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AQUAPONICS AS A TEACHING TOOL IN A SWEDISH CONTEXT

How to successfully integrate it into 8th graders' syllabus



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Abstract

Aquaponics is a sustainable way of producing food in a closed system, an answer to better use of natural and human resources during the climate crisis we are in, and can be used as a teaching tool to educate and empower students. Previous research has shown its advantages and utilization in different countries and levels of education, one of which is Sweden. Nevertheless, there is a lack of literature on providing educational tools to teachers based on the Swedish syllabi and its educational framework. This study aims to lay a solid foundation of tools for 8th grade teachers in a Swedish context to implement an aquaponics system as a teaching tool by designing and sharing guidelines with recommended activities and practical explanations. An aquaponics system was built and maintained by 75 8th graders in a Swedish school during a full academic year, to test its pedagogical application within different subjects such as STEM, home education, Swedish, and English. Three rounds of semi-structured interviews were carried out with the teachers working in close contact with the system to analyze and reflect upon the activities experienced, together with personal reflections from the designer of such activities. The key findings are: a lack of time from the teachers to start new projects by themselves without already made teaching materials, a better organization on when to hold the activities through the academic year, and what is needed for teachers to know when starting from zero. All of these are presented in the guidelines designed based on this study and are considered relevant as a baseline for further research, to reiterate and expand on the activities suggested to embed aquaponics as a teaching tool on a deeper level within the Swedish educational framework.

Key words: *aquaponics, teaching tool, system thinking, sustainable food production*

1. Introduction

The human race needs to completely change its food production system now to sustainably produce food for the expected 9.8 billion individuals on Earth by 2050, and aquaponics is a viable option to perform this shift. It has a pivotal role in reaching different Sustainable Development Goals (SDGs) such as zero hunger (SDG 2), quality education (SDG 4), sustainable cities and communities (SDG 11), climate action (SDG 13), and life below water (SDG 14) (United Nations). Moreover, the way food is currently produced represents one of the drivers of climate change, with deforestation, land degradation, exploitation of groundwater sources, and loss of biodiversity as some of the consequences faced (Da Silva, 2012). Farming for commercial production reaches 31% of the overall greenhouse gas (GHG) emissions caused by humans (United Nations, 2021), with 14,5% coming from global livestock (Food and Agriculture Organization of the United Nations). There is still time to restrict global warming to 1.5°C — as suggested in the Paris Agreement —, if action is taken now, and to reduce GHG emissions by 43% by 2030 whilst cutting down methane by at least one one-third. Nevertheless, due to humans' activity on planet Earth, not only more and more extreme weather events such as droughts and storms will happen and are already, but also socio-economic shocks related to the above, about which the food production system needs to get prepared and be more resilient (Food and Agriculture Organization of the United Nations, 2021).



Figure 1 - SDGs tackled by embedding on a deeper level the implementation and use of aquaponics

Aquaponics can be an answer to this call on various levels. Even though it cannot be the only change enacted in the food production system to reach goals such as food security, closing the gender gap, avoiding food loss, lowering GHG emissions, and educating new generations about this kind of farming, it still represents a valuable road to take for the sake of approaching those goals. Part of a broader answer to these goals would be to have a *climate-smart agriculture*, the three key aspects of which are: reducing agriculture-related GHG emissions, improving resilience to climatic variability and changes and increasing agricultural yields (Whitfield et al., 2018). The main advantages of producing food through aquaponics are the higher food rate conversion that fish have compared to

terrestrial animals, the higher grow rate that plants have when being cultivated with the roots directly in water exposed to nutrients, a better utilisation of resources such as land and water and such system does not require chemical pesticides nor fertilizers (Somerville, 2014). Moreover, not many food production systems in urban farms can provide proteins, and aquaponics is one of those that can (Bezner Kerr & Nelson, 2022).

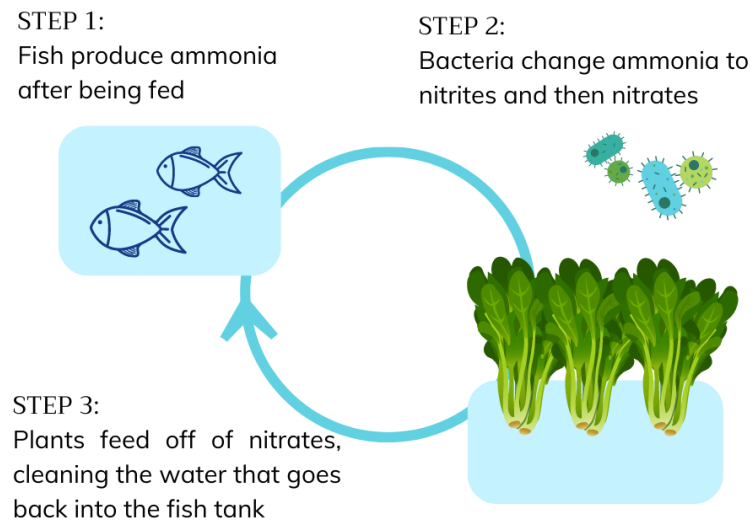


Figure 2 - Aquaponics system functioning

Aquaponics can be classified as climate-smart agriculture since it focuses on innovative technologies whilst possibly informing and educating about them and the necessity of changing the way food is produced and consumed. Social and climate unbalances are present within this field nowadays. According to a study conducted by the FAO in developing countries, food can be lost up to 30-40% within the production chain, with one of the main reasons being the improper utilization of transportation facilities — which are necessary due to the distance between the producing and the selling locations — (Food and Agriculture Organization of the United Nations). Aquaponics systems represent a viable solution to this issue, due to their scalability and possibility to be set in different locations, helping to reach SDG 11, sustainable cities and communities (United Nations). Furthermore, such systems — together with hydroponics ones — increase food security, especially in urban agriculture and in water-stressed environments or arid areas, where land and fertilizer utilization are considerably diminished, connecting aquaponics to the SDG 2, zero hunger, specifically 2.4¹ (Intergovernmental Panel on Climate Change, 2022) (United Nations). Moreover, SDG 13, climate action, is supported by aquaponics systems too, since they represent an alternative to currently existing unsustainable ways of producing food such as agriculture and fishing, by tackling the target 13.3² specifically. Concerning SDG 14, life below water, aquaponics can help towards

¹ « By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality».

² « Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. Extent to which (i) global citizenship education and (ii) education for sustainable

reaching target 14.7³ (United Nations); by increasing the amount of fish produced and captured not directly from the sea and oceans, aquaponics helps the problem of overfishing, bycatch, and ghost nets related to fishing. The last SDG that aquaponics could potentially touch and that its use touches within this thesis is quality education, SDG 4. The aquaponics system can be utilized as an educational tool, integrating it in different syllabi with experiential learning as a teaching method, as explained further in the next paragraph. More specifically, students with specific educational needs or with mental health problems can benefit from this nature-based teaching approach, as the plants in it 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 (Junge, 2020). Furthermore, personal agency is strengthened through this, since the plants will react to care, either positively or negatively and an individual's subjective well-being, functional level, and synergy with their environment are promoted too by this relationship (Junge, 2020).

1.1 Experiential learning

As defined above, aquaponics can play a key role in addressing the issue of climate change and food availability. Moreover, in recent years, there has been an increasing interest in its utilisation as an educational tool. Different theories exist in the literature regarding types of learning and educational objectives, and, to better understand the general background of this field and for the scope of this thesis, Laurillard's (2002) categories of learning, Krathwohl's (2002) revision of Bloom's (1956) taxonomy of educational objectives and Ossimitz's (2000) definitions of four dimensions of thinking will be considered here and as a baseline of the work that will be conducted with the students and teachers throughout the current academic year. According to Laurillard (2002) learning can be divided into six categories:

1. Acquisition (via reading, watching, listening);
2. Inquiry (by doing research);
3. Practice (execution of assignments);
4. Production (of material, either for peers or teachers);
5. Discussion (have conversations and questions around the topic)
6. Collaboration (common goal reached through shared activities for students) (Laurillard, 2002).

In order for the student to reach an effective learning, teachers have to make sure to continuously merge these six learning groups through different activities and whilst assuring cycles of communication, both from their part and the students and among the students and their peers as well (Laurillard et al., 2018).

With regards to Krathwohl's (2002) revision of Bloom's (1956) taxonomy of educational objectives, the main difference from the original taxonomy is that instead of being a cumulative hierarchical framework it is a two-dimensional one, with *knowledge* and *cognitive process* as the two dimension,

development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment»).

³ « By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism».

maintaining the six categories of knowledge, comprehension, application, analysis, synthesis and evaluation, proper to Bloom's taxonomy, but categorising them on a different scale (Bloom, 1984; Krathwohl, 2002). In fact, this same six subcategories are found on the cognitive process dimension, being labelled as: remember, understand, apply, analyze, evaluate and create (Krathwohl, 2002). On the knowledge dimension, four subcategories are present, such as: factual knowledge, conceptual knowledge, procedural knowledge and metacognitive knowledge. It is of interest to discuss this taxonomy since it can be used as a tool when designing activities beforehand in relation to the given curriculum as well as when reviewing them once done and understanding where and how to adjust the activities based on necessities.

In order to introduce experiential learning, the last concept considered is system thinking and, more specifically, four dimensions of it:

1. Thinking in models;
2. Interrelated thinking;
3. Dynamic thinking;
4. Steering systems (Ossimitz, 1996).

The first two dimensions are highly connected to classroom aquaponics (Junge, Bulc, et al., 2019). Thinking in models requires being able to determine how to represent a system depending on the model considered (e.g. deciding among equations, different diagrams, etc.), whereas interrelated thinking considers causes and effects of a determined system (Ossimitz, 1996). Both are enhanced throughout experiential learning, as it is defined below, and are therefore considered key competencies to understand the majority of problems in the world, including sustainability (Junge, Bulc, et al., 2019), main aspect within this master thesis project.

Experiential learning is an educational theory based on John Dewey's work as a psychologist, philosopher and educator. During the decades, the body of literature around the topic has grown exponentially and from that and for the sake of synthesis within this thesis, Kolb's view of it is reported. As Kolb (1984) writes: "Learning is the process whereby knowledge is created through the transformation of experience" (Kolb, 2000). Experiential learning, also described as "learning by doing", emphasises the importance of the process of experiencing a lesson over its outcomes (Kolb, 2000). Within this framing, the role of an educator is to distinguish the experience of something from the expectations around it. In the utilisation of an aquaponics system as an educational tool, this would mean that it is more important for the students to fully understand its functions, more than achieving the systems' perfect functioning (Junge, Bulc, et al., 2019). Moreover, the difference between learning, performance and development is constantly integrated into the environment where the learning takes place, meaning that to learn it means to think, feel, perceive and behave, as an holistic process of human adaptation (Kolb, 2000). In relation to this, knowledge is passed from the educators both in forms of new concepts and as a modification of old ones already acquired from the learner (Kolb, 2000). However, a crucial aspect of teaching is to maintain the interest of the students over time; in order to do so, educators have to consider the environment in which the difficulty of a specific task is given, not to overwork the students (Milliken, 2020b). Nevertheless, errors will occur in everyday teaching and this is why it is recommended that educators, or the designers of the activities, not only *experience* themselves, through experiential learning, but also *repeat* the learning cycle over time and then *exchange* knowledge about a specific field, among peers (Vaneycken, 2020).

1.2 Participatory design

Participatory design is a research methodology comprehending a group of practices, methods and theories where more stakeholders act together towards a common situation whilst making explicit what normally is tacit knowledge (Spinuzzi, 2005; Vaneycken, 2020). The goal is to have participants' knowledge as an essential part of the process, since it describes how it is perceived and experienced, also emotionally, in order for it to shape the artifact of the design process through a higher level of empathy around it (Dell'Era & Landoni, 2014). Moreover, it is a research methodology that requires reiteration in order to process and enhance the understanding of the artefact, tacit knowledge included, from both the participants and the designers (Spinuzzi, 2005).

Participatory design and experiential learning are similar and intertwined in the way that they both comprehend a shared exchange of knowledge and actions over time and repetition. They both are appropriate for this specific project due to the fact that identifying students' behaviors and their changes towards sustainability are the main aims of this part of the SMAK project, together with communicating the sustainability of blue food, as further explained in the dedicated paragraph. The students will be given different roles in decision-making related to this project, so to build trust in taking initiatives and collaborate with adults, once established a safe and trusting environment. Said environment will be as power-balanced as possible, in order to be productive for the students, even more since their approach is different from one of an adult, since their age (14/15 years old) allows them to an openness towards connecting with things that is less culturally conditioned than the adults' one (Vaneycken, 2020). One of the goal of using this kind of approach is to empower the students through practical activities towards proposing their own ideas and suggestions.

1.3 Examples of aquaponics systems used as a teaching tool

There is a small body of literature that displays some examples of how aquaponics can be used as a teaching tool already. Cases such as Junge (2019), have considered different countries and different grades to start activities with. One of these has a specific relevance for this thesis as it was conducted in the same country as this study is, Sweden, in a primary school (Älandsbro skola) on the east coast. Students considered for this case were aged 9-12 years old and the study was carried out for a total of 10 months. Some of the activities performed were in relation to maintaining the system and considering its changes through daily evaluations of it, such as addition of water, concentration of relevant parameters (pH, nitrate, nitrite, ammonia), and state of plants and fish (Junge, Griessler Bulc, et al., 2019). Another example is the one conducted in Switzerland for one semester with students aged 12-14 years old (Junge, Griessler Bulc, et al., 2019). This is considered to be relevant both for the students' proximity in age and for the understanding that merging aquaponics into already existing syllabi positively influence the students' system thinking. In this case, distinct groups of students were assessing the system at different times, exchanging a dairy for transferring the knowledge acquired throughout the study. These studies expose how concepts such as feedback, relationship among system components and system thinking can be deepened and understood through maintaining an aquaponics system and designing activities around it (Junge, Griessler Bulc, et al., 2019). Although these studies provide a solid structure upon which base similar ones, more research is still needed, within different countries' ways of teaching and at diverse levels of education. The idea from which

to start the change is for aquaponics' knowledge and understanding to become accessible to as many people as possible.

1.4 SMAK project

Smart Mat från hAv till Kök project (SMAK) is a communication project guided by the Swedish Mariculture Research Center (SWEMARC) since 2018 (Universitet, 2022). It focuses on creating a deeper understanding of sustainably produced nutritional food, via aquaculture and aquaponics, for the public's everyday life. The public, commercial, and private meal sectors are targeted through various events and activities to reach different goals. SMAK's four main communication objectives are the following:

1. Increase and disseminate knowledge about sustainable aquaculture;
2. Change the target group's attitudes towards sustainable aquaculture;
3. Make targeted contribution efforts to the identified target groups;
4. Influence food consumption patterns in favour of sustainable aquaculture.

Among the smaller projects and events organized in order to reach the former objectives there is the one explained and taken forward within this master thesis. As previously observed, aquaponics systems are one of the possible answers to not only the climate but also food production crisis that the world is facing. The SMAK project attempts to recognise how people can change attitudes and grow in system thinking through experiential learning. One way, among others activities, through which it does so is having an aquaponics system implemented in a high school and utilised as an educational tool. A group of approximately 75 8th graders and the school staff will have the opportunity to learn by doing whilst seeing locally what difference this kind of systems can act and, from there, the responsibility that they could have to make a change either in a small or large scale, since it could theoretically be reproduced everywhere globally. Therefore, the goal is to work in close contact with them during the academic year 2022/2023 by learning the different aquaponics systems and more in relation to them, such as how they function from a biological point of view, why they are necessary from a sustainable perspective and the effect that growing one self's food can have, both individually and as a community. Sustainably produced food is used as a way of talking to the people, both as a concept and by using it in real life examples, as in the making of algae salt. Lastly, there is a focus on showing how food produced through aquaculture and aquaponics supports a healthy and nutritional diet thanks to the essential amino acids and omega three fatty acids present in the fish and to the vitamins and minerals in the vegetables.

1.4.1 Communication

The way blue food is talked about in the media and how communication is framed around it helps to form the understanding and acceptance that the average consumer has of it. There is a need for a deeper comprehension of aquaponics way of producing food from the consumer point of view, in order for those products to be integrated into everyday consumption more, and, eventually, be preferred over other not sustainably produced options, such as industrial farming and wild-life caught fish and seafood. Furthermore, the fact that aquaponics products are not yet approved to be certified as organic does not help the consumer's choice, when those same products are perceived as higher in price as well (König et al., 2018). Therefore, effective communication strategies and marketing plans aimed to educate consumers and shift their behaviors need to be planned as soon as possible (Miličić

et al., 2017), even if aquaponics, aquaculture, and hydroponics lack observable data to start acting on such strategies in Europe (König et al., 2018). For these reasons, it is utterly pressing that different stakeholders come together to discuss such bureaucratic limitations and act to raise consciousness around the importance of supporting sustainably produced food through everyday choices, starting with public decision-makers (Miličić et al., 2017). Hence, the importance of this project stands in tackling the disinformation around aquaponics starting locally in the Gothenburg area, through educating students and teachers via experiential learning activities, workshops, and lectures. That is because this lack of knowledge from the consumers around aquaponics and aquaculture is evident in Sweden too: when 1002 Swedish were tested in a survey around their overall understanding, 31-58% of the participants did not know about fish farming and farmed fish (Rönnerstrand et al., 2020).

1.4.2 Fridaskolan

The SMAK project for the academic year 2022/2023 takes place at one of the six Fridaskolans primary schools in Sweden, the one located in Grimboåsen, Gothenburg. Fridaskolan are private schools, six of which primary, six preschools and two high schools. The one where this master thesis project is held is located in Kvillebäcken, and comprehend a total of 601 students from age 6 (förskoleklass) up to 16 (grade 9). The students considered for this study are the ones in 8th grade, for a total of approximately 75 pupils: some of them have changed school or moved out of the country during the year. The teachers that took part in the study are four, within the subjects of science, technology and mathematics, English, Swedish and home economics. The art teacher was part of the project too with regard to few activities, but not as connected and involved as the others. A preschool is also present in the same location, taking care of toddlers and kids from age 1 to 5.

