Aquaponics as a teaching tool

How to integrate it
in 8th graders syllabus
in a Swedish context

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Why aquaponics?

Its educational advantages...

Education is one of, if not *the*, most basilar levels in which a society can invest to grow and heal. As you as a teacher may know, there are many ways through which something can be taught and learned: among these, we find experiential learning. Also called hands-on learning, it allows students to learn concepts through experience-based activities and repetition. By applying theoretical knowledge to real-life practices, all kinds of students get to the core of the lesson: it opens up the accessibility to learning to a wider group with different prerequisites. This happens also thanks to the proximity of plants in the aquaponics system, allowing the students to get closer to natural elements such as water and the process of growth through time. Themes such as photosynthesis, statistics, and preparing food can be thought through and with the support of an aquaponics system. By working with their hands, usually, in a new environment, students perceive the class on a more personal dimension, and working with an aquaponics system their systemic thinking enhances, leading them to a deeper understanding of complex world problems, such as sustainability.

... and sustainability wise

Aquaponics is a closed and circular system that produces food sustainably. It is predicted that by 2050, we will be almost 10 billion individuals on Earth and, the way we are producing food *now* is already an unsustainable one for the current 8 billion. A wiser utilization of water, soil, and sea resources is needed, and we can tackle this challenge by educating the new generations to sustainably farm food, preparing them for the future (and present for some areas of the world already) they and we will face. If all of this still has not convinced you... consider this: farming for commercial production reaches 31% of the overall greenhouse gas emissions caused by humans and fishing from seas and oceans has led to 90% of the global marine fish stocks being overfished.

I know it sounds discouraging because it sort of is. But there is still time. There is a way through; let's put our hands in it, together! This guideline will lead you in providing information and examples of activities, explanations, and support to start with your path in discovering and teaching aquaponics. Ready? We can start.

Contents

Practical and technical information

The goal of this chapter is to help you set an organized structure to start from, that will guide you time-wise, with the materials required and possible economical resources. Here you will find all of the practical and technical information that may seem more challenging when facing aquaponics for the first time. But fear not! This guideline is tailored to your needs, and hopefully, they'll all be answered.

In the next pages, you'll find a yearly and weekly schedule, what to do on a daily basis for maintenance, some information about which water parameters are the most important to check for and how to do so, the components needed to build a system together with a suggestion of useful tools to have around it, and some inspirations on how to finance a similar project. In the yearly schedule, the activities are talked about as "Activity #1" and similar, referring to the activities explained in further details in the next chapter.

What is written here was gathered through a year worth of experience with implementing an aquaponics system in a primary school, grade 8. The teachers that participated in this project were the ones suggesting how to structure the activities: at the beginning of every semester, with clear start and ends, according to the academic year workload. This is a suggested structure for you to follow as well, but feel free to change it accordingly to your school's specific needs. You will notice that the weekly schedule does not include weekends: this choice is made intentionally, since it is in relation to an hydroponics system, which can survive without being checked on for a couple of days. The daily maintenance is thought for a fully functional aquaponics system, the goal you'll eventually reach. Be that as it may, know that unforeseen challenges will rise. Just remember: the aim of starting this is for students to understand the process, not for everything to always function perfectly. Trust the process.

Picture: Thomas Johansson

Components you need

As expressed before in this guideline, you can decide whether to buy an aquaponics system online or to build one from the start, searching for pieces by yourself. This choice is based on your needs and goals with the utilization of the system. Generally, buying one online means spending less time searching for all the technical information and looking for the pieces, whilst (possibly) spending a bit more money instead. When starting a system from scratch, on the other hand, you could save some money by reusing what could be there already or buying second-hand at cheaper costs for the planet too (for example the plant grow bed could be made out of an old ice cream box). With that in mind, if you decide to buy a system online, consider asking for some guidance from the company itself; if you decide on building the system from scratch though, here is a list of what you require to do so.

