressing the practical questions of a rapidly growing population and the pressures of development on agricultural systems. How can aquaponics be part of the solution to future food needs?

Day 1: Intro to resource scarcity

http://www.hfcsd.org/webpages/tnassivera/news.cfm?subpage=1059

Day 2: Population and agricultural demand projections

http://worldpopulationhistory.org/teachers-resources/

Day 3: Urban Agriculture

https://www.asla.org/sustainablelandscapes/Ed_UrbanAg.html

http://columbiaurbanag.org/our-programs/lessons-and-activities

Day 4- 5: Local Sourcing

Research lesson: Students will research and source specified crops as locally as possible. Teacher's choice as to appropriate crops: site specific.

Standards addressed: MAFS.7.SP.1.2, SC.68.CS-CP.2.2, LAFS.7.SL.2.4, LAFS.7.W.3.8

Week 15: Social Impacts cont.

This week will focus on research questions intended to target real world scarcity issues and have students work through basic system designs keeping in mind specific scarcity issues within specific geographic regions. Students will also be required to take into consideration cultural practices within these geographical regions and how those may factor into food production and labor concerns etc.

Day 1-2: Resource-scarce regions

Research lesson: Students will analyze the needs and cultural profiles of resource scarce regions globally. Individuals or groups will assigned a geographical region and will determine the resource challenges specific to each region.

Day 3-4: Aquaponics viability for resource scarce regions

Research lesson: Students will research design an aquaponics system for a specific resource-scarce region, with an emphasis on the local environmental and cultural necessities of that region, ie what is available, what is not, and what dietary considerations/preferences are culturally preferred.

Day 5: Quiz 8 – Social Impacts

Standards addressed: MAFS.7.SP.1.2, SC.68.CS-CP.2.2, LAFS.7.SL.2.4, LAFS.7.W.3.8

Week 16: Harvest Intro

This week will be the last week for academic lessons concerning aquaponics. In a lead up to the actual harvest, students will be introduced to determining the actual yields from their harvest, as well as the actual methods used to harvest and process their crops.

Day 1: Harvest Index Intro

http://oklahoma4h.okstate.edu/aitc/wheat%20lessons/lesson7.pdf

Day 2-3: Fish Harvest Intro

- Introduction of the proper handling, processing, packaging and storage of fish. Ready for market

http://www.aces.edu/dept/fisheries/education/NationalCouncilforAgricultureEducation_AquacultureCurriculumGuide.php

Day 4-5: Vegetable Harvest Intro

http://www.aces.edu/dept/fisheries/education/NationalCouncilforAgricultureEducation_AquacultureCurriculumGuide.php

Standards addressed: MAFS.K12.MP.6.1, SC.68.CS-CS.2.2, SC.68.CS-CS.2.2

Week 17: The Actual Harvest

This time period is dedicated to the actual hands on harvesting of the system's crop. In-field application of Week 16's lessons. The fish and vegetables will be collected, processed, packaged and stored for market.

If allowable, the students may prepare a meal with their products…. Have a fish fry and salad!

Week 18: Final close out

Day 1-2: Review for final exam

Day 3: Final Exam

Day 4-5: On site clean out and preparation of system for the next semester's cycle.

Applicable Florida Academic Standards

MAFS.7.G.1.1- Solve problems involving scale drawings of geometric figures

MAFS.7.G.2.6 - Solve real-world and mathematical problems involving area and volume

MAFS.7.NS.1.2 - Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

MAFS.7.SP.1.2 - Use data from a random sample to draw inferences about a population with an unknown characteristic of interest.

MAFS.K12.MP.1.1 - Make sense of problems and persevere in solving them.

MAFS.K12.MP.2.1 - Reason abstractly and quantitatively

MAFS.K12.MP.5.1 - Use appropriate tools strategically

MAFS.K12.MP.6.1 - Attend to precision.

MAFS.K12.MP.7.1 - Look for and make use of structure

MAFS.K12.MP.8.1 - Look for and express regularity in repeated reasoning

SC.68.CS-CP.2.1 - Develop problem solutions using visual representations of problem states, structures and data

SC.68.CS-CP.1.2 - Select and use data-collection technology (e.g., probes, handheld devices, etc)

SC.68.CS-CP.2.2 - Evaluate the logical flow of a step-by-step program by acting it out through computer-free activities

SC.68.CS-CP.3.1 - Select appropriate tools and technology resources to accomplish a variety of tasks and solve problems.

SC.68.CS-CP.3.3 - Create an artifact (independently and collaboratively) that answers a research question and communicates results and conclusions.

SC.68.CS-CS.1.4 - Interact with content-specific models and simulations to support learning, research

SC.68.CS-CS.2.11 - Predict outputs while showing an understanding of inputs.

SC.68.CS-CS.2.2 - Solve real-life issues in science and engineering (i.e., generalize a solution to open-ended problems) using computational thinking skills

SC.68.CS-CS.2.3 - Perform a variety of operations such as sorting, filtering, and searching in a database.

SC.68.CS-CS.2.2 - Solve real-life issues in science and engineering.

SC.68.CS-CS.2.4 - Organize and display information in a variety of ways such as number formats

SC.68.CS-CS.4.4 - Identify and describe the use of sensors, actuators, and control systems in an embodied system

SC.68.CS-CS.5.1 - Describe how information, both text and non-text, is translated and communicated

SC.68.CS-CS.2.2 - Describe how humans and machines interact to accomplish tasks that cannot be accomplished by either alone.

SC.68.CS-PC.2.3 - Describe the influence of access to information technologies over time and the effects those changes have had on education, the workplace, and the global society.

SC.68.CS-PC.3.1 - Answer research questions using digital information resources.

SC.7.L.17.1 - Explain and illustrate the roles of and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web

SC.7.L.17.2 - Compare and contrast the relationships among organisms such as mutualism, predation, parasitism, competition, and commensalism

LAFS.7.W.2.4 - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

LAFS.7.SL.2.4 - Present claims and findings, emphasizing salient points in a focused, coherent manner

LAFS.7.W.3.8 - Gather relevant information from multiple print and digital sources, using search terms

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