The school in general is sensitive to sustainability aspects. Moreover, Fridaskolan's teachers way of working as a community appeared to be appropriate for this project — having a constant communication among teachers of a same grade and sharing activities through inter and transdisciplinary education —. To run an aquaponics system entails growing or working on different aspects, among which, the social one of increasing community cohesion (Rizal et al., 2018). It then seemed relevant to start the project where this cohesion was already present (Melén, 2022). Additionally, one of Fridaskolan's central way of teaching is value based education, where human values are focal and taught via practical example led during everyday life from the teachers. The goal is for the students to become “train wanderer”, a metaphor to express the action taken by the students when facing challenges, resulting from this teaching approach (*Mer om Fridaskolorna*).

Lastly, the chosen aquaponics system for the study is a raft one, and it included: a fish tank of approximately 200 L, a total of 8 grow beds for 80 pots with a length of 4.16 meters, two water pumps, and two bags of approximately 40x30cm of bio-balls for the bacteria to colonize and live in. To maintain the system functioning and check the water parameters, the following tools have been used: a water testing kit for pH, NH₄, NO₃, NO₂, and KH, and iron and trace elements supplements for the plants and bacteria whilst waiting for the fish to arrive.

1.4.3 Aquaponics' limitations and challenges

As discussed above, a wider use of aquaponics can be beneficial under various aspects. However, it should be noted that aquaponics has some limitations too, both generally speaking and with regards to its teaching in schools. Some relevant general limitation is that knowledge on aquaponics' impact on climate change is still scarce (Bezner Kerr, 2022). On the teaching angle, practical situations such

as technical issues, insufficient expertise and holiday maintenance along with teachers' possible indifference are all factors to be aware of and consider (Junge, 2020).

1.5 Main aim

There is an urgent need to expand and deepen the current knowledge around sustainably produced foods together with and in order to positively shift people's behaviours around those. Aquaponics' systems can be used as an educational tool in order to reach these goals. Recent cases reported by Junge et al. (2019) (Junge, Bulc, et al., 2019) also support the hypothesis that it can be used in such manner, providing case studies in different levels of education and from different parts of the world such as Sweden, Switzerland and Belgium, as already discussed above in further details. Nevertheless, there is a lack of scientific background on how to use aquaponics as a teaching tool with older pupils within the Swedish educational setting. This master thesis's project is focused to explore and describe how an aquaponics system can be used in Sweden to facilitate teachers' use of it as an educational tool in different schools whilst deepening the knowledge of sustainable food. Therefore, the aim of this master thesis is to lay a solid foundation for teachers to start using aquaponics as an educational tool with similar projects in new realities.

1.5.1 Research question

What are the guidelines for a successful utilisation of an aquaponics system as a teaching tool for 8th graders in Sweden, based on the Fridaskolan's Kvillebäcken case study conducted in the academic year 2022/2023 with pupils aged 14-15 years old?

1.5.2 Objectives

The following objectives are defined in order to answer the research question formulated above:

1. Construct and maintain an aquaponics system during the academic year of reference;
2. Formulate guidelines meant for teachers to start similar projects from, with a general timeline and suggestions for each phase;
3. Design examples of activities for 8th grade teachers in Sweden that combine aquaponics' related topics with their already existing syllabi, whilst enhancing system thinking through experiential learning;
4. Gather examples of everyday life obstacles that can be met during such projects and communicate how to manage them;
5. Identify and propose viable solutions on how to finance similar projects.

2. Methods

This thesis is structured following the action-research methodology, meaning that systematic data collection (through the semi-structured interviews described below) and practical work (through the activities designed and actuated at the school during the academic year with the students and teachers) combine (Spinuzzi, 2005). This choice is based on the results from previous research on aquaponics as a teaching tool, which suggest the use of qualitative methods, such as semi-structured interviews together with self-observation, to be more valuable than quantitative methods, for this field of research (Junge, Griessler Bulc, et al., 2019). Therefore, these are the two main methods chosen for

this master thesis, supported by others further described in the sections below. Lastly, the structure displayed in the following image is taken as a reference for the methodology of this master thesis (Junge, Griessler Bulc, et al., 2019).

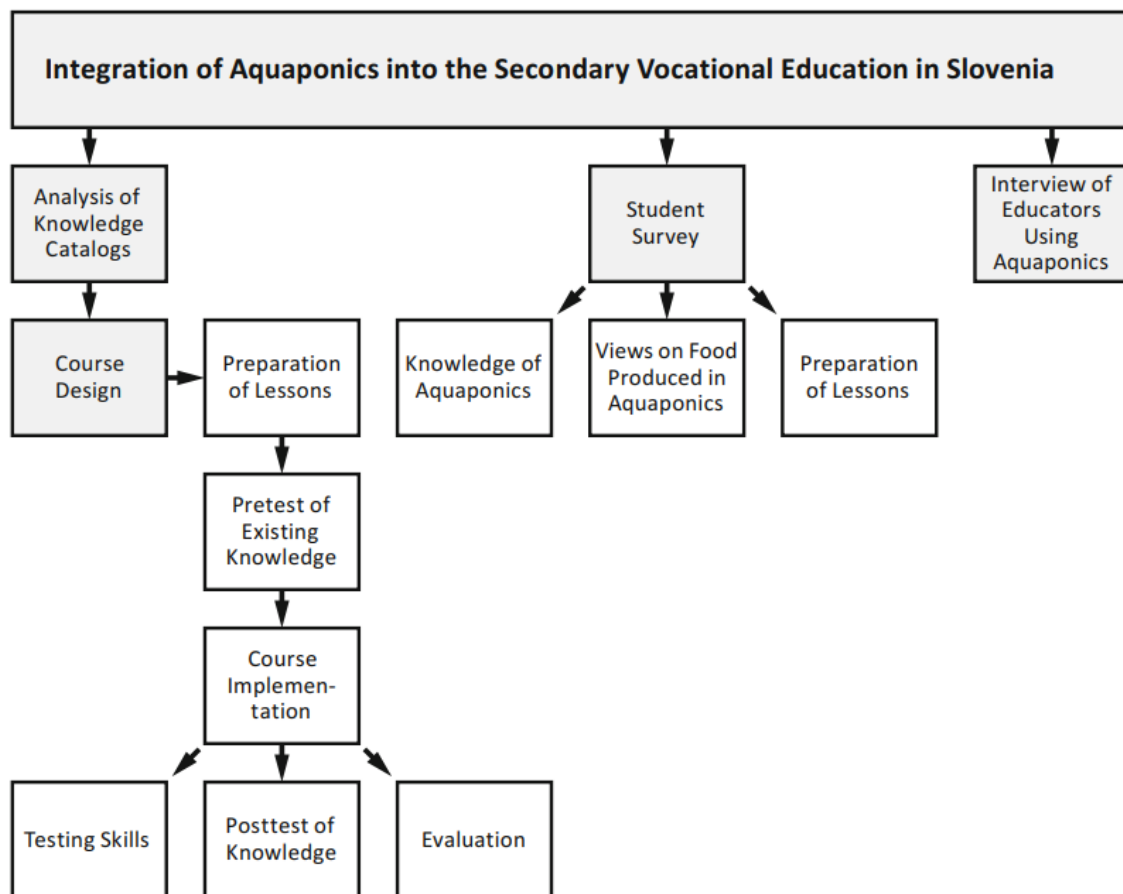


Figure 3 - Structure from Peroci (2016) (Junge, Griessler Bulc, et al., 2019)

Within this chapter, three subsections are considered: teachers, my role, and students.

2.1 Teachers

Three different semi-structured interviews are carried out throughout the academic year with each one of the four teachers that work in close contact with this project (see appendices A-N). Each of the three semi-structured interviews has a unique framework, based on the phase of the project upon which it questions about. The first one is held in January/February and it concerns the prototype and starting phase; the second one, in March, goes in depth about the hands-on part, building the system and taking care of it when only the plants are in place; the third one, in April, examines the phase where the fish is in place and how the students relate to that. The structure of each interview is designed to identify what worked and what did not work for each phase. This is to not only have a more explicit understanding of it, to have a baseline to start from when a similar project is carried out again in a similar context but also and mostly to have a solid foundation upon which designing the guidelines for the teachers. Furthermore, these interviews are *semi-structured* in the sense that an order in which to ask the question is designed beforehand, but when the interview is held, it is just as important to be able to let go of said structure and possibly come back at it later, if beneficial for the flow of the conversation (Longhurst, 2003). Generally, the first questions should revolve around

easing topics for the participants to talk about, and the most uncomfortable questions should be left by the end of the interview, or when it is noticeable that the interviewee is comfortable enough to answer honestly (Newcomer et al., 2015). Something more to consider is the tone through which a question is asked, together with the silence that comes afterward for the participant not feel pressured or too controlled (Leech, 2002). The role of silence is vital during pausing moments too. When the participant may need a prompt, words are not always the right ones to use; at times, some things as small as tilting the head or nodding in silence are exactly enough for the participant to continue with further explanations, while on the other hand words or exclamations of astonishment may cause the opposite, having the participant feel uncomfortable and not understood (Newcomer et al., 2015). Other examples of probing techniques are echoing the participant's last word or a central one for the discussion and "baiting" them into thinking that the interviewer already knows certain pieces of information, making the participant comfortable enough to expand on those (Whiting, 2008). This way of conducting interviews allows the interviewer to open a space of focus on topics that they may have not considered as of interest in the first place, therefore permitting openness to uncertainty to support the study. Nevertheless, at the end of each interview, it is a good scientific practice to check if everything was asked (Longhurst, 2003) and note anything relevant that happened. It is also good scientific practice to review the notes either the same day the interview is taken or as soon as possible, for the experience to still be fresh in the interviewer's mind (Leech, 2002). Lastly, the participant should always have clarity about whether the conversation is recorded and for what use (Whiting, 2008).

After each round of interviews, I hold a workshop with the four main teachers working on this project. Each workshop is based on what emerges from the interviews and from what kind of knowledge or understanding of each phase is missing. The workshops aim to deepen the understanding of each phase through different activities, as explained in further detail in the next section.

2.2 My role

In this paragraph the use of I as in myself will be present, to facilitate the explanation. By conducting this master thesis project, I fill different roles. My sole presence in the space together with the way I communicate with others affect the way this project is perceived and the opportunities that creates. Moreover, I am the designer and organizer of how this project is conducted and of some activities within this, such as presentations, workshops, field trips, and semi-structured interviews carried out throughout the academic year considered. Additionally, my figure comprehends the role of tutor and facilitator of learning: I help to enable a learning process around aquaponics that is guided, supervised, and directed to transfer knowledge and possibly create a network of people already embedded in the school system, or not, that are interested in this project (Milliken, 2020a). Whilst being present at the school, the role of the facilitator faces more intragroup dynamics through which it is necessary to understand how to move to make the interpersonal and group exchange beneficial. The goal is to balance the six different dynamics that are present, which are: "groupthink, laughing out loud. free riding. unequal power, apart together, destructive conflict" (Vaneycken, 2020). With regards to workshops, the structure from which to present them is layed upon the doubts, questions or ideas retrieved from the semi-structured interviews from the same phase – either prototyping, hydroponics or aquaponics –. On the overall, there are three parts of each of the workshop: introduction, core and ending. The main goal of each workshop is to explicit concepts useful for the

formation of the guidelines. These concepts can be represented by prompts, knowledge and awareness related to the aquaponics' utilisation as a teaching tool: they do not have to be tangible in order for them to create meaningful change (Vaneycken, 2020).

Within this project, teachers are part of the experiential learning process just as much as pupils are: they are subjected to gaining new knowledge whilst maintaining the pace with their academic program. Hence, within my roles, it is vital to protect their involvement in the long term as well. One way to do so is to help provide ideas and materials related to aquaponics that can be integrated into the school classes to reduce their amount of work (Junge, Griessler Bulc, et al., 2019).

Personal reflections are also a part of the methodology of this thesis. By summarising my interpersonal and not experiences at the school through daily and weekly reflections, I put into practice experiential learning. This is done through explicating what I live, what can work and what does not in terms of educational activities, and how to communicate clearly the importance of producing food sustainably. I follow a general structure when reflecting upon the days and the activities, together with writing down peculiar things that happen. The general structure for personal reflection is as follows: note date, what kind of event, describe what happened, what I research, with what method and how does it connect to the methodology and approach. Lastly, pictures and videos of activities are taken throughout the academic year to report and as documentation.

2.3 Students

As expressed previously, the main aim of this thesis is to formulate and design guidelines in order to help teachers in Sweden to reproduce similar projects in different schools. Therefore, the methodology used in relation to the students' is central as in they are a fundamental part of the teaching process, but not pivotal for the aim of this specific thesis. One way through which the students' knowledge around sustainability and aquaponics is tested through within this project in SMAK as an overall is a questionnaire. The students answered its 20 questions at the end of the previous academic year, 2021-2022, and they will take the same questionnaire one academic year later, 2022-2023 in May, at the end of it, once they had the chance to work hands-on with the aquaponics system and learn about it through experience-based activities. The answers will be compared and discussed as part of SMAK, and will not be considered for this thesis due to time restriction. Nevertheless, it is of importance to state the existence of this questionnaire to put this thesis into context.

The methodology used within the scope of this thesis to test the students is for them to decide which kind of system to have – putting into practice their personal knowledge –, build it in real life, to maintain the system functioning, and to take daily notes about the systems' parameters using the table shown in Appendix O. This include when the system is fed and when water is added to it, then to test for pH, ammonium, nitrate, nitrite and alkalinity concentration, water temperature, activity of the fish and states of the plants.

3. Results

A summary of the main findings with relation to personal reflections, students' roles, semi-structured interviews and workshops is provided in this chapter.

3.1 Personal reflections

In these citations, the names of students, teachers, and people have been changed in order to maintain the privacy of the protagonists.

The majority of the categories of learning previously described (Laurillard, 2002) are found within more references in the personal reflections collected throughout this academic year. For the sake of punctuality and significance to the thesis's objectives though, only some of these have been selected. Concerning the types of learning of practice, discussion, and collaboration, the following comment is considered from the activity of connecting some pipes to the system for the water to flow from one tank to the other:

«Each one of us had different ways of teaching: S's way was doing and telling what was needed to do next, J would do things without necessarily explaining them verbally, and as for myself, I guided the students with reflecting about how to practically do what was needed to be done. Each of these teaching ways is beneficial in its way» (26/01/23).

Within this example, the pupils could follow different ways of teaching, and therefore learn differently. In the following ones, the category of discussion and comprehension are present again, and participatory design too, since the students in question either felt like trust was built over time and therefore felt comfortable expressing themselves or took the initiative proposing solutions or were an active part of decision-making:

«Today students that never spoke to me up to this point started timidly to have conversations and ask questions; maybe not necessarily about the project itself, but it still is an improvement in how they feel they can come across to meet me in a different language which, in my opinion, represents an obstacle» (02/12/2022).

«A student asked if there were other schools that were doing something similar working with aquaponics: realization of them being a part of something bigger» (27/02/2023).

«Today Student Y asked me if he could bring in another student to do the water parameters checking together and I agreed. One way to have the knowledge passing by to as many students as possible is for the students themselves to talk about it whilst experiencing it together at the same time» (03/04/23).

«I asked some students how to make a calendar that could work as much as possible for them: they said e to decide for themselves, and not expect the opposite» (03/04/23).

In relation to system thinking and its enhancement through experiential learning, more specifically within the subfield of interrelated thinking:

«Student X had a good comment on how to fix the leaks we've been having: if it was possible to lower the pressure of the water coming from the small holes in the white tubes. This shows that she understands how the different parts of the system are connected» (13/03/23).

An aspect of interest in the next reflection is around the teachers' involvement over time and my role as facilitator and organizer, which is found in the second example as well. In the third one, the role of the facilitator and the level of collaboration are explicated:

«I reminded the four teachers I work with that we would have the second workshop next Tuesday, and a crash with real life and planned life happened: some of them forgot about it. We decided to postpone it, either to next week or the week after. This moment in the academic year for the teachers is a pretty stressful one since they have teachers-parents meetings the whole time and one of the goals of using an aquaponics system as a teaching tool is to maintain not only the students' but the teachers' interests too over time. Therefore, I understood that it was not the right time for me to respond and waited for them to decide among themselves; it was for the best that I did not intervene, even though by nature I would have done so. But, instead, this gave them the time to pause and somehow relax at the idea of still having to participate in the workshop and having to set it in their schedules» (17/03/23).

«Where to physically locate me when I'm in school and not working with the system? The more reasonable answer would be in the room where the system is, for people to start associating my face with that place and also for them to feel more opportunities to approach the system/project if a familiar face is there to talk to. But that place is also "far from the action" I work with, it's a floor downstairs from the 8th graders» (07/03/23).

«Even though one focus of this project is the students, they are not the only one and not having them around today allowed the janitor and I to talk about the system a bit more. Of course, I will not be able to catch how these kinds of conversations throughout the year will maybe start or change something in someone's life, but they are still relevant and, overall, make the bigger picture easier to follow for more people, giving a sense of community work and goal» (06/03/23).

About my role as facilitator and tutor and group dynamics:

«During the second group, from 9:30 until it was done, around 11:15 the majority of the students took turns except for two of them, Student 1 and Student 2, to whom I asked if they wanted to keep building also with the second group, both to give a feeling of continuation to the experience and because they were helpful players too. Through their help, I had the opportunity to raise the group dynamics. This also leads me to describe how delightful and enlightening it was to sit through their different ways of expressing different intelligences. For instance, Student 1's one today was very practical, whereas Student 3's was kind and obliging and Student 4's was talkative. There has been a moment when a small black piece of the system was nowhere to be found. We searched for it for a while and then the students lost focus, so I asked Student 3 what he was thinking, where the piece could be. He said that maybe it was put accidentally inside a different part, to which I answered, "And could we manage to see that?" Student 4 then proposed a way how to do so. Another student followed that explanation and less than ten seconds after that we found the piece and were able to finish putting the system together. I tried to leave the space for the students to express themselves, facilitating the explicitation through words and non-verbal communication of what we, as a group, were working with – to "solve" it – whilst also trying to guide them and keeping the things going properly at the same time» (13/01/23).