Hydroponics

- Grow lights
- Timer for grow lights
- Cables, sockets, and plugs as needed
- Grow bed for plants to be put in (it could be old ice cream boxes, flower boxes, or something similar. Just be sure to use the right kind of plastic, #2 HDPE, High-Density Polyethylene that is marked "USDA/FDA/NSF approved" or "food grade")
- Pots for hydroponics (same recommendations as above for the plastic use, since you'll eat the products that will grow in the system)
- Media to put your plants in (for example lava rock or expanded clay), if you're going for a media-based system
- Bioballs for bacteria to colonize
- Nitrifying bacteria to start the system
- Either fish waste or nutrients for plants and bacteria to start the system going

Aquaponics

- Fish tank (blue barrels are convenient both for availability and resistance to possible interferences from... teenagers)
- Fish tank lid (for example a wire mesh or a plastic lid) and grippers to put it in place and stable
- Pipes of different dimensions and shapes depending on your needs (space availability, chosen system)
- Thermometer to check for water temperature
- Bundband to secure cables lying around
- Fish and fish feed
- Water pump

...and useful tools to have close by

- Spare pipes of different sizes and shapes
- Fish net either for cleaning purposes or moving the fish if needed
- Buckets to fill with water to refill the system when necessary and to put the soil in when moving plants into the system
- Paper-to-dry spillages and similar
- Gloves to handle water test kit
- Aquarium-safe silicone to fix potential leaks
- Tray to put plants on when moving them around
- Scissors/knife to harvest plants
- Lighter to sterilize scissors/knife
- Cutting board to cut plants when harvesting
- Plant tweezers/plastic tweezers for handling seeds or small plants
- Masking tape to keep track of seedlings' variety on the seed tray side

Picture: Thomas Johansson

Yearly schedule

September
Activity #1, 2, and 3.
ST*: 1 intensive week.

October
Activity #4, and 5.
Activity+ #1.
ST: 1 week.

Nov/Dec
Plant seeds, buy system.

January
Build the system and get it going with plants and bacteria.
Activity #6. ST: 4 days.

February
Activity #7, and 8.
Add fish to the system and start daily maintenance(check daily schedule provided).

March
Activity #9.
Daily maintenance.

April
Harvest periodically and daily maintenance.

May/June
Daily maintenance and harvest. Closing the system for the summer!

*ST = suggested time. Check the next page to see suggested structures in further details.

Yearly schedule

A little more in depth

In this section, only September and January are considered. This choice is made intentionally, as those are the most important ones for structuring the project if following the suggested schedule. It is recommended to start with the physical system after December, to avoid having to check on it during the Christmas vacation, and for students to have time to soak the knowledge in. In the overall academic year, it's up to you to decide whether to have the activities within the same week or not. Here, when the week is described as "intensive", it is suggested as a concentrated one on aquaponics activities. But, once again, it's up to you!

September

Day 1: presentation of what is aquaponics, how it works, and the different kinds. Students in groups research which kind they think is the best fit for the school and start prototyping it (sketch, cardboard, creativity is on!).
Day 2: pause the prototyping; activities #1 and 2.
Day 3: field trip to aquaponics company in the area/ something related to sustainably produced food and/or the importance of water as a resource. This is truly important for everyone to visualize and help with the understanding of the project.
Day 4: finish prototypes, and present them to the class (activity #3).

January

Day 1: field trip to either:

- aquaponics company from which to take bacteria to start the system (or purchase them online beforehand, it depends on the availability and the contacts)
- places such as restaurants that merge sustainability completely, museums, local universities related to aquaponics/aquaculture/hydroponics, etc.

Day 2: build the system and add water to it (have a pump to oxygenate it); add plants and bacteria.
Day 3: Activity #6
Day 4: Start to check the water parameters twice a week. Always rinse your hands before dealing with anything related to the system.

Weekly schedule*

Monday

Rotate both plants and seedlings, in order for them to grow straight and balanced.

Tuesday

Check seeds and plants' roots, and if necessary, remove rotting parts.

Wednesday

Move bio-balls to aerate them and clean the bottom of the tank from build-up waste.

Thursday

Harvest plants if needed and give them to the school's kitchen to use for lunch.

Friday

Check for water levels in the tanks; if too little, add water.