More in-depth on group dynamics faced through the year, what it meant, and handling everyday frictions:

«Before leaving the school though I had a brief and meaningful conversation with teacher X about an unfortunate comment they made the day before about the system. Yesterday, after having heard that comment, it felt like they were not respecting the project and the work we've been doing together.

Then, having reflected on it, I decided to politely let them know that their use of some words was not appropriate and I asked them what they thought of it, also saying that I know that misunderstandings happen and that we also speak a different language, making it more prone to these kind of situations to raise. They realized that the use of their words was unfortunate and told me that they didn't mean it, then proceeded to assure me that they all – and them too – are glad that this project is happening and grateful for my presence here. Although the confrontation went well, I was relieved to have clarified a misunderstanding within a short time, avoiding it to become bigger than it was» (13/01/23).

«The rest of the group was genuinely interested in it, but could not completely focus due to the presence of the others. In the end, we skipped the last part of the activity, their reflection papers, and they'll do it tomorrow during English class instead» (01/02/23).

«To share a physical environment does not necessarily mean being on the same page. Teacher 2, on the other hand, seems to be sharing both spaces: the aquaponics one and the teachers' one, making him a vital component of this project» (21/02/23).

In terms of educational activities that worked, the following are considered:

«Something that worked is to have students join in groups when we have all of them (approx. 72 people) doing the same activity at the same time: this way it was possible to include and keep track more easily of the difficult students among the others. Moreover, a sense of responsibility toward the group arose in some students, and communication among peers was tested as well. [...] Concerning the teachers, I asked them directly what their opinions were of the day at the end of it and they all expressed enthusiasm in seeing students so well-focused. They were not expecting the outcome of this day to be this surprising» (11/10/22).

«When, before giving a little reminder of the different aquaponics' types, I asked them if they remembered them in the first place, all of the classes named all of the different systems we studied» (02/12/22).

«A conversation between two students I partook in that went like this. Student 1:” Recently I’ve developed quite a deep and real sense of interest towards biology...” Student 2 ”Don’t you think it’s probably related to the aquaculture project?”» (09/02/23).

On the other hand, educational methods and activities that did not work are stated below:

«A difficulty among group members was that some just wandered around, leaving the whole group work to their colleagues. [...] Some group dynamics were frequent such as the division of the workload not often being equal among the group members and some pupils being a little out of reach, not participating in the activities. Nevertheless, teachers say that those pupils are considered to be “problematic” within all the activities they have» (11/10/22).

«[...] need for a better communication system among us; even though the disconnection is shown more often from the other part; how to prevent this?» (30/01/23).

3.2 Students

During some activities based on participatory design in September and October, the students decided the kind of system to have for this project. Then, a small group of students and I built the system in January, as shown in the picture below. To name one of the said activities, we had a day-long workshop on researching, studying, and prototyping their favorite aquaponics system for our specific



Figure 4 - Top picture: students building the system; bottom left to right: students inserting seedlings from soil into pots for hydroponics; student harvesting bok choy. Pictures: Chiara Fasoli

experience, based on our needs and goals. The presentation I gave to start that day is included here as a single example of the various ones I held for the students during the year, and it can be found in Appendix P. After that, an activity with planting seedlings to grow and then be transferred into the system was carried out by all the 75 students, in order to give a sense of belonging to each one of the pupils so to feel more connected to the project. When the seedlings were ready to be put in the system, we did that and then we started maintaining it functioning by checking on it approximately twice a week filling in the water parameters table, provided in Appendix O, whilst waiting for the fish to arrive. Once the fish arrived, in late April, students and teachers started checking on it daily, using the table shown in Appendix Q with regards to the fish feeding part. At the start of May, the first big harvest took place, followed by a home economics class where the students cooked and ate the vegetables produced from the aquaponics system: two different varieties of bok choy and basil. Even though we managed to keep the system stable enough to function with no major incidents happening, it is important to reiterate that the goal of using aquaponics as a teaching tool is for the students to fully understand its purpose and how it works, rather than handling a perfect functioning one (Junge, Griessler Bulc, et al., 2019). Through the year something I put a lot of attention into is to properly balance the amount of responsibilities and workload on the students, being careful not to overdo it to maintain their interest and drive on a long term prospect (Milliken, 2020a), even more after carrying the semi-structured interviews with the teacher and acknowledging students' level of stress through their words too. Lastly, the combination of the activities performed during the academic year showed

all of the six levels of learning described by Laurillard (2002) to be attained from the students (Laurillard, 2002).



Figure 5 - Student verifying water parameters: ammonium's level. Picture: Thomas Johansson

3.3 Teachers

3.3.1 Semi-structured interviews

SSI 1

In the first round of semi-structured interviews, a common view amongst interviewees was that the activities held within the first phase, and the prototype one specifically, generally worked. As for references:

«When we talked about nitrogen and its cycle, they learned a lot [...] everything we did last semester actually worked. [...] we had time to plan the whole thing. We took time to do that and you have to do that because otherwise you can't plan a big thing like this» (teacher 1, 08/02/23).

«We can make things in the curriculum happening in the correct order within this project, we don't have to take things outside the project and put it in the curriculum. We can use the curricula and we have done that in a proper way» (teacher 2, 24/01/23).

«Good to have a day for it and that we have a start and some end of the project, a lot of that part at the same day that it didn't grow and become a week or a month for all, because of it was that narrow of time [...] Yes, it's good. With math we did the parts of volumes like that type of calculation that we did in 9th grade, but because of this project we got to do it in eight grade and that did work good. [...] the system and building it and in science those parts, and English and... *Home economics*? Yes, home economics. It has been really good assignments too» (teacher 3, 26/01/23).

«We know each other already and then it has been like I think really great to know you and have the connection around this project» (teacher 4, 26/01/23).

Nevertheless, there have been some activities that did not work as well:

«If we would have done things in the proper order and the way we have decided to do it, things would have... the outcome would have been easier for us, but we keep forgetting things since we have more things to think on all the time and that we don't predict when we are doing our schedule etc etc. So I think the plan is actually really good from the beginning, but I'm not quite sure it's there all the way because we keep forgetting things» (teacher 2, 24/01/23).

«That activity that we did that was too hard. They taught that they have already done it» (teacher 3, 26/01/23).

The themes of different levels of learning (remember, discussion, and collaborate) (Laurillard, 2002), participatory design and experiential learning (experience, exchange, repeat) (Vaneycken, 2020), both among teachers and among students, recurred throughout the dataset. The most relative examples of these are:

«If I took new students in 7th grade and I knew that we are going to do this project in the 8th grade, I should plan more how to, what I'm going to do in the 7th grade before the project to really use the aquaponics system project in 8th grade better. [...] Things we did in the fall was really great and I had a red thread in everything we did, so I don't want to change that, but so maybe it's about the things I did in seventh grade, if we're doing this again, I should save that for the Eighth grade when you do the aquaponics instead» (teacher 1, 08/02/23).

«Throughout the project we have learned a lot and I think that's [learning by doing] the way you learn it. [...] *It's always nice when you can see that they are... Reflecting? Yes, that they take the knowledge within their... like they metabolize it and they can use it for different things than just having the knowledge itself.* I think so too and take it to another situation or place and reflect upon it. It's really cool. *Do you feel like they've been doing that to reflect upon the different activities or?* Yeah, some of them and in some occasions not everyone and always, but that's impossible once again. Yes, they are! They are talking about it in different situations and referring to it» (teacher 2, 24/01/23).

«I got more and more interesting in it. Probably because I understand it more than I did in the beginning; I got bigger understanding from the students and the work that they have done and looks and told about a little, told me about and that was really good. [...] Prototype day was a really good day: almost everyone went all in and try to understand [...] and that they felt that their opinion counts. [...] A lot of students like this project, as I might think and to see what they're doing in school is a real project and is connected to the university... hm, yes, that's a reason to do it. It's not just us as teachers to tell them that's good» (teacher 3, 26/01/23).

«You do things on real [...] I think the student did their best on every single task that we were giving them and then they have like they needed to transform theoretical things and make it practice and practice sizes... these things in real if you know what I mean, because if they didn't do the math they couldn't do the math task that they were doing... [...] I think everything worked but maybe it doesn't went on like it was supposed to do in the first time but then, I think you and we did some something on everything. not going as you have planned you can change it when you are doing the thing that you're doing or you can... something will come up, it will always come up things that do that you have to change your plan or something» (teacher 4, 26/01/23).

It is relevant to point out in the second to last quote before mentioned, the passage of knowledge from the students towards the teachers, as a circular exchange of it. Concerning the students' interest during the first phase, there is a sense amongst interviewees that it raised as much as the aquaponics knowledge deepened.

«It's their project, that's our project, the students' project. So they know more about it than I do it right now. It's good. [...] Over time the students got more interested, I think in the beginning they didn't understand anything» (teacher 1, 08/02/23).

«Together with the knowledge about what we are actually doing from the nitrogen level all the way up to the sustainability level, I think the more they know the more it's easier to be part of the project in the right proper way, [...] I think their interest increased together with the knowledge, I think» (teacher 2, 24/01/23).

Commenting on the students and in relation to system thinking, one of the interviewees said:

«For some of them, I think that they see the bigger thing in it and what I mean with bigger thing is... that they can see how things like connect get connected to each other» (teacher 4, 26/01/23).

More on system thinking, but from the teachers' perspective, and with regards to the importance of communicating things clearly through different stakeholders and therefore through different levels of knowledge and understanding of the topic:

«I only knew about the word "bluefood" and had no idea what we were talking about, so I didn't understand» (teacher 1, 08/02/23).

«At first I didn't understand, I couldn't figure it out, how it will work» (teacher 3, 26/01/23).

Reflecting upon what could be changed in order to enhance the learning and teaching process, would a similar project be carried out in similar contexts, all of the four teachers expressed the need to spread the assignments in a more balanced way both during the semesters and within the different subjects. Lastly, one interviewee stated that it would have been:

«Easier for the students if we had gone and seen some aquaponic system in the first semester [...] and make them see the aquaponic system in real before, because then they can have like a picture of how it should look because for some of them it is like too abstract to see the bigger thing and that they don't do it not because they don't want to see it, but because they can't see it. [...] they would have been more motivated» (teacher 4, 26/01/23).

SSI 2

Regarding the second cycle of interviews and what worked within the second phase, the following concepts arose:

«I appreciate the dinner we did for the parents. I think that was really good. I think it was. It was good timing in the project because they could talk a lot about it for their parents when they were up into different classrooms and showing what they have done. That was good» (teacher 2, 29/03/23).

«Good that now for a little bit of time we have not been doing that much, that there have been resting from it. [...] Now it's the fun parts, because you can see it and see how much it's growing» (teacher 3, 13/03/23).

On the other hand, some references on what did not go as planned and led us to work and deal with failures:

«Of course we will do stuff that wasn't as good at it it could be, but that's normal I guess when we actually try something yeah, it's an experiment» (teacher 1, 20/03/23).

«It was hard for us in the beginning to have an open view for everything that was going on (with relation to the project)» (teacher 2, 29/03/23).

With regards to the students' participation in the activities, how much work to present to them or not (Milliken, 2020a), and how they felt about it, which is a human aspect to consider when managing people's motivation, the teachers said:

«I think some of them is scared to miss out in other subjects [...] we will always get students that are interested in the system and want to do it, but when it's too much for them in the other subjects, it will get harder and harder to get to add a student to help [...] I think we have a lot of students that want to participate and I think it's interesting to do the water testing but we have a lot of students actually as well whom we shouldn't allow to do that because they won't do a good job. Maybe if we are, we can supervise them. They can do it and that if we can supervise everyone. I think everyone should do it once» (teacher 1, 20/03/23).

«Need to involve the students to see that these assignments, to check out the fishes and do the tests and stuff like that, doesn't impact on the other studies so that they feel understand and that they have the time to do it. I think that's very important. [...] be really clear with them that this will happen like once, twice [...] they're divided on how to divide their time into this different things right now. Yes, that's the same for some of them that really like this, that want to be a part of and they like to go down and do things with you» (teacher 3, 13/03/23).

The following quote refers to the students as much as the previous ones, but it is appropriate to state that it includes me expressing an opinion as well. This is considered relevant to include for two reasons: firstly, because of the different roles that I simultaneously play in the school context, and secondly because of reflecting upon my role is part of the methods of this thesis. In this case, the roles played are the ones of designer and facilitator of learning (understanding how to have the conversation around the aquaponics system be more present among the students):

«I have noticed individually you can say, for the part where they have been down here and learning about the water parameters [...] the ones that are interested has really gained interest [...] *and I started going with almost everyone, they were more flexible around it like I guess maybe they felt like as if there was a bigger sharing of the experience. [...] good to include as many people as possible in, with regards to the phases like if it's a phase when you can have more people than do it because it's more of a shared experience then*» (teacher 2 and me, 29/03/23).

From now on, my presence in the quotes – when it represents more than only supporting the interviewee through questions, but also expressing opinions – will not be further explained, and will be given as an identifier of the different roles I have played. With that, the following quotes revolve around the different levels of learning of repeat, and remember, (Krathwohl, 2002; Laurillard, 2002) interrelated thinking and experiential learning.

«More beneficial for them to have the activities straight after the knowledge the theory part which could happen next year. Or maybe not, because then they, we talked about that then and now they are,

what's that now again and then "oh yeah" and then remember on a totally new level. *Yeah, but I wouldn't wait too much time though because it feels like lots of them didn't really remember*» (teacher 1 and me, 20/03/23).

«I think they will understand chemistry and ions and the cycles even more when they actually test the water and they see the NH₄ symbol and "ah!" Ammonium ion, that's why we talked about that okay. We tested now, how much we have and that's good» (teacher 1, 20/03/23).

«If I should do it again, I would do probably almost the same. Because we have talked a lot about stuff that's going on both inside the body and inside the environment and etc. So it's good to have the project because I would have talked about those things anyway. [...] Teacher 1 was actually down (in the biology room) with her youngest (son) yesterday. Maybe maybe we could copy that. maybe our students could do that also: "this is our system here are the fishes it's tilapia and blah from Africa temperature good feeding fish blah blah and these are our veggies. We have the blah blah blah blah blah" and then we can fika» (teacher 2 and me, 29/03/23).

«What about for the students? I think they have learned a lot. I was actually talking to one of the girls preparing lunch for us every day and she said that 8th and 9th graders never had so much salad or veggies as they do right now and I said maybe that could be a part of our project. I don't know. Wow! Uh-huh! I don't know, but they are eating really really much veggies and if I take a look at their plates right now. There are more colors then it is usually so, maybe maybe...» (teacher 2, 29/03/23).

«I think if we should like have this kind of project in the future. We need to think it through so that we can have more, different types of subjects knowledge. Because you have a list of things that the students need to be, that they should have like learned before the 9th grade. [...] I think that you should... if you should be in this project for next year, you should talk to the teachers. *Yes, I think there should be some kind of exchange what I was trying to say is that you as teachers from this academic year, 8th grade [...] and the next teachers that are gonna come and use this system, so that you transfer the knowledge that you gained during the last year*» (teacher 4 and me, 20/03/23).

In relation to what to change considering this phase, the theme of structuring activities differently, more evened out through the academic year and connecting more subjects at the same time, surfaced again:

«Take the assignments with us we did in the fall and think about what of them can be saved for the spring» (teacher 1, 20/03/23).

«Områdesarbete⁴. Yes. I think we should have had one of those sometime here. I think we should have one in the beginning and maybe two during the way and one at the end also» (teacher 2, 29/03/23).

«I think that the most important thing is to start up with the project directly after the summer break because then you can like have a plan for the whole year and you can also plan other things that the students need to do. [...] I think that we could have more SO⁵ maybe in this project and talked more about the global goal and shipping. [...] But if we had, if we had known these things that we know today, we could have like saved some things and do it in this project. [...] and you can like prepare

⁴ *Områdesarbete* is the concept of working on the same topic as a group, tackling it from different perspectives.

⁵ SO in a Swedish academic context refers to social subjects such as social science, history geography, and religion.

them in the 7th grade and because if you do so, I think it would be would have been more easier for them to manage to do the things in the 8th grade» (teacher 4, 20/03/23).

SSI 3

With the last series of semi-structured interviews, when referring to the students and touching upon practice, collaboration (Laurillard, 2002), the following opinions were expressed:

«I don't think that teenagers are generally that interested in fish and plants. They think it's cool that we did it and that they can see it. But I think the majority of the students just are used to it now, so " yeah, yeah, it's the aquaponics system". And the ones that take care of it are the ones that are more interested in it because they feel attached to the whole system» (teacher 1, 27/04/23).

«and when this system is up and running younger kids can also participate in this, maybe they can't take care of the fishes, but they can do something they can write about tilapias. They can write about different vegetables. They can write about things and paint and whatever, there are always things to do which involves the kids and once the kids are involved the teachers must be involved also because they get questions and they must be. They are forced to be interested, so I think once the system is up and running it's more easy to involve everyone yes, I think that is the key» (teacher 2, 26/04/23).

«Yes, but someone, some of them are happy and excited about the fish [...] I talked to Student M and she was just stressed, but she didn't know what to do, and Student L said "I can show you, this is just going to check the water levels and stuff like that" plus, so that's the easy part. So she tried to calm her down, it's not that much» (teacher 3, 24/04/23).

On the topic of experiential learning, the next two quotes are both from the same teacher, the former with regards to experiential learning among students, the latter among teachers:

«Show them that their opinion is it's important for us and if we haven't suggest "let's do like this" and they don't know it really, it won't work. It's good to listen because it will probably not work if they say so. They know each other. [...] show them how much you can involve in like math, we have done a lot of stuff in this project in the fall about the volume and calculation like that. That's a big win and the students see a reason to do it» (teacher 3, 24/04/23).

«I think we have one thing that it's good to do, is to do a lot of stuff in the beginning of every semester because in the end of it we are stressed out about everything about the students and stuff like that. Then stuff that we have to do by the curriculum and stuff like that because this is a really good project. I think, but take a lot of time to do it in a good way. And so, do the biggest part and most of it in the beginning that will help a lot, I think» (teacher 3, 24/04/23).

With relation to possible changes with a similar project, the theme of spreading the assignments differently through the year was stated again, together with comments on the amount of student, and the locality, as it follows:

«Or maybe more students that are involved in it and take care of it, because we have more students that could do it, but we don't have the energy or time to do that right now» (teacher 1, 27/04/23).

«Keep the system in the cafe, that would have been the perfect spot for it because we will have vegetables in the correct area in school, not stacked in some classroom somewhere, where most of the school never comes to, it would be in the restaurant where everyone goes to all day, and this would have been easier for everyone to take part of it» (teacher 2, 26/04/23).

«Get the system running faster, I think so. And I know it involves a lot of more work. Of course it does but I think that's still the thing we are interested in. [,,] So I don't think we need to change anything else. I think we have the right students to help, I think we have thought of a lot of things... especially you have! *Yes, that's another topic. What about all of these thoughts if this head is not here? Where are they gonna be? How are they gonna be used?* Yes, that is a problem if you weren't here, we wouldn't have anything of this of course» (teacher 2, 26/04/23).

Quotes that reveal an understanding of system thinking, from the teachers on their experiences:

«You need to involve the students. And then force the interest to the teachers, because I think if the teachers or the staff in school knew a lot about this, so they would feel so sure about it that they could be able to teach their own kids or husbands or wives or whatever, they could come here during the weekends and show it to other people. Families or whatever I think that would be, that would be the best part I think. [...] (the principal) could also send another email which has "if you're in first grade you can do things like this with our class. Just don't go up and look take part... let the kids be a part of it". Yes, these are examples on how you can do it» (teacher 2, 26/04/23).

«For teachers as well: if the students get so involved in it and see the reason why to do it. It's easy for the teacher to do this as well and not that many discussion about why are we doing this and stuff like that. It's easier to make a lot of stuff in the short time because we are working with lots of teachers and do the whole "områdesarbete" and that's win win about the time. You save a lot of time by doing like that» (teacher 3, 24/04/23).

«Up to our school leaders and then other I don't know people to decide if we should do more or less, and if we should do more then we should involve other people then they need to find space for us to do it» (teacher 4, 25/04/23).

Lastly, relevant comments commenting on the general interest, how to keep it going whilst maintain a good quality of mental health and stress:

«We are tired, really really tired. We have a group of students that take all the energy away. So we are literally walking on our knees. It's hard to get out of bed in the morning, because you're so tired, so I don't think it has something to do with the system actually, we are just very very tired. I think that we don't get the help we need with the students right now, so we are fed up with... *And the school is indeed a stressful environment to work in.* Yes, very very much» (teacher 1, 27/04/23).

«We were going to get t-shirts and I think that also could have been a part of raising the interest because if we had a fun t-shirt and something on the back like "would you like to know anything about aquaponics? ask me!" that would also create interest I think» (teacher 2, 26/04/23).

«*Add something to the schedule to say to the students that if they feel that it's too much they can come and talk to me about it. Just be very clear about it. That's true. To consider the mental impact*» (me during the interview with teacher 3, 24/04/23).

«It's not the personal interest, it's about the curriculum that we have [...] And there is the issue that I see, because I have an interest of doing this, but then we have like other things that we must do that

are not connected to this project. [...] if other people have the interest I would say it would work out and I hope that they have the interest to start up with it after the summer again» (teacher 4, 25/04/23).

3.4 Workshops

1

After having held the first four semi-structured interviews, I reflected upon what the teachers thought about what worked and how to integrate it, together with what did not, in a meaningful way into creating the guidelines. As a start though, during the core of the first workshop, I asked the teachers to think about and share what useful guidelines have and are in their opinions. The images below were created during the session and gathered information that became explicit throughout the workshop.

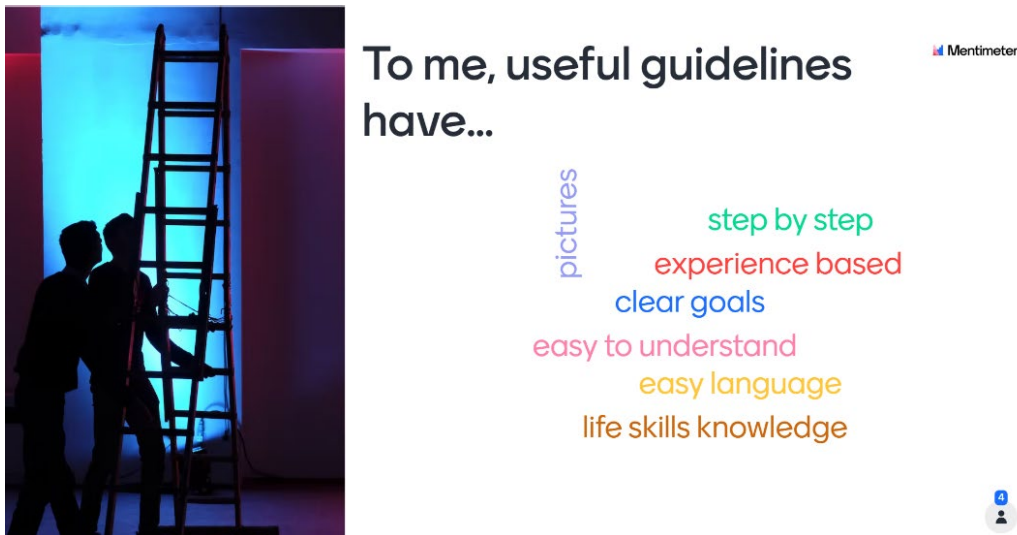


Figure 6 - Explication of what useful guidelines should have in the teachers' opinions

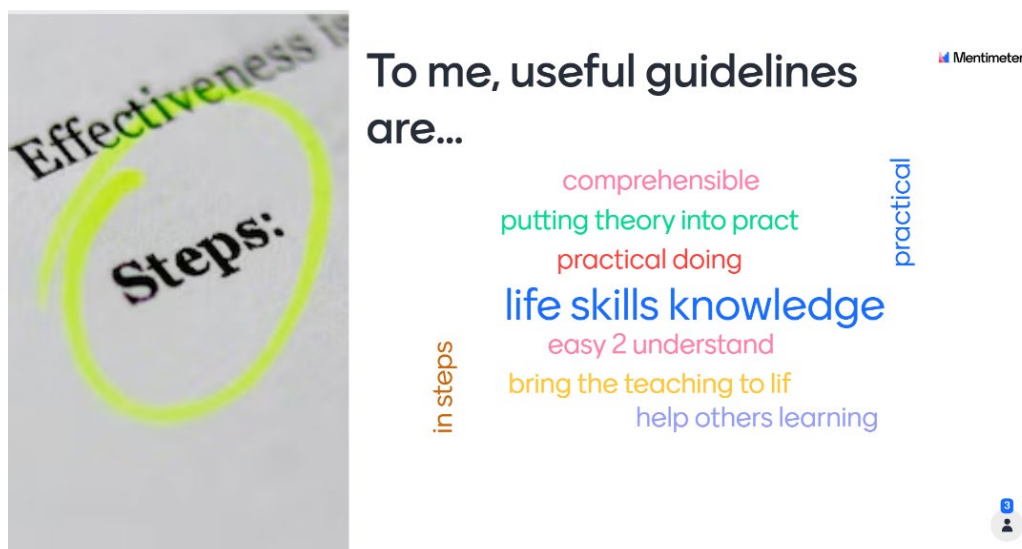


Figure 7 - Explication of what useful guidelines should be in the teachers' opinions

Afterward, we filled an *idea bank* with the different concepts that emerged and then I divided the group of teachers into pairs, both to stimulate a deeper conversation among themselves with the prompt of “What would you include for guidelines related to similar projects?” and to improve energy and ease, by asking them to find a name for each pair. Moreover, I showed them guidelines that

already exist on using aquaponics as a teaching tool, such as the Erasmus+ AQU@TEACH project and the eco-life aquaponics one, to start the conversation upon what needs to be included in their opinions as the targeted audience of teachers (*AQU@TEACH home page; K-12 AQUAPONICS CURRICULUM*). We then had a brief discussion about the different phases and brought the workshop to a conclusion by having some anonymous feedback on it, such as the following:

«Nice way to have workshop» teacher 1.

«Supergood! For a different flow in the answering process maybe hand us the questions in writing, to be answered. Some of us are having trouble understanding otherwise. Good job!» teacher 2.

«Thank you, it's nice to discuss different ways of further developing the teaching and how to spread it to other schools and the profit of working thematically» teacher 3.

2

In preparation for the second workshop, I realized that the teachers' knowledge of their syllabi, their goals, and how to combine those to enhance students' learning and system thinking with the support of an aquaponics system had not yet been made explicit. Therefore, the core of this workshop revolved around this, by highlighting the goals directly from the syllabi, and around the activities that we already proposed to the students, to discuss what worked and what did not, including time management, reiteration, group dynamics, and power-balance-related topics (Spinuzzi, 2005; Vaneycken, 2020).

3

Before holding the last workshop, I started designing the guidelines based on the findings of the previous two. This allowed me to understand how to structure this one, by having a clear vision of what I was lacking in results. Thereby, the core of this meeting was composed of a discussion on how to structure the activities differently, timewise, through the academic year, a conversation with the teachers about the parts that needed to be discussed more thoroughly to be more effective, clear, and comprehensible as possible – such as examples of activities and what subthemes to include in them – and a visual presentation of what I had done until that point to ask for opinions, and suggestions. The feedback on this workshop were the following:

«Very good to get an overview on things we have done! You are prepared which is really importante!» teacher 1.

«Nice to sit down and discuss the things that we have been doing» teacher 2.

«I think it helped you a lot. It was nice to see your guideline» teacher 3.

4. Discussion and guidelines

Based on the results, this study found:

1. A structured way in which holding the activities through the academic year that supports the teachers' schedule, without adding more stress or being time-consuming;

2. Suggestions based on experiences and discussions on how to create interest around aquaponics, both for students and for teachers, such as creating boundary objects on the theme (t-shirts with the logotype on them for instance) that form a sense of belonging and help committing to it on a more personal level, and visiting similar realities to visualize aquaponics systems beforehand, to understand in real life;
3. An overall appreciation of experiential learning through aquaponics, recognized both by the teachers and the students.

The first two points expressed represent two of the three main units in which I decided to divide the guidelines: a general introduction to the document and to each chapter, practical and technical information section, and examples of activities. This division is based on the results obtained through the methodology, and to reach the main aim of this thesis, which is helping to make the use of aquaponics as a teaching tool in a Swedish context as accessible as possible for teachers. Each unit is explained in further detail in the following chapters, where some visual examples are shown. For the sake of clarity and accessibility to both documents, the guidelines as a whole are delivered as a separate PDF from this thesis. The level of detail decided for this guideline has the aim to give a general overview of the functioning of aquaponics, without going too much in depth. That is a step required for the teachers to partially make on their own, based on their specific context and educational frameworks.

Overall, the tone and the vocabulary used in this guideline are decided according to the target audience in mind, teachers working with 8th graders in Sweden, and to the results obtained in the workshops held with the teachers, mostly the workshop number 1. Therefore, the idea is for the information to be as clear as possible, providing just the right amount of details to fire the interest of the readers without exhausting it, whilst guiding them step by step. The palette of colors used is based on one of the logotype designed by one of the students, which I believe well captures the concepts of aquaponics with its shades of blues and greens. The choice of the different fonts is based to facilitate reading to the greatest extent without boring the target audience, and on personal taste. Lastly, canva is the graphic design tool used within the creation of this guideline, both for its free version is accessible to everyone and for its user-friendliness. If this guideline is to be reused and possibly modified by next users, then this tool was thought as being the best choice for the reasons mentioned above.

4.1 Introduction

This section provides a general overview of why aquaponics is needed, how to use it and its advantages from an educational perspective. The concept is for the teachers to start reading from here, and then to feel interested and supported enough to keep going with the practical utilization of the guidelines.

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: even the so-considered "difficult students" oftentimes behave differently than usual, in a calmer way. 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.

4.2 Practical and technical information

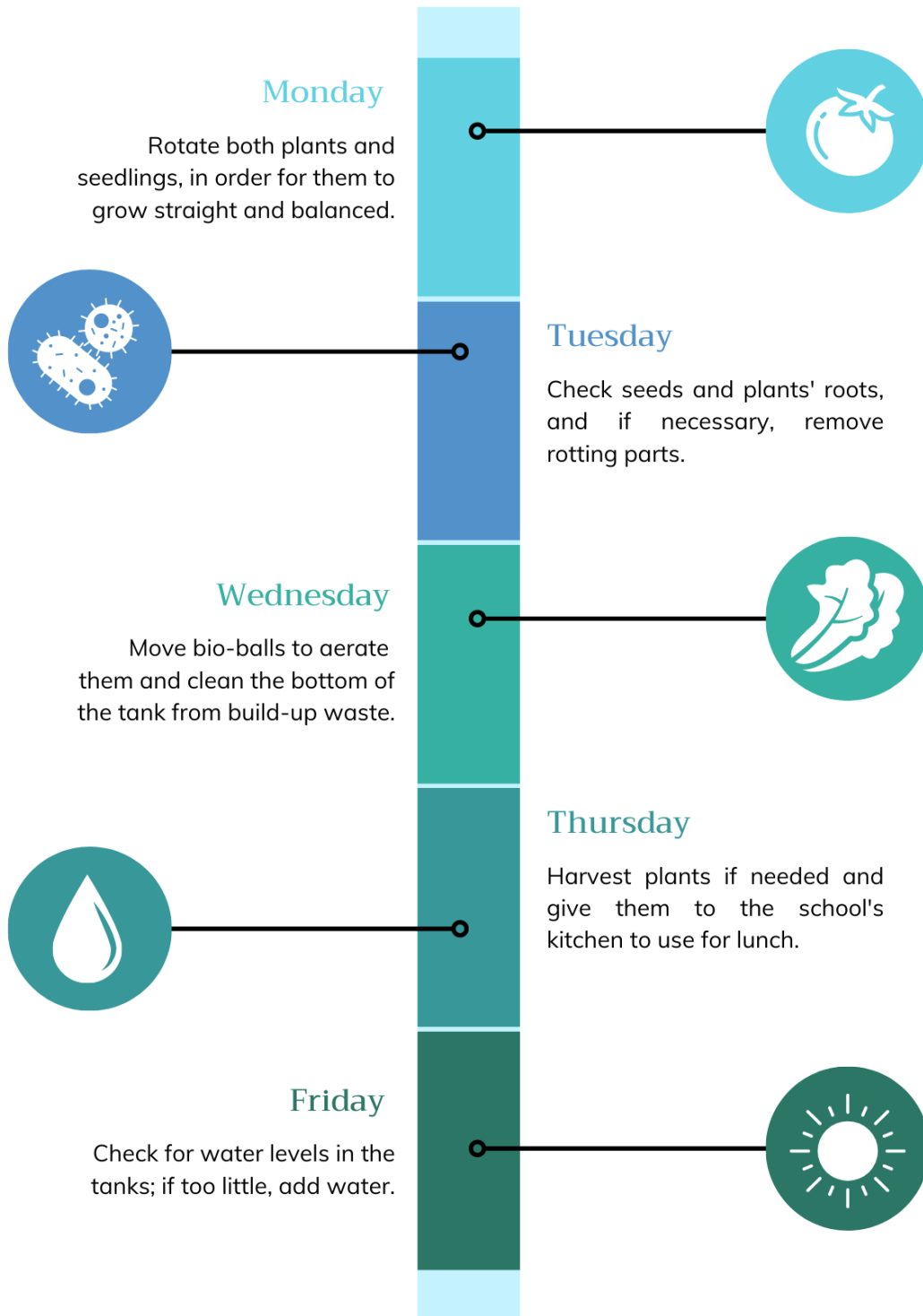
This part is the most critical one, as it provides all of the practical and technical information that may seem more challenging if facing the theme of aquaponics for the first time through the guideline. It includes more parts such as:

1. Yearly and weekly schedule with a suggested distribution of activities;
2. Daily maintenance of a fully functional aquaponics system, with more thorough information on:
 - a. How to take care of the plants
 - b. How to take care of the fishes
3. What needs to be measured and how;
4. Components needed to build the system when starting from scratch;
5. Everyday obstacles and how to manage them.

With regards to point 1, the results show the best outcome to be dividing the activities according to the academic year, by having sections devolved to aquaponics with clear start and ends, mostly at the beginning of every semester. Points number 2, 3 and 5 are based on experience gathered about maintaining the system with the students through the year, whilst point number 4 is based on Junge 2014 and personal reflections (Junge et al., 2014). Within this section, the weekly schedule and the daily maintenance are taken as examples. In fact, understanding how to maintain a system from scratch can be the most intimidating part, even more since it involves live-beings in it. At Fridaskolan, I printed a copy of the daily maintenance and put it up on a wall in the biology room, where the system is located. This way, students during weekdays and teachers on weekends have the feeling of being guided and can accurately take care of it.

The weekly schedule does not include weekends, and this choice is made intentionally, since an hydroponics system can survive without being checked on for two days, which an aquaponics one could too, with the exception that is required by the Swedish law to check on the fish daily, for the animal welfare. On the other hand, the daily maintenance part is thought for when a fully functional aquaponics system is in place.