* when system running is hydroponic only (for aquaponics' maintenance see daily schedule on the next page)

Daily maintenance

Fish

- Check for their behavior: are they swimming around as happy fish or staying still for a long time on the bottom of the tank as sad ones? If the latter, make adjustments such as changing how much feed, making the environment less stressful by lowering the sounds around the fish, and checking on the preferred temperature of the water based on the species
- Feed them at approx the same time every day (range of 4 hours, ex 8:30 -12:30) and write down results (you can use the fish feeding table provided further on in the activity section)

Plants

- Harvest herbs or vegetables, if needed, using the cut-and-come-again method by pruning a little the head of the plant, so that it can grow bushier and fuller
- Rotate them towards the light, so that they can grow straight and strong
- Check for dead leaves and remove them

Overall maintenance

- Water parameters*: follow your water test kit instructions and write down results (you can use the water parameter table provided further on in the activity section)
- Leaks: always visually scan for new ones, and keep everything outside of the water dry to easily spot new leaks
- Water level: check for it and add some new water if there is too little. Make sure to remove build-up waste from time to time

* check the "water parameters" section on the next page for a more in-depth explanation of how to

Water parameters 💧

Water quality is a key component for the system's overall functioning: it influences fish, plants, and bacteria health and growth. This is why it is vital to check the parameters daily, once the fish are added to the system. Feeding the fish changes the water chemistry and it is better to verify it before the change happens, to know in advance if some value is not within the optimal range and, if so, possibly act to fix it. Therefore, taking the water for testing before the fish are fed is a good practice when maintaining an aquaponics system. The main parameters that require daily testing are the following, together with their optimal range and a brief explanation:

- Ammonia (NH_4): 0 ppm
  - highly toxic molecule for fish, can cause death
- Nitrites (NO_2): 0 ppm
  - normal to have a small spike in the first stages of a system (up to 0.5, then act)
- Nitrates (NO_3): between 20 - 100 ppm
  - far less toxic than the first two, this is what plants feed of from
- pH: between 6.4 - 8.0
  - depends on the type of fish, plants, media, and materials used
- Carbonate Hardness (KH): 4.5 - 8 dH
  - used as a buffer for pH, the higher it is, the more stable the pH

Remember that some of the range can slightly change depending on what kind of plants and fish you decide to have within your system. Make sure to double-check for your specific ideal values. Lastly, the easiest way to check for these parameters is by buying a water test kit that includes all of them: they are easily found in the aquariums department.

- Temperature of the water is another value to make sure of to ensure a good quality of life for the fish, plants, and bacteria;
- Dissolved oxygen (make sure your system is properly ventilated)

TIP: always keep aside some more water than needed, to be able to double-check results if necessary

How to finance it?

Different stakeholders

To start a project like this on your own is feasible, but it is even more so, when support from more sides is given. Therefore, you can try to reach out to some of the following stakeholders that may be interested to work with you:

- Academia (different schools or universities)
- Private investors (students' parents? some local company?)
- Government (municipality)

Local support

- Try and reach out to already existing networks of interested people in the area, such as local farms or communities like REKO-ringar, for more practical help, such as maintaining and checking on the system during weekends and holidays. It could show support not from a financial side but from a time-one.
- Support can be given in the form of trying to start change from different levels as well, by starting the conversation with the municipality on fundings for similar projects or legislations on how to include sustainability more in schools and kitchens.

Useful links

Here are some platforms that fund sustainaiblity and research projects:

- Formas: government research council for sustainable development
- RISE: Sweden’s research institute and innovation partner

Picture: Thomas Johansson

Activities to generate interest

This chapter aims to maintain a key factor in the implementation of the aquaponics project: interest. This is meant both for teachers and students, about the complexity of the activities presented and considering the surroundings in which they are held. For these reasons, here you will find examples of activities that can be held in a school environment based on the different syllabi (science, mathematics and technology, home economics, English, art, Swedish), examples of extracurricular activities designed to boost energy through the year, when stress and tiredness are higher than usual, and examples of tables for teachers to use, about water parameters and fish feeding.

The suggested activities should be considered a starting point for you to go from... and add more, if the creativity, involvement, and time allow. As you will see, every activity states the time necessary for its actuation, both for teachers and for students, as this is one sensitive topic in a school environment, when pressing matters such as grades and meetings with parents and other teachers overlap. This will hopefully help when organizing the workload throughout the year/week. The subjects that the activity touches upon and their aims are also expressed for every activity, making it simple for you to decide whether to use them or not, and, possibly how to combine them with different subjects through a Temaarbete. Other sections are provided, such as some background, goals, a step-by-step procedure, some discussion points, and a section just for you, “for the teachers”.

Here you will find "normal activities" first, such as "Activity #1" and then some of what is called "*Activity+*": think about the latter as activities that go more in-depth in aquaponics as a concept and to develop a closer connection to the project, both for the students and for you, as teachers. The more you'll know about aquaponics, the more passionate you'll become!