Weekly schedule*



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

Figure 9 - Example of second section of guidelines, "Weekly schedule"

Daily schedule

Fish

- Feed them at approx the same time every day (range of 4 hours, ex 8:30 -12:30)
- 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

Water quality

- Check the parameters every day before feeding the fish: this will change the water chemistry and it is better to have it checked before that happens, in order to know beforehand if there is some odd value that needs to be acknowledge
- Always have aside some more water than expected to be able to double check results if needed

Overall maintenance

- Plants: any leaf or dead plant that needs to be removed? Are there plants that need to be rotated or harvested?
- Leaks: always check for new ones, and keep everything outside of the water dry to spot easily new leaks
- Water: check for the level in the system: add some if there is too little. Make sure to remove build-up waste from time to time

4.3 Activities to generate interest, and examples of material provided

The last part of the guidelines revolves around a key factor in the implementation of aquaponics as a teaching tool: interest. This is meant both for teachers and students, with regard to the complexity of the activities presented, and considering the surroundings in which they are held (Milliken, 2020a). The subparts into which this chapter is divided are:

1. Examples of activities and workshops that could be held in a school environment based on the different syllabi (science, mathematics and technology, home economics, English, art, Swedish);
2. Examples of extracurricular activities designed to boost energy through the year, when stress and tiredness are higher than usual, such as fieldtrips, and organizing events related to produced food through aquaponics and similar. This is relevant to consider as it represents an essential part of the context in which the study has been implemented and will be again, and it was found to play an important part explicitly in the results too;
3. Examples of tools for teachers to base activities from, such as water parameters and fish feeding tables.

In this chapter an example of activities in the school environment is shown. As illustrated in the following picture, the activity is described within more sub-sections: time necessary for its actuation, both for teachers and for students, subjects and aims, background, goal, procedure, discussion, and “for the teachers”. The first two subsections are relevant since they target the lack of time of the teachers to implement new projects in different ways. Firstly, having clear how much time the activity will require allows the teacher to easily organize the workload. Secondly, knowing which subjects are involved with which activity makes it straightforward for teachers to decide whether it is for them or not, and, possibly how to combine it with different subjects through an “områdesarbete”, which has been shown to have a key role in supporting teachers’ work in the context where the case study took place. The background part permits to the teacher to present the activity without the need of a very detailed personal research beforehand and the procedure part is especially important as it gives step-by-step instructions on what to do.

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.

5. Conclusions

The use of aquaponics as a teaching tool allows students to learn through experience about a variety of themes already included in their syllabi. This way of learning, being different from the more used one of frontal lectures by having the students actively involved, makes it possible for pupils to challenge themselves in a new context, so to open to new behaviors for a deeper and more comprehensive education. Moreover, it was shown that taking care of living beings such as plants and fish enhances the students' sense of responsibility and understanding of complex systems, leading to a clearer perception of environmental issues mostly related to food production.

The teachers involved in this study and I designed and held different experience-based activities during the academic year and tested what worked and what did not within these. The most important outcomes to emerge from this study are:

1. To divide activities through the academic year with more focus on the start of each semester, for the teachers and the students not to perceive it as a burden during more intense academic periods such as the end of semesters, with gradings and such;
2. To visualize a system in real life in the first phase, to have more students and teachers get a deeper understanding from the beginning;
3. Either the necessity to have a figure role to lead similar projects that is not a teacher in the school, due to lack of time set aside to do so, or to find a way to integrate this way of teaching on a deeper school level.

These findings, together with the produced guidelines, will be of interest to teachers in Sweden to implement similar projects, by providing insights and practical suggestions on how to do it based on a case study. The guidelines provided are to be considered a materialization of this thesis research question, being a prototype from which possibly start a reiteration and deeper research on practice. Therefore, a natural progression of this work is:

1. To share the guidelines with primary schools in Sweden, for them to acknowledge this possibility and understand whether to implement it themselves;
2. To reiterate the guidelines in different school contexts and have focus groups of teachers giving feedback on them to understand its strengths and weaknesses, and what to change to get a better user experience;
3. To discuss them with the schools in Älandsbro and Gotland, which have experience in the field with using an aquaponics system in a Swedish context, but with students of a different age than 8th graders;
4. To keep the conversation open in the school taken as a case study, for them to comprehend how to embed this way of teaching in the long term, and possibly include it in the various Fridaskolan's locations.

It is necessary to state the limitations encountered during the implementation of this study too. Firstly, combining participatory design practices with the larger than usual number of students for a classroom (75 of them, with respect to usually 25 in different schools) represented a challenge in understanding how many of them and who of them to integrate into which activities. Even more, since the goal of such projects would be to embrace and empower as many students as possible.

Moreover, sometimes students wanted to join aquaponics-related activities but did not want to lose the classes going on at the same time, making it complicated for them to understand how much to get involved, even when the interest was present. Secondly, teachers' time was periodically very limited, and some activities that could have been integrated within the aquaponics system were not, because they were already been studied during the previous academic year. This could represent a field of further research, to find more activities related to the syllabi – such as photosynthesis – that within this case study did not have the opportunity to be tested in real life. Finally, another limitation has been the cultural and language barrier present between the Swedish environment in which the project was carried out and me, as an Italian international student and English speaker.

Lastly, it is indisputable that for a bigger and easier shift to happen to include aquaponics as a teaching tool on a broader range, more stakeholders – such as the Swedish Ministry of Education, municipalities, and private investors to name a few – need to take accountability in the conversation and take action by changing pre-existing structures of educational aims and goals by inserting environmental sustainability in them. Key players in the educational framework need to discuss this further and act on it if they want the new generations to be prepared to face climate change on a practical and active level. This would be a fruitful area for further work together with assessing the long-term effects of using aquaponics as a teaching tool on students' academic or work-related life choices.

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8. Appendices

Appendix A, Teacher 1, SSI 1

This interview will be a part of my master thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this conversation.

What is the first thing that comes to mind about this project?

Participation. The students can participate a lot in this project and they learn a lot.

And have you seen that in their behavior based on these activities, or like how they talk about the activities?

Yes, and they ask about it. When do the fish arrive, it was about when are we going to build the aquaponics system. And then when we talked about nitrogen and its cycle, they learned A LOT.

And what about the first memory related to this project?

It is when we had the first meeting, and I only knew about the word "bluefood" and had no idea what we were talking about, so I didn't understand until teacher 2 showed me a picture on the computer.

I was thinking... what about the first image that comes to your mind if you think about this project?

The first memories is when we had the first meeting and I only knew about the word blue food and I had NO idea what we were talking about... so I didn't understand a bit! Until teacher 2 showed me a picture on the computer and.... "aaaaaahhh, now I understand".

Okay, so maybe I expressed I was thinking not the first memory but more like the first image that comes to your mind if you think about this project.

No, I do not understand, isn't it the same thing?

Maybe you already... mmm. I think it could be different like it could be something more but maybe you already said it with participation.

Yeah.

So in this interview, we're gonna talk about what we already did up until this point. So we did, from the start, from when I step in in September we had the kids getting to know aquaponics, learning the process of how it works, the different kind of systems, then we had the prototype day, then we had the field trip to HDK Valand and the library and the nobel dinner and the aquaponics related activities that were there. So these are some of the parts that we did together and then of course there's also the part that you did as a teacher by yourself. So with that in mind what in your opinion did not work? If anything. For example could be the environment, the outcome for the students maybe was to broad or maybe....

I think everything it did last semester actually worked hmm and everything worked.

That's nice to hear.

Maybe we didn't have the same picture of it in the beginning but we found a solution and we made it work. So no, nothing.

Hmm, and what about... So there was no friction or like no problems, what do you think that worked in on the other hand? What did you think that made it possible for this to work up until now?

That we had time to plan the whole thing. We took time to discuss what to do in all the subjects and which subject we can could do it from more than just biology or we could discuss how we should do it in geography and social sciences as well, so that stuff take time and we took time to do that and you have to do that because otherwise you can't plan a big thing like this. I guess

That was good. That's true. We took some time in the beginning which also reminds me that we have to do it again. But we're gonna talk about that. Okay so something that worked was to take some time off beforehand to plan and what else?

I guess the school is a good place to do something like this on, because we control a lot of our schedule ourselves, so if you call us a day before and say can we do this tomorrow? Often we can manage to do that... in another type of school it's not possible because it's a lot of other people that are included in that and they have more rigid schedules, so it's hard I think. We usually work like this because we have our equality and it's like we decide that we want our students to learn about this thing. What can we do and what subjects can we include in that? and we maybe have like three of those each year, so this project with aquaponics is one of those, so we're used to work like that and that helps.

Yes, what are the other topics for this year?

Sex and aquaponics again I guess because it was so big, so we needed to have at all in the fall and spring but in history they are going to talk about I don't know the word for it in English in the 18 1900 now, oh my god. When we started to build up industries and do stuff and industry and in Swedish

Industrial revolution?

Yes, when we started to build up industries and do stuff and industry and in Swedish Industrial Revolution, maybe it's the same order and so they're going to talk about that in history and then I can do some assignments in technology as well, so it's smaller one and I am talking about electricity and that's also really important thing in that area.

What does it mean?

I don't know I have to give you the name later on when I have a computer to search it.

And just curiosity, are the subjects usually related to the year are they based on the age or your interests or both, maybe?

Which omron we are planning and the curriculum I guess what we're going to, what we have to teach them about and then we take the subject that is a good one to collaborate about, I guess.

Do you feel like... you said before the time was... to take time beforehand was something good that we did but do you feel like keeping up with the timing when we had the schedule going was something maybe that didn't work as good? For example with the system we had to, it was supposed to arrive before Christmas and then it arrived after Christmas... do you think?

Yes, it would have been better if it arrived before Christmas because now we are afraid that the fish doesn't gotta get there before we are leaving for summer I guess. So maybe that would be better but that's in... now when we are going to plant the plants and we didn't get any plants something like that will always happen, so we have to just make it work otherwise, so that's right, but that's life. I guess?

Yes, and I was thinking I was talking about it with another teacher, with teacher 3 and she told me that actually in her opinion it was good that it didn't arrive before because the students were in her opinion... it was good for the students to settle down and metabolize the idea a little bit. Which honestly made sense, that was so, that's true like there's life and then there's also maybe what's not so bad in the end.

But it worked.

But something that I've been trying to reach, like to have the students understand it's that: that's true that are going to be small or maybe big things preventing you to reach your goal and that doesn't mean that it's not going to be reachable anymore it just means that it maybe it's gonna take more time or more effort. Do you feel like that's something that we've been that they may have understood more with time passing by working with this system or not?

I guess so and that's that's good for them to learn that. And actually nothing in life will ever be as you have pictured and they need to learn that, so if they thought that and I thought maybe that we would have fishes in like October and maybe they did that as well. So yes, we didn't get the fishes in October, we get the fishes in March, so that's life.

I feel like with this, with the fact that it's so practical and they are a part of these practical project as well, they understand like, if there's a leak they know why we have to wait more because the leak needs to be fixed so like the fact that they see it so hands on.

It's their project, that's our project, the students' project. So they know more about it then I do it right now. It's good.

Okay, what about the activity that you held without me as a teacher? Did you feel like maybe some of them did not work or...?

No... A lot of them I've been doing before, all of them I've been doing before in some way because it's... it says so in the curriculum as well, that they should learn this. So it worked but I guess it made more sense to them because we could talk about it in the same way that we talked about the aquaponics system and then they understand more about it, I guess. Why should we learn this? Yeah? You learn we have to learn this because otherwise you can't understand this and if you don't understand this you can't understand why we are doing the aquaponics system thing.

Oh, which reminds me that about the class that we're gonna have on a more general why we're doing this. We can plan it. So what do you think that it could be changed in order to have a more meaningful learning process and teaching process as well considering that the phase we are right now it's different from the one we already had because now we have the system.

I guess, a lot of things that you suggested that we're going to talk to the students about, like the plant, how a plant is build up and plant anatomy and fish anatomy and other stuff. We have already talked about that a lot in seventh grade, so if I did this again, maybe I should... if I took new students in seventh grade and I knew that we are going to do this project in the eighth grade, I should plan more how to I what I'm going to do in the seventh grade before the project to really use the aquaponics system project in eighth grade better. Do you understand what I mean?

It makes sense. How would you do that for example?

I maybe had not talked about the plant anatomy for example in 7th grade. I should had saved that for the Eighth grade instead but science if you knew, when you learn science you can't just separate science in parts because everything is... I know the world for it...

Related?

Thank you related to each other so, it doesn't matter.

And could you do that to just skip one topic and do it next year?

Yes, I can do whatever I like.

Okey nice. That's nice. That's freedom.

In the curriculum it says that the students are supposed to learn this before they graduate the ninth grade, so what I do in seventh grade, eighth grade, nine grade: it doesn't matter, just and they should get everything they are supposed to get but it doesn't matter when yep.

Okay so this is for what we've already done like you would in order for them to have more meaningful learning process, you would consider it beforehand. What about for the new phase that we will enter and also for the teaching process as well.

But just I don't think I have a lot of more things to add up to the aquaponic system right now because we have done everything so I don't know what to do in my subjects this term, just small things but I did a lot instead in the fall.

I see... so maybe to distribute it in a more balanced way.

Yeah, maybe I don't know how though, maybe as you were suggesting to skip the anatomy of the plant part and do it now in the spring semester for example. Yes, and maybe everyone should plant their seed so everyone had their own home plant downstairs, but we planted plants last semester in seventh grade, so we have already done that actually, so some of them may be "why we're doing this again?", but they really liked it in seventh grade, so if you had saved it would be really nice in this term. Maybe a water quality and that stuff you could do. It is kind of small in the... it's a little.

We were talking about to have a bigger assignment. That's true. We haven't. We can talk about it more in the next meeting.

That's true.

To have it more balanced in order for more subjects to be integrated and also not to have all the weight just on one or two subjects for example. I was thinking about history because I don't know why I didn't think that they do history, but they do who's the teacher for history here?

Teacher 4 and 3 together.

Because I was thinking about...

The whole history, geography, social science or religion is the same part. They are all that for you.

All together? That's a lot.

Yeah.

But I was thinking for example with history like actually aquaponics it's dated back in 3000 years ago, so like, so so long ago and that could be something that they can talk in history. I don't know why I didn't... I mean I know why: I'm not a teacher here and I don't have the full picture of all the subjects

And that we didn't know that also.

But that could be another way in which it could be balanced more.

Yes.

And I have another question for you. How did this students' attention towards the project change after the activities as anything specific caught your attention?

More interested, I think in the beginning they didn't understand shit and me. One of the first time, when Snuttan was here, they didn't behave.

That was not easy.

No, it wasn't easy, but I think if we did that again, they should, would behave a lot better.

I also feel like with that specific activity maybe there was some misbalance between academic like higher level academic education and lower.

We are...kids. Really small kids actually. So, it's hard.

So you saw a change of interest as in they are more interested now.

Yes, but they understand it more and now when they can actually see it, they understand a lot and after the nitrogen cycle assignment maybe 80% of them actually understood it really well.

Yeah, that's a good percentage.

Yes.

What about, because I feel like some of them we lost in the... I mean the year is not over and we can change that and everything, but like some of the students that are more problematic, we lost them... because they don't, they are problematic on more sides, maybe social maybe academic educational so like the fact that from the educational part maybe they didn't get for example the nitrogen cycle or I feel like it also you could see that in the way that they were interested, meaning that they were not. What do you think about it?

I think these students have problems all over, so it doesn't matter what we do actually, we have like 10 minutes of their interest and concentration and listen you know. And I don't know how to have a solution to that because we always have that problem, that you have some students that don't understand why they are going to school. They don't do things because they want to learn they don't do things because they want better grades, they do things if they do something they do that because their parents say that I have to or maybe we say that you have to or the parents say that if you don't do this you can't do this in the weekend. So, they don't learn because they want to learn and I don't know if it's that they are too young or maybe just it's their personality. I don't know...

or maybe the context

I don't, I can't follow the students when they are grown up, so I don't know what happens with them when they go to the High School instead of...

And for as much as you can work together with them like you don't know all of their aspects like we don't know what happens in their families and that kind of stuff as well.

Actually... we don't know a lot... we can just make them participate in the 10 minutes there and we can make them do something and some of the assignments and we can and we can make them to sit and listen for a bit so and it's good enough. It has to be good enough.

In relation to that like today I had Student 11 I don't know which one at one of them, tall one or the small one tall one and he was you know he can require a lot of patience, so he was making you know this so many questions not really related to the system, just to get on my nerves, I guess or I don't know just to have attention maybe and at some point I was like okay Student 11, because you know some of the students I took them out because they didn't they took the attention of the whole class last time so like, I couldn't manage all of that so, I told him I was like, "you were not supposed to be here today because you didn't behave last time, so please do that now" and he was like "I actually am right now like you know for who I am" and then I realized that that's true. I don't know his average.

No.

So like you know in relation to what you were saying, maybe they only have that 10 minutes and for the rest they look like they, I mean they look like, they are you know driving the others crazy or something? So, we maybe should try to have those and, I don't know...

I have like maybe seven students that if they work 15 minutes of a lesson we should be very proud, or just supportive something like that. Yes, but I don't know it's good for them to do: "good

for you. You worked 15 minutes. That's good." You can't you can't think that they are going to work for 60 minutes because they can't

And I think that's a difference I have compared to you, like you have been, you have more experience in the education field so like you probably have already been in this kind of situations when you realize okay, of course you know they're not the same, but then you also realize in practical life

And usually tell them when they lose the concentration if you want to be here you do as you are told otherwise you can leave you don't have to be here. You can leave you can sit outside and you can do what how you like. But don't sit here and disturb and make the lesson bad for everyone else sometimes they actually go away and sit outside instead, and sometimes, most of the times, they actually tried to stay and try to concentrate because they're getting older so they really need their grades to continue to high school. So somewhere they actually want to do it, but it's hard for them.