As in the previous chapter, these examples need to be considered as such, examples. It's up to you to personalize them to your liking... and I'll love to see how you do so! Remember to take pictures to have some memories... and also, fun.

Teachers: 1 hour 30'
Students: 2 hours

Plants from Sweden

SUBJECTS AND AIMS

HKK: ability to plan and prepare food and meals for different needs and contexts.

Background

Different aquaponics systems require different kinds of plants for both to thrive. For example, a raft system wants lightweight green vegetables such as lettuce, kale, and herbs, whereas a media-based one can support root vegetables and up-weighted ones such as tomatoes.

Goal

Deepen the students' knowledge of local and not local plants whilst understanding why a specific plant could work (roots, the overall weight of the plant, or similar).

For the teachers

What plants can your system support best? Check for availability in the area. Some plants may not be available during autumn or winter. In that case, seeds could be a solution.

Procedure

This is a Think-Pair-Share activity. The students start by themselves, forming critical and individual opinions. Then they are divided into couples to confront and express what found. Finally, the whole class discusses the different results and decides on which plants will be used in the system.

Discussion

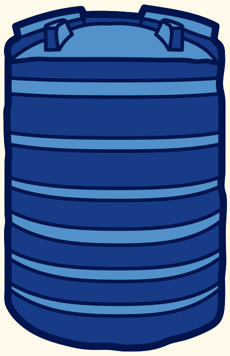
Which kind of plants have they found? Discuss whether they are available to be bought already, and if not, whether it is possible to start them from seeds.
Explain the importance of choosing local vegetables instead of shipped worldwide with regard to sustainability and GHG emissions.
Decide on which plants to go through and think about a couple of recipes that you could make with them, to keep the interest forward and up.

Teachers: 1 hour
Students: 2 hours

Tanks' volumes

SUBJECTS AND AIMS

Math: methods for calculating area, perimeter and volume of geometric objects, as well as unit changes in connection with this. Geometric theorems and formulas and arguments for their validity.



Background

The students will already have some calculations taken during the prototyping phase, upon which they will base this activity.

Goal

Understanding the importance on a practical scale of calculating the volumes of different figures to fit the space available.

For the teachers

Prepare some examples of calculus that would not work and ask the students who finish earlier than the others to explain why.

Procedure

Divide the students into small groups and make them use the calculus made during the prototyping phase to graphically visualize and calculate the measurements and volumes of the different tanks of the system (plants' tank, fish's tank).

Discussion

Not to have during the activity per se, but it involves the tank and the decisions around it.
What kind of material would the students like to have the tank in? Glass, plastic, steel? Discuss the different options based on: where the tank will be located (school classroom, anything can happen, better for it to be sturdy), what is the goal of the tank (to keep the fish healthy and safe), and who will be around the tank (students of different ages, then it is important to consider safety too).

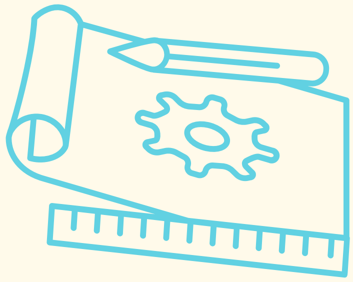
Prototyping session

SUBJECTS AND AIMS

Math: geometric objects and their properties and mutual relationships. Construction of geometric objects, both with and without digital tools. Scale when reducing and enlarging two- and three-dimensional objects.

Background

Farming for commercial production reaches 31% of the overall greenhouse gas (GHG) emissions caused by humans; we NEED to change the way we produce food, in order to use the resources in a more sustainable way. "Think globally, act locally".



Goal

Obtain a general overview and understanding of aquaponics, of why producing food sustainably is vital, and the different types of systems on the market.

For the teachers

Explain what to consider when choosing a system: the purpose of the project, the location, how much space and water are available, how much light, and room temperature.

Procedure

After the teacher's presentation the students are divided in groups and: research different kinds of system, choose one, sketch it. Then, they prepare a presentation on why they made that decision. Finally, they start building a model of it as a prototype (using carboards, and creativity).

Discussion

What kind of plants would the students like to have in the system? Are they complementary to the kind of system that they chose? Consider the technical capability of the system (the rule of thumb of fish biomass is 10 times less than plant biomass). How long do you plan to have the system at the school? Is it a temporary or a permanent feature? Talk about the importance of having spare parts available close by.

Teachers: 1 hour
Students: 2 hours

Critical consumers

SUBJECTS AND AIMS

HKK: ability to plan and prepare food and meals for different needs and contexts.

Background

Some plants do better than others in different aquaponics systems. For instance, leafy green vegetables and herbs (kale, lettuce, basil) are the best choices for a raft aquaponics system.

Goal

Being able to estimate on the long-term which choices to make when buying food, based on seasonal availability, and sustainability of food production.

For the teachers

What grows seasonally in your area? Could it be problematic to find some plants based on your location and season?

Procedure

This is a Think-Pair-Share activity.
The students have to decide what to grow and why in the aquaponics system considering more factors: healthy and balanced diet, economy and environment.

Discussion

How long does every plant take to grow? Would you base your diet largely on the aquaponics harvest, you have to consider this, together with the functioning of the system: not everything can be ready to be harvested at the same time.
What does it take to be a critical consumer? Discuss around today's challenges as a consumer.

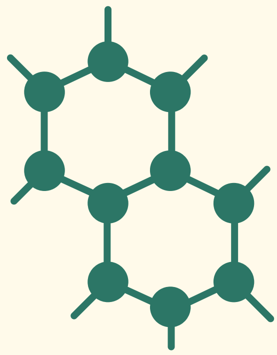
Teachers: 1 hour
Students: 5 hours

Nitrogen cycle... ...fairytale

SUBJECTS AND AIMS

Science: The properties of the carbon atom and cycles in nature, in society and in the human body.
English: texts that are instructive, informative, descriptive, narrative, debating, argumentative and contact-making. Processing of own written representations to clarify, vary, specify and adapt communication according to purpose, recipient and context.

Background



When metabolizing food, fish produces ammonia, which is highly toxic to them. This is why nitrifying bacteria are such key players in an aquaponics system: they convert ammonia into nitrite and then nitrate, which plants can use as nutrients, cleaning up the water that goes back to the fish.

Goal

Understand and be able to clearly explain the nitrogen cycle and oneself in English.

For the teachers

Example of Temaarbete. It could be done in other languages too if students' level is considered high enough.

Procedure

The students write a fairytale in English about one little atom and that atom’s "nitrogen cycle trip" in an aquaponic system.

Discussion

Sometimes, small or invisible things do not get the recognition they should, as happens with bacteria in an aquaponics system. People usually ask about the fish, then the plants, and rarely about bacteria, since it's not visible and they may not know about their existence. Reflect upon the importance of all the parts in the system for it to work, and how this is seen in world-related systems such as societies or schools.

Teachers: 5 hours
Students: 15 hours

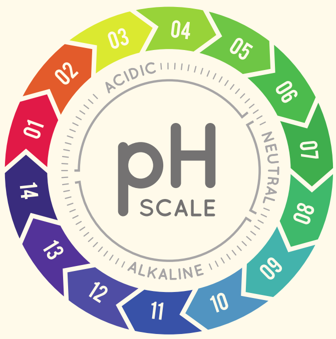
pH, acids, and bases

SUBJECTS AND AIMS

Chemistry: Elements, molecular and ionic compounds. Separation and analysis methods, for example pH measurement. Water as a solvent and transporter of substances. Observations and experiments with both analogue and digital tools. Planning, execution, evaluation of results and documentation with pictures, tables, diagrams and reports.

Background

pH plays a key role in an aquaponics system, as it impacts all of its components: bacteria, plants, and fish. Plants can absorb nutrients better when the pH is lower, around 6, but some fish prefer the pH to be a bit higher, depending on the species.



Goal

Learn how to measure different water parameters, and how they can influence each other in an aquaponics system. Knowledge about pH, acids, and bases.

For the teachers

Check what kind of pH is best for your chosen fish and plant species, then have a contest for students to guess. The one that gets closer to the real number gets to feed the fish the first time!

Procedure

Hold classes around acids and bases. Once the ground knowledge is established, have the students try out different ways of testing the water from the system through a water testing kit.

Discussion

.Where else is pH considered an important factor? Discuss around its implication in our stomachs and in fish stomachs, if considered of interest.