So that's about the student's attention and what about the teachers' attention. Do you feel like it has changed or anything specific that caught your attention?

I don't know because my point of view I did a lot in the fall, so now I'm a little bit laid back. I think because I've done the projects I wanted to do... these couple more I want to do but I really need to do other things like the sexualities theme, sex education and I need to do the thing about the human body and I really need to do the electricity thing and it's not so much aquaponics.

Or? it could be maybe with the growing lights...

But really really really little and because I need to do it because then I have just one year left or actually not one year maybe just a half year because the last semester in ninth grade it's just tests, national tests in science and in math and Swedish and English and all the time, so it's not a it's not a whole term there.

So for your attention you feel like... there was this unbalanced situation and now okay, but what about the so maybe there was a contrast for with the syllabi with the syllabus as well.

I don't know or I don't know how to have a solution on it because we... things we did in the fall was really great and I had a red thread in everything we did, so I don't want to change that but so maybe it's about the things I did in seventh grade, if we're doing this again, I should save that for the Eighth grade when you do the aquaponics instead.

And maybe like the electricity put it in the seventh grade...

Actually right I should have done that but... I didn't have time.

You didn't know... so and because you usually have the kids you take them when they start 7th grade and then you bring up up to 9th right?

Sometimes sometimes. Yes okay, most of the times. Okay, so like I could really go and take them in fourth grade, but I've never done that. It was not that much needed. Oh, I could have not jumped, okay.

No, I was thinking just you know in the span... in the time like, if you would be the same teacher so to have a clearer bigger picture or if it would be more teachers like different years more teachers, but you would say it's usually the same for these three years.

Yes.

Okay okay and what about the other teachers? Have you felt like their attention changed somehow?

Maybe they feel the same as me because they did a lot of this in the fall as well, the one that had social studies and that history, geography and religion they need to do other stuff as well. Geography is an environmental subject, it's a part of geography as well, but they need to do history now and they need to do social studies and they need to do religion and it's hard to include that in the aquaponics system.

So I don't know actually, home economics is easier, but do you feel like except for the subject per se, do you feel like there is a difference also in the teachers?

Yes, but it's not that we don't like the aquaponics system, that we don't think it's interesting because we do and it's really funny and really nice to work with it, but it's I think that we did most of the work in the fall.

Because you said social studies, religion what else did you say?

Geography and history is a part of their subjects like that mines are chemistry, physics and biology and technology... My fourth subject technology to build the whole aquaponics systems is actually technology but because of that not all the students were a part of it, I can't really do that as an assignment. Of course I see that the students that were a part of it do a really good work and I can take that into account when I grade them but to do this with everyone I should have seen everyone in it so... yeah. Hmm like, student 14 for instance. He's been really good in the technology thing when you put all the things together... didn't he?

I was just thinking that memory again. I can show you a video later. It was very fun. Yes, but I see what you mean. So maybe to have it broader for some topics but not all of them because at some point we're going to lose their interest and it's not gonna be beneficial for the whole project to have more people involved.

No.

Okay, so a couple last questions. What if we change something up until this point? We already talked about this a little bit, but what would that be for you?

I don't know if I want to change something more. I don't know actually! Not more that what we already talked about. So spread the assignments out I guess. It's hard to do that, I don't really know what...

So, talking about time for example you suggested to spread the assignments in more years, but what about also the time that we had. For example in the afternoons or when the project started, do you feel like that was enough?

Yes.

Okay. I don't know if you have other ideas and that, if we could change something more.

No, not right now. But I can think about it hmm.

I'm thinking if I have any prompts for you, for this question. Except, you know, for the timing part... but not for no. Okay, so now some demographic questions so your name?

Erica.

Your age?

42.

And your gender? The way you identify yourself.

Female.

And that was it.

So, what would you do now with the aquaponics system? They are... we have plant seeds? In dirt, I think.

Appendix B, Teacher 2, SSI 1

This interview will be a part of my master thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this conversation.

So, we're going to talk about the project that we've been working with

Good, I know quite a bit ahahah not all.

That's what we were aiming for... so what is the first thing that comes to mind about this project?

Sustainability of course.

What about the first memory that you have related to this project?

I was actually part of the project the year before also, when we talked about it with the teachers in the 9th grade now... but there was never enough time to set the project to start... but I think it's just that way I think, sustainability of course, in school, because you make all the subjects work together but also in the world of course because we need to do something completely different than what we're doing right now... and this is one part of it.

That's so true; and do you feel like we're doing this right now?

I hope so, at least we have started lot of things in our students' minds and if that changes anything, I'm not quite sure of it because, I think the industry needs to do it for us because almost no one will do this on their own any time at all in their life in the industry since we're almost eating all the ways from the industry the industry needs to do it. And I don't know if you talked about it before or if you have read anything about it, but there is in Småland a couple of agriculture places farms that has stopped breeding cows and pigs and instead is breeding fishes in this way and they are aiming for growing more fish than Norway and Norway it's a lot of fish. So there are a lot of farms spread out around the main farm but the main farm has the big fishes and the farms around have the small fishes and when they are big enough they come to the big farm and then they go to slaughter or whatever you call it. That's cool I think.

That's cool. I think I agree and I agree with the fact itself that of course it's an individual responsibility as well, but not only and actually it's more a systemic responsibility for now and of course the individual can change but as long as this system doesn't change if there's no point or yes, there is point always you know in everything that we do but it's too small that they impact that we can have as individuals.

Yes, that's true. I have a few things in my fridge in my freezer at home that I have grown myself or picked myself from the forest but it's not much, I can't feed on that. I need the industry. I can't I can't kill a chicken. Yep, I can't grow everything I need because I would die. I don't have the place to farm it. I don't have the knowledge to farm it or the time so the system needs to help me or the industry needs to help me and this needs to be industry. I think.

So going back to what you were saying before the first thing that comes to your mind is sustainability and the first meeting that you had which was with the ninth graders..

Yes and Carl-Johan and someone else that I don't remember... was it Snuttan? No, I don't think so maybe maybe it was Snuttan. It's like long time ago now one and a half years almost.

And why the change from nine graders to eighth graders?

Because there was not enough time to set everything up last year. We didn't have any plans. We just started to talk about it. We didn't have any place to put the tank. We didn't have any... so all persons involved would like to do it, but there was not enough time to do it and to start everything up with the 9th graders and not be able to finish was not a good point so it's better to start this fall instead.

And you were a teacher with the nine graders.

Yes, I have them also in a homec so that's why I was involved from the beginning.

So for now you're a teacher's both in eighth grade and ninth grade.

No, just a eighth grade now because the ninth graders don't have homec but next year I will be for my 9th graders then and the new eighth graders because they will have homec. So you only read a home economics in 8th grade.

But you're still going to be a teacher for the Eighth graders now next year with different subject.

So I will have English for them right okay, so now I have English and homec for the Eighth graders, but next year I'll have English for 9th and homec for like 40% of my time. I will not be with my kids.

You will not be.

No I will be 60% for the ninth graders and 40% for the Eighth grade. That's okay, I think.

Did you say your kids talking about the students or your reals?

The students.

I met Phillip on my way here and I was like aaw!

Yes. It's nice super nice.

So talking about the students. Have you felt like.. and if so, how did the students attention towards the project change after the different activities that we did? Just as a reminder some of the activities that we did we started to get it to know aquaponics, the different kinds and they learned about it, than we had prototype day. We had the field trip to hdk and the library, then we had the noble dinner and aquaponics related activities and this is just something that we did.

Those are great things everyone I think. I think, together with the knowledge about what we are actually doing from the nitrogen level all the way up to the sustainability level, I think the more they know the more it's easier to be part of the project in the right proper way, maybe I don't think they will be like Ambassadors for this because they are always doing so much in school. They can't be ambassadors for everything but I think that I think their interest increased together with the knowledge, I think. And some of them are really interested you know that since you've been talking to them a lot and you don't always you can't always reach 100% of the kids. You can't, it's impossible.

Yeah, that's what's not what we're of course you want to reach them every time but not all them in the same way, that's not I don't think it would be good for the teachers either.

No, I don't think so either, because there is not always one subject that everyone likes... no, no of course not.

So you've seen a spike of interest in knowledge...

Yes, I think so.

... after activities.

Yes.

That's nice and you were saying something more about, of course the more knowledge you get around something the more you know how to handle it or also just how to talk about it. Which is also the same reason why we're gonna have a smaller group being in closer contact with the system at the beginning at least.

When we had rice today, Jonathan said, “oh, it's like the greenhouse effect when you open the lid, you know?” “yeah, good Jonathan very good!”

Yes, it's always nice when you can see that they are...

Reflecting?

Yes, that they take the knowledge within their... like they metabolize it and they can use it for different things than just having the knowledge itself.

I think so too and take it to another situation or place and reflect upon it. It's really cool.

Do you feel like they've been doing that to reflect upon the different activities or...?

Yes some of them and in some occasions not everyone and always, but that's impossible once again. They are! They are talking about it in different situations and referring to it. So, I think so, but I think it'll be at least important that we get the fishes here and things start to grow because then I think it will be more... the Swedish expression is "take on"... hands-on projects are always better when kids.

It's interesting what you were saying about the reflection that it doesn't necessarily always happen and it doesn't always happen with everyone but you feel like... I guess as teachers you sometimes have activities where the goal is to actually have the students reflecting about what they've learned. Do you feel like it could be beneficial maybe to integrate some more of those activities within this project or do you feel like this sort of random reflection could be enough or just what needed?

No, I think we can have benefits from that. We can benefit from that actually but I think we need to start growing things first and like feeding the fishes and taking samples from the water and you know that kind of stuff. I think we need that because we have done everything else we can do right now and the kids we have reached so far they are capable of reflecting over that, but the kids we haven't reached so far... they really need that hands-on. I think.

Which is also interesting because these projects they've been done already in the world... This is not the first one and it's not gonna be the last one and the goal, even though it is nice to have plants growing and it would look like the goal is that one, the goal is actually for them to understand what we're doing with [the project]

And they will learn that with the nitrogen and the carbon and etc when they see the tomato you see what I mean. Or the herb because what makes this grow? You can have it in your hand now: what do you think?

Like the combination of different learning processes?

Yes, I think so.

But was there something that you in your opinion did not work: for example the time frame that we use or maybe you saw it on the outcomes from some students or some environments of the different activities that we were talking about before or the ones that you as a teacher had by yourself which was related to this system.

If we should do this again with a new group and start from the beginning and... what could we have learned from this project? I think that maybe we have needed more time sometimes we solved things in the last minute. We're not prepared because there are so much things going on all the time so maybe we should have more time to think about it and and make things happen in a proper way. I don't think that the students have recognized it, but I think you have recognized it sometimes and you help us remembering things which is good because we have so many legs to stand on.

I was about to ask do you feel like it could be possible with the current system and like how many you are or the whole activities that you still have to take into place which are yours activities as teachers. Do you feel like it could be possible to give this project more time? Wouldn't it be like your free time?

Yes probably but if we would have done things in the proper order and the way we have decided to do it, things would have the outcome would have been easier for us, but we keep forgetting things since we have more things to think on all the time and that we don't predict when we are doing our schedule etc etc. So I think the plan is actually really good from the beginning, but I'm not quite sure it's there all the way because we keep forgetting things.

Okay ambiguity is also something that at least Carl-Johan and I were talking about this kind of project. We always integrated and considered because it's... as you were saying, it's not just one individual doing one thing but it's more individuals coming together for some similar goals but not all of them, so like everyone everything so many different things could always pop up and lead to different and you know somehow like shift the energy or the attention towards something different s, that's true that ambiguity and like I got distracted by the song.

Good one right.

Yes good one... okay, so you feel like it could have been possible but ...the structure was good, but their attention sometimes lacked, right?

Sometimes we talk in school about if there's a fire burning and of course it's not a real fire, but you need to put it out and if I have two students fighting or I have to do something thinking about the aquaponics system I always choose the students fighting, because I have to and then I keep forgetting about the aquaponics until next time. There's a few of those occasions that is quite clear that we didn't do it at the particular right time.

But this is something I wanted to ask do you feel like it would be possible to give more attention to this, given the context you were describing like it's always so chaotic but you know what I mean like it's always so many different stimuli at the same time because we're working with teenagers, so it's normal, it is just the way it is... but do you feel like it could be possible to give more attention and if so, how?

I'm not quite sure because there are very few hours we are sleeping on the job. So I'm not quite sure if it would be possible and to be honest the four of us working close together, two of us are more involved in the project than the other two and the two of us are doing what we can I think, I think the other two are probably doing what they can also, but they're not showing the same interest and that is not a strange thing because they are not doing this for their own subjects.

So maybe something more could be how to fire not only the students but also the teachers' interest.

I don't know...

Not just at the beginning but throughout the whole year.

Yes and maybe two out of four is a pretty good.

That's true as well and it's like something that's new and... were you given, like did they ask you: do you want to participate in this? Or was it more like hey we're doing this you're gonna be a part of it.

I think so too, the second one. And teacher 1 and I... I was in it first and I think it was super interesting and I got to work with the chef which in fact from the beginning was more of co-op than what it is, what actually came out of it which is too bad because I would like to work more with the chef, I like him and he's been.

It seems like he likes it too.

Yes, and then teacher 1 came in after me, a couple of months, six months maybe and she was even more attracted to it, which was super good! Because her subjects and her own interest, I think is more in the in the pre-phase and my subject would actually be more in the later phase, so that is so cool actually because then we could help each other throughout the way and we are interested and the other two aren't that interested. They help with their time and what they can but they are not they're not running any of the projects in the project and that I think it's fine, but sometimes we could have needed more time to it and it's hard to find because all the other stuff to do at work will be there all the time anyway.

But exactly, do you feel like there could be a frame for the school as a system to maybe give you more support?

I don't think so because then we would like maybe have to hire one more that's doing some of mine and some teacher 1's job and that's hard...

Or maybe without hiring anyone more you would still be like a rebalancing the responsibilities... maybe integrating more people, like more teachers.

Yes, maybe if that wouldn't end up in more meetings and more administrative things...

That could be...

So, I think it will be good. I think the outcome will be very very good for the students and that is like our main thing with the project I think. The rest of us in school learns a lot throughout the way and we can make things in the curriculum happening in the correct order within this project we don't have to take things outside the project and put it in the curriculum we can use the curricula and we have done that in a proper way. I think.

That's very good

That's good, but I can't see any other school in Sweden throughout history that has written an English essay on the nitrogen cycle in the aquaponics system! No one has, but we are writing essays, and it doesn't matter if we are writing an essay on this or that, and this time we use this.

Which leads me to to the next question which would be do you think it could be actually - which here somehow you already answered- possible for other schools to implement it the same way? Because it's it was pretty easy with this kind of school and the way you're working to integrate the syllabus within this project or the project within the syllabus but since I will work on guidelines for other teachers to be inspired from and to understand how to put it in their specific case, do you think it could be... there could be like a...?

I think it would be hard, because we are working so much together here and that's kind of the solution. I'm not sure that they are doing so much work close together in other schools. I'm quite sure of the opposite actually and if you should implement this on other schools, I don't think you should go to the teachers. I think someone in school should have an aquaponics system and bring in the teachers and students in that project, but I don't think they should run it. And maybe that person could be just anyone that is interested in school.

There's an example of this already in gotland. There's the science teacher she decided to do it by herself and she also takes care of the system, but it's like it came from herself.

Yes, and I think I think that's the way to do it because then she can implement the other teachers and other subjects in her project. But I think it will be hard to do it like we do it. I think so.

Which actually makes me think about as well my role in this project, because would I... not because it's me, but a master student. Would it would this project have been going on without a master students, do you think [it could work]...?

I think so, but not without you, you see what I mean? Any other school would also need a Chiara there is supporting them because the schools lack of funding so it would be hard and the funding could be money but you could also be experienced and so other stuff also so I think they will need someone to help them throughout. Mhm at least the first and maybe the second time they are doing it. Because the school in Gotland has been doing it for a couple of years right and the first year must be the hardest I think and next year, it's easier because, you have different subjects for the kids to read this in and you have tasks already made out and you don't have to order everything and remake it.

And also just understanding how the system works like for example when I had a chat with science teacher from Gotland, she told me that the first year they used basil, which is a good plant because it grows a lot but also not because it's very sensitive to pests, so it died a lot so, that's true like the first year could be the most challenging one especially if you don't have a guidance from outside. So we've been talking about the students and their time frame environment and outcome for the students, you've seen it positive, but what about...do you think something could be changed in order to have a more meaningful learning process and teaching process?

What do you mean?

Like for now we've been, not just from the students point of view, but also from your point of views so as teachers. Do you think something could be... but maybe you already answered like more time and more attention.

Yeah, I think so, I think so because it's throughout the project we have learned a lot and I think that's the way you learn it, because we couldn't have like read aquaponics' ABC book, like "here you have it" and then you start that would be too much, we need to do one thing at the time I think.

And do you feel like the teachers' attention has changed throughout time and with the different activities? You were talking about this a little bit before.

I don't know... it's us four that are close to the project and I think we know what we're doing, now, but for the rest of the school...they met you guys for a meeting once and they hardly know anything more about it, so I would guess that they think "oh, this is cool" and not so much more, but also for them I think it will be more hands-on when things are start growing and the fishes are there because I think they can see that it's it's not so hard to do it and we can do it!

But then again, and that's probably a hard part to pass, which is that the most important thing is for all of us to understand how this works and how it can help us and not, specifically in this case, not to produce food because we're not gonna base our whole diet from that, but it's also true that like it's easier if we see the results of something instead of just talking theoretical for a long time. Okay so about the school, generally... They are a little bit interested, but they don't really know... what about the four of you? Have you noticed like a difference in the attention towards project? Maybe related with the schedule of the year?