Teachers: 1 hour 30'
Students: 2 hours

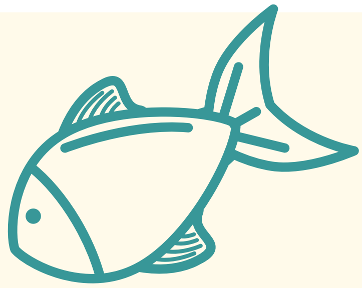
Fish in our diets

SUBJECTS AND AIMS

HKK: the ability to value choices and actions that occur in a home based on how they affect health, finances, and the environment. Ability to plan and prepare food and meals for different needs and contexts.
Science: discussing nutritional content and health.

Background

The majority of fish stock in the seas and oceans is currently overfished and the fish consumption per capita is predicted to raise in the next years. There is a need to farm fish sustainably and aquaponics can be an answer to this need.



Goal

Learn the dietary needs and the nutrients that fish provides, such as Omega-3 fatty acids, and vitamins. Understand why those are vital for the human body to function.

For the teachers

Food for thought: how is fish valued based on different cultures backgrounds?

Procedure

There are more options within this activity: you could either engage the students with questions and facts connected to aquaponics - such as the ones found within this guideline - whilst cooking some fish, or you could have classes around the importance of carefully chosen food, both with regards to origin, sustainability, and dietary requirements. Both of them are also possible of course!

Discussion

Do you usually help with groceries in the family system? If so, how often do you check where the fish you are buying comes from and if it has any label concerning sustainability? If not, raise the discussion within the family circle. Regardless of the answer, discuss around labels within the food industry and their impact on consumer behaviour.

Activity #8

Teachers: 30'
Students: 2 hours

Plants' growth

SUBJECTS AND AIMS

Math: Functions and how they are used to describe connections and change and examine the rate of change. How functions are expressed in the form of graphs, tables, and function expressions.

Background

Plants grow faster in hydroponics and aquaponics, because their roots don't have to "search for" nutrients in the soil since they are already provided with them in the water. The energy saved from that research is then engaged in growth.

Goal

Understand the different phases of a process, in this case, plant growth, and how to use graphs and statistics in real-life examples to examine and describe evolutions of situations.

For the teachers

Students with specific educational needs or with mental health problems can benefit from growing plants: plants grant an interaction that provides non-discriminatory rewards to whoever takes care of them, as opposed to the hardship that an interpersonal interaction could, on the other hand, represent. Moreover, this activity allows repeating concepts such as photosynthesis and the carbon cycle.

Procedure

The students measure with a ruler and document through pictures how much the plants have grown from the start until the harvest. Then compiled into an appropriate chart to present the results.

Discussion

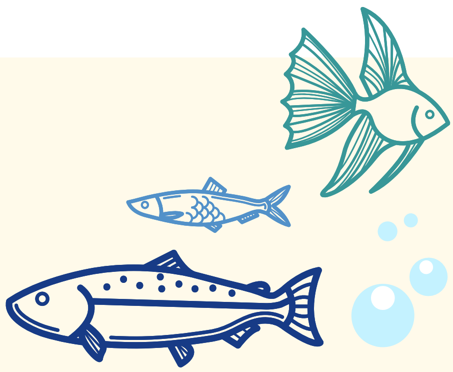
How can aquaponics help tackle world hunger by growing plants in places where it wouldn't usually be possible, due to climatic, social, or economic conditions? Are there any ways you could help tackle world hunger or have a more sustainable food consumption in your everyday life? It could be fun to start a small initiative in the class, to do so, such as "Meatless Monday"!

Teachers: 1 hour
Students: 3 hours

SUBJECTS AND AIMS

Math: methods for calculations with numbers in fractional and decimal form for rough calculation, main calculation and written calculation. Use of digital tools in calculations. Methods for calculating area, perimeter and volume of geometric objects, as well as unit changes in connection with this. Geometric theorems and formulas and arguments for their validity.

Fish stocking density



Background

The quantity of animals kept on a specific area is referred to as *stocking density*. Different fish species require different stocking densities, which must be considered when setting up an aquaponics system as part of animal welfare.

Goal

Understand the functioning of the system concerning its biomass, and basic animal welfare concepts.

For the teachers

Which type of fish is available for you to have in the system? Start from that one!

Procedure

The students calculate the volume of the fish tank and how much water each fish should have. How many fish can you have in the amount of water contained in the tank?