I think so too and I don't know actually, I told you I'm doing the Hydroponics system for myself at home! I think that's, that would be cool exciting, but I don't think that maybe teacher 4 and 3 will do it. So even if they like the project, I think they more like the project in case of learning for the kids, instead of "oh, it'll change my life" I don't think they are there.

But what about in relation to this school like to the life inside the school: do you feel like their attention it's still there or maybe...?

Yes, it is and I also think that it is a good time in the world to do this right now. I think it is actually super important and super interesting and it's all over the news and it's everywhere all the time so everyone knows about the problem, but as I said in the beginning, it's hard for each and everyone to change everything, we need the system to help us and we need the industry to help us because otherwise we can't do it because we don't have time.

No, that's true, like there's the everyday life that comes in and we cannot change that.

Yeah! And if we can do anything in school here that is good for the environment, I think everyone will like it, but I don't think everyone will take part of it, because they have other interest also.

That's true. Which like to define and understand which one are our struggles or the struggles we want to put our energy and fight for

Everyone can't be vegan and buy things in the second hand store, everyone can't, but it's good if we go from 1% to 2% or 2% or 5% I think that's good about it, but everyone can't.

And it's also true that it's important to have the shift in, it doesn't necessarily have to go a hundred percent like it's also a step further if for one week you're vegan or like for one day a week you're vegan, instead of not changing anything at all

And the school food helps us over with that, we're having vegetarian food like twice. But we can eat vegetarian every day if you like, that is so much better than it was like 10 years ago!

I have a couple more questions, but we are going towards the end. One is, what if we change something up until this point, but we were talking about it a little bit before and it was... Because you talked about it before and you were talking about giving it more time.

I think we need more time for preparations.

So beforehand.

Yes.

Okay.

I think so. To be more ready when things actually happens sometimes we do it stressed and that's not good. But I think the outcome is quite okay for the students anyway, they haven't...

I see what you mean. They don't notice but... yeah.

They haven't suffered anything from it. Anyway.

I think it's absolutely very interesting what you said at the beginning about the fact that not all of them and possibly none of them will take these as their thing to do in life, but I don't know I don't know like you never know you know it's sometimes you just put some seeds and then you don't even see that how they will grow and if they will but sometimes they do

Sometimes they do.

And sometime like or it has happened to me, I was a scout master a couple of years ago. I've been in the Scout Group sometime in Italy and without actually trying to have anything back, just to give, and then I came back this year to help out again and I met so many of the kids that have been growing up in the meantime and they were maybe telling me stories of the way, how maybe I or some other people from the group have inspired them to do... and that's to say that I think you're doing the same you know as being a teacher even though sometimes we just don't have the luck to see how this is developed after some years, but I think maybe like I feel like with some of these students it could be like that.

That's cool. I like that thinking.

Because it's so easy to forget about it. If you don't see it...

You can harvest later on. That's cool.

Okay, so just some demographical questions because we are done. your age. No, sorry your name

Okay, Johan, 50.

50??

Yes, turn 50 September.

Which day?

23rd. The same day as Bruce Springsteen.

That's cool. My dad is a huge fan. We went to see him in Firenze like some so many many years ago my dad always goes to see him. Have you ever seen him?

No, not yet

But he comes to Gothenburg quite often! I think it. I think we can stop this...

Appendix C, Teacher 3, SSI 1

This interview will be a part of my master thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this conversation.

So the first question I have for you it's, what is the first thing that comes to mind to you about this project?

The first thing I think it's really interesting and cool to do this in school environment and have it with fish and plants, everything to get the students to be so much involved in it. It's wonderful!

And do you have like a specific memory like an image that comes to your mind as a first not impression but maybe, impression?

But it was that we are going to have fishes and plants in the classroom and that it'd be a whole system that just goes around.

So it was somehow already like an imagination of what it would be.

Like when I finally understand what it was at first I didn't understand, I couldn't figure it out, how it will work and that's what's really good about it. Okay, that's it! I heard from teacher 1 and teacher 2 about your first meetings about it, but when we sat down earlier this last semester... it was really good yes okay. So, when is it that you actually had a grasp of it? When we had a meeting or...? What was it? Was it in September?

Ah! When we talked about how to put it into the syllabi?

Yes! Then it was that, got it really. First I couldn't yes imagine it. I would just go around.

That's interesting because I asked each one of you what comes to mind to you for the first time and then it's of course different for everyone, but then there are also things that we have all done together so as you were saying as you as teacher and me as a master students, we've been having meetings or

with the students. We had the prototype day and field trip to the HDK design faculty and then the library then we had the noble dinner as well. So that was... this is the part that we are discussing right now. Which was the first part more or less, like having a hype for the season to arrive and getting a good baseline of knowledge to understand it. So now that we are gone through that phase, what would you say that worked or what did not work? For example with the different activities that we did. Do you think that in some activities maybe the environment was not the best? Or the outcome from the students was not what we expected or the timing either...?

What I think did work really good was the day that the students did the prototype and the calculation and draw and everything like that and did the small models of it. That was a really good day! And the students was really involved in it and they liked the assignment a lot and that was really nice to see... how almost everyone yes went all in and try to understand and choose what type of system that we should have and like that and that they felt that their opinion counts that was really good and that we chose one of those and did build it then and had that an idea that was really good.

That's important to put some responsibility to give them some responsibility in an active way and then to show them that we that there's listening as well. It's not just: "Okay, you think that's the good then we're gonna do something different" no, it's like: "okay. We're gonna trust what you decided. If it's reasonable of course" which was the case.

Yeah. It was really good, and the student was really proud that those project was one and chosen for it.

That's good. I was about to ask. What do you think it worked specifically about that day, but you sort of answered, but maybe is there something more except for the giving them the responsibility and the fact that almost all of them were in. Is there anything more, like maybe the way?

I think it was good to have a day for it and that we have a start and some end of the project, a lot of that part at the same day that it didn't grow and become a week or a month for all, because of it was that narrow of time. They really worked good at the day.

Do you think that these on the other hand has been something that has not worked up until this point? The fact that sometimes we could also see them and like for example with the system right? It took some months to arrive.

Yeah.

So do you think that this is something that maybe hasn't been working in the best way? The timing...

The timing... but I understand that it takes some time to order and that is a process to do that.

But do you feel that the students feel that?

They are, I think they are going to be really happy, up and going when the plants arrive and like that or they that they plant it. They are going to see what they are doing and what they have been doing last semester and that's really good. I think that's what they needed right now, but have you, if we have done that in December I don't think, I thought... I think that they were tired then. It's good to wait.

Okay, but just to come back to something that may have not like... do you see anything that may have not worked up until this point? Also maybe in specific activities.

Yes... that activity that we did that was too hard. They taught that they have already done it. So that was really hard to just I forgot the word to motivate them to do it, that was really hard to do and a lot of them thought: "but we have already done that, but why are we do it one more time on the calculation" so that was hard for them...

And I think about that specific activity something more was not just the fact that they actually more or less already did it before, not just the activity specifically, but also that maybe too much maybe too much was asked at the same time.

Yeah.

So like either they didn't have the motivation or they felt like it was too much.

Yes, or too big for that. They only had... what was it, like an hour? To do it and just to measure the room took half of that and the introduction of the assignment was... it became too big for them.

Interesting, okay. And what about the... I don't know if you had though because science and like teacher 1 and 2, they had but I don't know about you. I'm thinking about the activities that you hold as a teacher just by yourself without me about the project, but probably...

No because in math we did it together at that day, the calculation and stuff like that. So and we did like this. Then an assignment on environment and stuff like that, but with all together and us as well. That's true. So I have no specific assignment but because just into this.

And for the other activities that we did together then, do you feel like there was something more that could have been improved or that did not go... [as planned]?

I liked the assignment and I a lot... we got some input from parents like that: "this is really hard. Why are you doing like this in school?" like: "I as an adult doesn't understand this".

Oh...

But the students did understand it. And that's what's really nice to just tell those parents.

This is something that I've seen like, mostly outside of the Education field like when we talk about people that are younger than us, it can be common for people to just think: "oh, but, they are either less smart or you know they have less experience so that makes me better", but that's not, or you know more sophisticated in a way, but that's not necessarily true like the fact that you as an adult do not understand the system doesn't mean that they cannot understand it because they already have a brain of themselves and you can. That's interesting, like the way we perceive them.

Yeah.

Or we put ourselves in that position.

Yes, but no, it's good. Yes with math we almost... did the parts of volumes like that type of calculation that we did in ninth grade, but because of this project we got to do it in eighth grade and

that did work good. It is not... and they still just understand okay: "this is the reason to do this and to be able to do this type of calculations and draw this type of figures" and like that.

They had a very clear connection in mind of why they were studying something

Yes, and connected to and that was good.

And what about the now you mentioned the parents, are those the only kind of comments that you received or...?

No a lot of parents is really interesting in it. I think it's really cool that we have this thing together with you and the university and have a question about how did it happen? Did Fridaskolan choose for this? So a lot of them really nice to see and want to see the whole system when it's up, so that's good and a lot of students like this as I might think and to see what they're doing in school is a real project and is connected to the university... hm that's a reason to do it. It's not just us as teachers to tell them that's good.

The thing that you just said leads me to another question which is related to students' attention to this project. Because obviously it changes over time so it obviously changes from the beginning so I'm thinking if you felt something like that, like that the students' attention changed after the activities that we done or with time passing by?

I think that see how everything is connected, that's really good that we are independent of each other in type of systems like that and to visit the plants and the fishes let's see that and connect that to people's and how we are feeding each other and stuff like that. They have a big understanding. I think of it, of course we have some students that are tired of it and is in a period in the semester that we always we only doing this and like that. It's become a lot of them, but some students is really interesting and study and really a lot of it in the spare time and says we have one that was really, he was looking forward to put the systems together...

Student 9?

And the pumps and he's really interesting in it and a lot of his friends as well and the students.

Okay so like, could it be that the more time passed by the more the ones that were in the beginning already more attracted became more attracted and interested and the one that were maybe not so much, we didn't get to them or?

I think that we did get to them! But they needed this pause that we have from December to now. Just resting it. Okay That's what's good.

This is actually something that's so good to hear because I was thinking it felt like it was so complicated to have the system to arrive here with the shipping company and everything... that I felt... but that was just my perception right? But it felt like it took a long time and I was feeling bad for it not having arrived before but maybe it was for the best then.

I think that was good because have you done it in December it has been... we have a lot of assignment to this project and what's good to rest in it and just think about it and then like get on with it again may helped some of the students to get interesting and now it's hands-on, and you can see the

system now. It's water as well and it's, gets bigger and they understand what they are doing. That's really good.

That's so nice to hear as well. Okay, I'm thinking if I have another question about what you just said because I had something but maybe slipped away maybe it's gonna come back... but what about, so this was for the student attention towards the project, and what about the teachers perception of it how has it changed throughout the time?

I got more and more interesting in it. Probably because I understand it more than I did in the beginning when I had teacher 2 and teacher 3 talk to us about it from your first meeting in what was in May? April? Last year, and then it was just big and didn't understand it a lot. I couldn't understand that we can have the system. They have fishes here and to look some, it's good to see and see I got bigger understanding from the students and the work that they have done and looks and told about a little, told me about and that was really good.

That's nice.

Because they put the words on it and yes, not just photos and stuff and but the text and how they explain it. So that's really good. I think it's really cool. I have told my children about it and promised them to come here when everything is up and going...

Yes!

To look at the fishes and plants and like that...

How old are they again?

They are seven and ten.

Oh.

So, they are also very curious about it.

What about the other teachers?

I don't know I don't really think some of them understand and then have seen it down and, but I think that some of the teachers really don't understand it because they know that you are here and we are doing something and building something but what is it? This to be, a little bit imagine right now before there have been seen it.

But what about the closer teachers we've been working with together, so for now it's only been mostly the four of you and me but then it's gonna also be Freddy but for now. Have you seen any changes in their attention towards these project?

No, that's in December we are tired, so I think it was good for us and the students that the parts didn't deliver but it's nice to see it going, good and look at it then stuff like that becomes real for us. It's really happening. So it's really nice.

I see so I'm... what do you think that could be changed in relation to the teaching process for now in order to have a more meaningful learning process for the students in relation to this project as well?

I don't know like just have it up and going and look some seeds there, see the process and see how it's all just becomes real so it's working as well as and follow the project as that as well, so that's... I don't see any problem right now, but it's hard to have to figure out how we are going to next step in it when it's up. What are we going to do with the students? Except for feeding the fish and the plants and everything like that. To have a good new assignment too.

We're gonna have a meeting next week to talk about it, the same way that we didn't September.

It's really good.

But it doesn't necessarily have to be a problem or something.

No?

No, it's something that could improve I think as well.

I don't know, I have no idea right now.

But probably what you said before could work as well like to have it more hands-on. Every day.

Yeah, because that's good.

Because that's what we're gonna need when the system is up and running, like someone that control that checks.

Yes we have to have some students and us teachers to have a schedule that's working for it.

That's good okay, and maybe you already answered to this but talking about something different, but what if we change something up until now would that be for you?

I don't know I have no idea. This has been an assignment before but some of the assignment that the students felt that they have done before, like the assignment that they had that we have done the system and building it and in science those parts and English and what ... is called in english?

Home economics?

Yeah, home economics. It has been really good assignments too. And we are... that maybe could change that we had a lot of science at one on very short time to have some... what was it? Two or three assignments almost at the same time and then we had a spare time before and after that maybe just spread those out, but it's hard because we did it in we have that meeting in September and then some of them already. But so, but I like the assignments.

And it's also true that some... this is a side project to your syllabi. So it's also true that as much as we can plan there're gonna be things that are...

Just happens.

Yes as well. That that should be taking into account too.. I feel like for now I understand that it has been good as well the fact that we had to wait for the system to arrive after the Christmas vacation, but now I also feel like there's so much, maybe it's just excitement, but at the same time some pressure about you know these things starting, like I've been asked so many times: "when, so when are the fish

are going to arrive?" and that's not really the point, the point is for the students to understand how these work and the different parts and how it can be connected to sustainability and how we can use the food you know, not only produce it but I can see how from the outside it can be: "okay, so when are the.. [fish and plants going to arrive]?"

**laughs* yes and that is probably the next problem to take, how to use this type of science and interventions and stuff like that, and how are we going to use in the society and how would it affect us as people as the environment and like that. It's good.. that will be good to talk with the students about.*

Yes.

Building from that then the transportations and how that's affecting the environment.

Do you know just random it has nothing or it's related but not to the interview. That like, up to 1/3 of the whole food production get lost in the production chain. So like when you move food from one place to another up to 1/3 of the whole food.

That's terrible.

Yeah... okay, so, I was thinking what could be changed maybe to spread more the assignments? But then again. There's this uncertainty of things that just happens that we cannot really control..

No, because this is school. And we are people and we are dependent on outside stores and transportations as well. It's hard.

Okay, so we are done actually. I just need from the demographic point of view... so your name is Malin.

Yes, Malin.

Your gender?

Female.

And age...

38.

Okay, and this was it! Yes, thank you and now we can go to lunch.

Appendix D, Teacher 4, SSI 1

This interview will be a part of my master thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this conversation.

What is the first thing that comes to mind about this project?

The first thing is happiness and... I just need to come on the English word for... cooperation like you do things on real. It isn't just to sit down and write a book or something like that. Instead it is like you have to do something and when you do something a real thing like we come out at the end and then this example is like the finish (end) of the project... so I think it's my answer on the first question.

If it was a memory of what already happened, what would that be? Like you know some of the activities that you were a part of... What's the first one that comes to mind?

I think it is when we were in the city with the kids, like we met you at the Museum and then we met Carl-Johan and we went to Gothenburg library that is the first thing that comes to my mind.

Why do you think is that?

I think it is because that shows the practice that we were doing, are doing. And that the things that they like to learn in here... they need to do in practical and they did it when we went into Gothenburg city

And they also behaved that time!

Yeah, they did, that was also fun so... And another thing is when we work with each other, when we have work like with Swedish and English and things like that together because that is what Frida is to me. It is the thing about this school that we do things together. It doesn't matter if you have like Swedish or English or I don't know because as soon because we do things together and we do things together in Swedish and SO... we do activities together.

And you saw that in the project as well up until now?

Yes.

Okay, so, as you were saying before we had the field trip at HDK Valand the faculty of design and the library... then we did prototype day. There was the noble dinner and before they start they studied a little bit about aquaponic and so this is what we've been doing up until now. And in relation to that, what do you think that did not work if anything?

I think everything worked but maybe it doesn't went on like it was supposed to do in the first time but then, I think you we did some something on everything. So I can't come up to something that I think didn't work because all of these things worked in one way or another so everything [worked], I would say yes.

For example maybe of the activities we did together or the one where I was not there that maybe you had in your classroom. I don't know with Swedish what you had... you translated the document...

In Swedish we had like they translated the document, and then the performance thing when they were selling things but no. I would say that everything went on well.

Okay, because for example. I don't know maybe sometime it's about the timing or the environment or what the outcome can be for the students, so all of these.

Yes, I think it went out well to... I wouldn't say everyone because there is a hard thing but most of them and this person that it didn't come out well it wasn't because the aquaponic thing because if we had done another thing I think that some of them it wouldn't come out well for them.

Okay, so, that's nice to hear that you think that everything sort of worked, but then..

Yes, because I think you can always like find good things and if it's not going as you have planned you can change it when you are doing the thing that you're doing or you can... something will come up, it will always come up things that do that you have to change your plan or something.

Yeah... but then, what do you think that worked instead?

I think the student did their best on every single task that we were giving them and then they have like they needed to transform theoretical things and make it practice and practice sizes... these things in real if you know what I mean, because if they didn't do the math they couldn't do the math task that they were doing...

How it can be so good connected to the syllabi that you still have to do. That's a very good thing. That's true and then talking about the learning process and teaching process as well. What do you think could be changed in order for them to be more meaningful... for them as in the learning process and the teaching process...considering that we are going to enter a different phase now as well.