Discussion

Why is it important to consider the right fish stocking density in a system? Reflect upon the different aspects that could be entailed to that: ethics and animal welfare, animal wellbeing and therefore functioning of the system, etc.
What else would the students consider about the choice of the fish to have in the system?

Why are we doing this?

SUBJECTS AND AIMS

Understanding complex world problems such as food production. Raising interest in aquaponics and deepening understanding of its relevance in today's world.

Background

Sad fact: farming for commercial production nowadays produces up to 1/3 of total GHG emissions caused by humans. Happy and encouraging fact: aquaponics represents one of the solutions to tackle this problem.

Goal

Realizing that there are sustainable paths that can be taken to shape a healthier future for the planet and the human race. Inspire and give hope, essential emotion to move from when facing climate issues.

For the teachers

Today's students' generation will face the problems related to climate change more often during adulthood, as they will increase in number and frequency. Hence, it is vital to face the challenge and keep them inspired through action.

Procedure

Have a presentation where a general overview of the problem is given. The way we are using Earth's resources is not sustainable and needs to be addressed. By 2050, 2 more billion people will live on our planet and will need to be fed. Unify these and more related facts for the students to get an extensive understanding of this and other environmental-related problems.

Discussion

Conscious food consumption is one of the ways we can make a difference in supporting a shift toward a more sustainable way of living. What are other ways through which we can make an impact in our society for a more sustainable future? This entails society, the economy, and the environment wise.

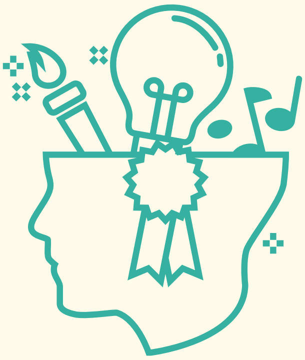
Teachers: 1 hour
Students: 2 hours

Keep the interest up!

SUBJECTS AND AIMS

Art: representing real-life images through pictures, sketches, or sculptures.

Raising interest in aquaponics and sustainable solutions.



Background

Maintaining students' engagement and interest in one subject is one of the main focuses within the education field, and it is not always easy to manage it. A physical reminder of the project could be enough to do so, such as a T-shirt, a bracelet, or a key chain. Go for whatever suits your needs better and engage you the most!

Goal

For the students to feel an active part of the project and engage in a more personal way.

For the teachers

Inspiring students is your super-power and letting their creativity run around a concept makes them feel more connected to it.

Procedure

There are more parts within this activity. The first is for the students to come up with a name for the system, and then design a logotype around it. Secondly, the students decide on their favorite logotype among the different ones created. After this, some content is created using the name and the logotype of choice, such as a small video, or T-shirt. "Want to know more about aquaponics? Ask me!" is an example of what to have on the T-shirt.

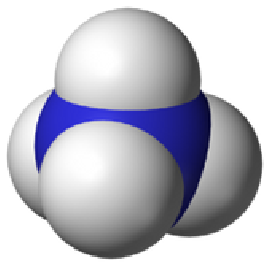
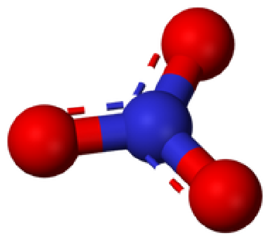
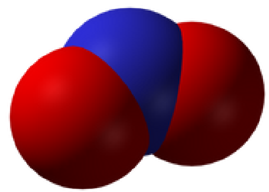
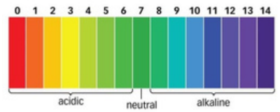
Discussion

How would the students like to do to feel more connected to the project? Try asking them, and go from there.

Tables

In this chapter, you'll find some examples of tables to use, to keep track of the system's values, both about water parameters and fish feeding and behavior. Feel free to change them if necessary or to use them as a draft to make your tables. You could, for example, add more values to be checked, such as iron and trace elements (mostly for the plants) or growth rate for both fish and plants. The students could have some ideas as well!

Picture: Thomas Johansson

		NH_4 			NO_3 			NO_2 			pH 			KH	Comments
Who	Date	start	end	value	start	end	value	start	end	value	start	end	value	value	

Who	Date	Feed in the system (gr)	Uneaten feed (gr)	N of pellets uneaten	Comments on fish behavior

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Enjoy!

Picture: Chiara Fasoli