Well, the only thing that I was thinking about is if we had go and see some aquaponics existing in the real maybe I think that those students that wasn't doing so much maybe if they had seen it for real before... they would have been more motivated to do all the other things.

I see what you mean... Because they would have visualize it and they would have understood maybe in a different way what we will want the end product would have been.

That is the only thing that I think about right now.

I mean it sort of was thought but then the field trip... I was thinking about going to somewhere like that, but now we'll probably going to go during the spring which is also nice because the weather is better. But also it is related to what you were saying before like things happen anyway that are not related to just this project and like life still happens and for example students. They fight or anything you know so those all of those unpredictable stuff. They still have to be considered as a part somehow like there's the need to have the space for them as well. Okay so talking about the students. How do you think that their attention towards the project changed after the different activities?

For some of them, I think that they see the bigger thing in it and what I mean with bigger thing is... that they can see how things like connect get connected to each other. When you start you did a plan how... the schedule they did and the other thing was like the table went down and did the prototype and then after the prototype we went like to HDK and then we did some other things and then now it's like it's not the ending but it isn't so far away until we get the plants and the fishes, so... for some of them I think that they are really excited I don't know if it answered your question, but...

Yes, I guess it does. I mean is that correct that you're saying that they got more interested in it?

Yeah.

More time passed by?

Yes. And the interest like get bigger and bigger.

And they also understood the bigger picture.

Yes, I think so. Many of the student students did that. But then you always have some students that don't understand it.

And how do you think we could we could go after them?

I think one thing is if we had went to some other place and make them see the aquaponic system in real before because then they can have like a picture of how it should look because for some of them it is like too abstract to see the bigger thing and that they don't do it because they don't want to see it, they can't see it.

I wanted to tell you this next week, but I was thinking about to just into you if we can have a field trip week five, which is actually pretty soon. Is it like next week? Well at zoologen, which is where they have an aquarium maybe then it can be the week after...

I think the week after.

It would be better which is also before the week the holyday. I was thinking whether well we can discuss this in the meeting with the teachers next week maybe because I was thinking whether to propose it to suggest it for the start of February or for the end, but maybe it's better before the holiday week.

Yeah, because after the holiday, they will go out to their practicing they should go and work with someone like an internship. Yes, exactly okay.

Okay, so that's how the students attention has changed over time for now and what do you think about the teachers attention?

I think it has been good and it's because me, teacher 1 and teacher 3 have worked with each other for about three years and teacher 1 had worked with us for about... two years, I think? So we know each other and then it has been like I think really great to know you and like have the connection with teacher 2 and other people around this project.

And do you think it has changed somehow over time or...?

No, not the working thing but it has been like things beside the project that have been taking much time. We have, how to say we it have been many incidents and things that aren't related to this project, but it is things that we need to address.

What we were discussing before right that like things still happen even though this [project is as well]

I think that besides that I think you were... it has been really great and you really fun.

So a couple of more questions... So what if we change something up until this point? What would that be for you? You know would we have this same project starting now with the knowledge that we have now.

The only thing is the thing that I was talking about before that I think that it would have been easier for the students if we had like gone and see some aquaponic system in the first semester yes and otherwise, I don't think it... I can't like... No, I don't think ... that is the only thing that came up.

That's good. Okay and then the last question are more related to demographic so your name, your gender and your age.

A male and I am 39 until March then I be 40.

Then now you're 39 okay. That was it!

So! I hope you got something out of this interview.

Yes.

Appendix E, Teacher 1, SSI 2

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. In this conversation, there's mutual trust and respect just as in all the conversations we have.

So in today's interview we're gonna talk about the phase we just lived so from January, February, March. So what happened was that the system arrived in January and we built it, then we decided which plants to have and we realized that it was not possible to have plans, so we started with seeds. We planted the seeds and then some plants. We had a field trip to zoologien then we added the bacteria and then we keep on with the maintenance of the system. So groups of students have been going in the biology classroom to check the water parameters, if there are any leaks, if the plants are okay and the water levels as well. So this is what we've been doing. And the first question is: have you noticed any difference with the students' approach to the project in this phase?

I think some of them is scared to miss out in other subjects. So they say no when you ask them if they can follow you and do some tests because they don't want to miss math or other things and we talked about that a couple of days ago. How to do that, so...

With the teachers?

You and I. And try to make an assignment of it instead to actually do something that I can grade them but it's hard because they're in the Eighth grade, not this grade that they will get in June it's not the most important one but the next one, the one that they will get next Christmas, this is the grade that they will have when they are applying for high school, so it's really important for them to get the grade set that they want.

This came out in the other interviews as well. And I've been noticing too, like when talking with the students and, what came out from the different interviews it's that either with grades or... Like we were talking for example with teacher 4 a way could be to have the activities more distributed or more like in shorter periods but more intense when there's not as much doing for the school. So, for example, would we do something like this next year as well, maybe not you I mean of course not you, but the teachers from they're going to be in the Eighth grade. Would they do it again it would probably be good to have maybe September October full immersion or you know sometime, then November and December they have their... you can go on with, the teachers and the students can go on with the syllabi without the aquaponics system and then they can take again on the aquaponics system like January February, and then...

This is good.

And then of course it needs maintenance and not daily now that the fish is not there but maybe twice a week or three times a week, but that could be done the same way that we are doing it now.

We will always get students that are interested in the system and want to do it, but when it's too much for them in the other subjects, it will get harder and harder to get to add a student to help about so we complement during a few weeks here and a few weeks there... I think it's better for everyone!

And of course again like there is still the weekly maintenance or the daily maintenance, it depends from the period, but that could either be a teacher or me? or a group of students as well and also like next year the ones that now are eight graders, they're gonna be nine graders and they've already done this. So they could come and help out somehow, not that much but like maybe checking the water parameters once a week. So that could be an idea as well. So like the difference would be for them not to be... syllabi they have to follow.

Yeah.

And okay the next question was in which way could the students be driven to participate more but I guess we already sort of talked about it. So to either have a bigger assignment the way we did in the first semester or grading them.

Yes.

Hmm because something more could be... like now they are scared that they're gonna miss classes. They could also have the material from I don't know like in presentations forms, that kind of stuff, but it's not the same and even more like in these weeks that you have the tests hmm... okay. Have you noticed these any difference with regards to how much time to give it depending on the syllabus, the interest or the energy level? And this is both for the students and for the teachers.

I don't know. It's, as we talked about before I did a lot in my subjects during the fall and I'm doing other stuff now, so actually, I haven't done a lot the little things I have been doing has taken a little time and that's alright... on Thursday and planting the seedlings. That's all right just fun to do with the students.

But what do you think about maybe not just for the students work but for the teachers as well like the approach towards the project. Do you think it has, have you seen any difference in the last months?

No, I don't think so, I guess everyone was more into it during fall because we had a lot of assignments that was connected to the project but now we don't have as much as we had it during the fall so our energy level is lower and that's not very surprising.

I think it's more things together like one, it's because the year has started from some time so like of course it's different the energy that one has at the beginning than in the middle or at the end and it's also and then it's also true what you were saying like you've been having, you as the teachers now in the last few months have been having less activities with the students in relation to the aquaponics system. It's been more me showing them how to take care of it and blah blah, hmm. Okay with regards to this past month so January February and March what if we change something what would that be for you?

Maybe do a big assignment that everyone are participating in so which was about that last time as well that a lot of stuff that I could do in this project in science, I already have done that in the seventh grade, so that's it's I can't make anything more out. I can't make anything up because I've already done it. I have no need for plant a lot or talk about the photosynthesis or because I've always done that, but if I did it all over again, I should have saved something for the spring semester so we could do it then so that everyone in the Eighth graders of the Eighth graders would be participating in the project. Now it seems like it's like 10 or 12 participating in it, the rest of them are just "don't we have any fish in yet?" ah okay and then they go and do anything else.

Poor bacterias. No one ever ask about the bacteria. No, everyone's always like oh, what about the fish? No!

Yeah, bacteria!

And they are growing!

It looks like pasta.

You don't want to eat that pasta. No, but... hmm, that would require of course like more preparation beforehand, but also like would we do the same next year with the Eighth graders, then how could these experiences that we are having right now could be beneficial? Like since we are we cannot if we repeat this next year we don't have the time to change the seventh grade syllaby because they already did it this year. So what could we change anyway next year for, since we know this that in the second semester can be hard.

Maybe take the assignments with us we did in the fall and think about what of them can be saved for the spring, so maybe just as we talked about before two there and two there and and then save a couple of them for spring instead.

And then starting... But that will require a lot of preparation because I'm thinking if we if this keeps going forward, not just next year but also the year after...

Then we could talk about how to what to do in seventh grade and what to do in eighth grade.

Exactly but that would be already in this summer you know.

So that requires having someone that knows having the...

Exactly, which can be done but it seems like, it seems like lots of people need to be on board.

But if this is not just a project that we are we are doing here. It's a project that which school... Every school in Sweden could do or other countries as well and then we can discuss if a school decides to do this project on the school year after year after year. Then we can give them examples how to plan for the seventh graders and 8 graders and 9 graders: save the planting for eight the eight year because it's really good to do that when you are taking care of the hydroponic system or aquaponics system and maybe it's good to talk about photosynthesis. It's hard to say in English but it's the same word actually in Swedish but you don't need to focus a lot on it in seventh grade because you're coming back to it in eighth grade. It's good for them to hear about it already in 7th grade, but so instead of doing a lot of that in seventh grade. I do this in this in this. Because you don't have time to do that in eighth grade because of the hydroponic system.

That's true. It doesn't necessarily have to be here.

No exactly, so it's the experience from here, but if we are giving tips for other schools we can give them each tip that we want to, that's it.

That's it.

In the eighth grade we have a hydroponics system and save this for the Eighth graders, do this in the seventh grade so you can have time to do this in 8th grade.

That's true hmm. But it would be a dream to have it here.

Yes of course but...

So considering we will enter a different phase that will need taking care of the system daily, a clearer distribution of responsibilities among the students and a clearer calendar on when and who has to do, what; how do you think it's the best way to keep going with the system for the next phase?

I think we have a lot of students that want to participate and I think it's interesting to do the water testing but we have a lot of students actually as well that who are not we shouldn't allow to do that because they won't do a good job. Maybe if we are, we can supervise them. They can do it and that if we can supervise everyone. I think everyone should do it once.

But that's the idea of what we are already doing right now.

And we're talking about that, but when everyone have done that maybe we should just say that your 15 or 12 group you can do it and then you have Monday you have just you have Wednesday and the grown-ups have Saturday and Sundays.

That makes sense.

Yes, plus they are just 15.

Or maybe someone will get on board like in this in between phase!

Yeah! Maybe students that we don't think can manage to do it and maybe will do a splendid work with it. We don't know!

Which is also why I think it's important that we gave them all a chance in this period before the fish arrived to understand before it gets maybe not too complicated but to... at a higher pace. So I think it was good for us to give all of them a chance the way we're doing like taking all of them down (stairs in the biology room). To show them so that maybe they can get interested as well again now that they are seeing for real what is going on and what's happening. Like for example student 1 and 2 the other day when I had them and they... student 2, I didn't really get it get that but 1, I knew that she was interested, but after I had them in the biology room during the water parameters and lalala, when they were going away. They said they thanked me and they said that now they understood for real for the first time what I was what we were doing and how the system worked and so like that was very important and they are, you know, one of those that are more interested in it so like, it did make a change for them. So I guess.

I think a lot of students will understand more on the next level because they understand the nitrogen cycle because we talked about that a lot during the fall and a lot of them actually understood that, but I think they will understand chemistry and ions and the cycles even more when they actually test the water and they see the NH_4 symbol and "ah!" Ammonium ion, that's why we talked about that okay. We tested now, how much we have" and that's good.

I also see...

It's for real!

It's for real. I feel that not that I feel that I know because I've been asking them when they come downstairs. I asked them, so what do you think we're gonna check right now? and they usually it takes them a while to remember if they remember, like ammonium nitrate, nitrite so I do believe that it would also be more beneficial for them to have the system which could be next year because we already have the system, it would be more beneficial for them to have the activities straight after the knowledge the theory part which could happen next year.

Or maybe not, because then they, we talked about that then and now they are, what's that now again and then "oh yeah" and then remember on a totally new level.

Yes, but I wouldn't wait too much time though because it feels like lots of them didn't really remember.

Okay.

So maybe a month after?

Yes.

Or we could we could also try like sometimes we wait a month, sometimes less or more.

If we had started the water project, the hydroponic system already in in January, that has been that should be good that had been good.

And that could happen next year for example.

Yes, now the parts are already here.

Not just the parts but also the experience, because I was talking with another teacher before and we were talking about how much preparation it requires before like, the fact that we talked about some stuff, but we didn't really cover everything when we prepared for this like, for example, the second semester. We didn't really manage to combine the syllabi with the project but like I think it's important to remember that the way like, right now, we are in-depth and we know what we are talking about and we didn't have this kind of deep knowledge when we started talking about it, so there were so many things that we didn't consider.

Yeah, yeah!

So, it's not just about having the parts but also knowing what to say and what to consider when organizing stuff.

We didn't know everything about it hydroponic system. Yes, exactly! I didn't know anything actually, so. I think this is a try out.

It is exactly that.

So of course we will do stuff that wasn't as good at it it could be, but that's normal I guess when we actually try something, it's an experiment.

It's trial and error and for example like and sometimes it would work pretty good, like with the plants!

Yes, oh nice they survived! Hopefully, it's not a lot of bacteria in it because of the dirt and I saved like three pots with soil in it but hopefully ther water level was so low at that moment so...
you didn't get maybe...

And I saved it. Really quickly, hopefully.

I was thinking whether to wait because today I've been here for some time already. I was thinking about and I put already the water in the fridge. So I was thinking about waiting tomorrow and do that with the students as well. But maybe I will test it today just to make sure that everything is okay, and you know if it's not then to work, to act on it straight away. But, it looks like it's okay.

But I saw some of the plants the new leaf that are growing and it's really pale.

We were talking about it with Student 7.

So they need magnesium? They're doing the chlorophyll.

It could either be too much water, too little sun, which again we have the growing lights maybe we could have more grow lights or too little nutrients.

So where do they get magnesium from? Because the chlorophyll, the green thing, in the middle of the chlorophyll molecule. There's some magnesium atom so if they don't get a lot of magnesium. They can't make any new chlorophyll and then they don't get green.

I don't know where they get it from...

Me neither.

Probably, I mean for sure either in the fish feed there's probably but

It should be.

But that's also because we've been giving the system fish feed and fish poop. Fish poop is liquid, so we never had a problem with that but fish feed do you remember that is liquid and last time we did it properly like we smashed it super super much and today. It took me longer because I took it out again because it was starting to rot again so I was thinking I was actually thinking whether to suggest to Snuttan or Jonathan not to put it anymore and wait for the fish to be there. Because they can eat it properly so that it doesn't rot but then maybe we cannot wait because...

Maybe or maybe not get not take so much? Maybe a little bit more often. So they can have time to take it up in the roots maybe to dissolve...

And maybe not in the gray box but in the pipes directly?

I don't know if it makes it... or is it good to smash it and then dissolve it before putting in the water?

Hmm. We could try that.

To do just like a solution. Try to do that. But it could be lights as well, because they need light to make a colorful as well. But if they don't get a lot of lights you can see that they are growing especially long they turning really really long and I don't think they are...

No, I think it's more about the nutrients, because the light I've been moving them around, so like I either turn them around face so that they always face the... so that every part of the plant faces the window or moving them in the different rows like if you notice, before we put the seeds the big plants were closer to the window. But then I moved them closer to the classroom because the seeds needed more sunlight. So like they've been having sunlight or light.

No.

But with relation to the interview because then I need to transcribe all of this.

Congratulations!

The last questions are, your name gender and age.

Erica, 42, I'm a female.

Appendix F, Teacher 2, SSI 2

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. In this conversation, there's mutual trust and respect just as in all the conversations we have.

Okay, so now we're talking about the second phase of the project, so the one that went from January February March. When the system arrived in January and we built it and then we decided which plants to have and then realize that it was not possible to have the plants so we started from the seeds. We planted them and then also some plants but not too many, we had a field trip to zoologen and then we added the bacteria and we started maintaining the system. So small groups of students from three to five usually, they would go down with me and check for the water parameters for leaks and if the plants are okay and for the water levels as well. So, this is what we are talking about and the first question is if you have noticed any difference with the students approach to the project in this phase.

Not as a group, but I have noticed individually you can say, for the part where they have been down here and learning about the water parameters etc and some of them aren't interested at all, you know exactly what I'm talking about, and the ones that are interested has really gained interest, but I haven't done anything in the project for a long time now with a group so maybe we're not talking about that at the moment we're talking about other stuff we're doing in school instead.

That is something that came out of the other interviews as well that like this period it has been more me working with the students than you us teacher student activities with them. So, that's true, but it's still relevant to have your opinion because you live them on a daily basis and also because in order to understand to change anything if to change it and if so how mmm. And talking about the ones that you were saying are not interested that much or at all because we also have some in all of the 70 students, in which way do you think those could be driven to participate more?

That is, as a matter of fact, the same students that aren't interested in anything actually. We have problems with them all the time, we had a meeting this morning in the groups in the classes talking about different techniques and how to study so we actually, and we actually open up question that that you need to be motivated, you need to be concentrated and you need to repeat your knowledge all the time and you actually have to take responsibility now for your learning because they don't and among these 75 it's actually too many there aren't interested in there development or motivated or wants to learn you know, you know... so, it's hard.

Where do you think that comes from?

I think I think the laziness comes from the society and I think it's a bigger question than the school. That's what I mean. I think that you get a ride to your training session. You don't have to wash your clothes after the training session you get to jump on a plane two three four times every year to go on a vacation. You don't have to do anything by yourself. You don't have to be responsible for your own happiness and I mean they are 14/15. They are pretty young, but there are stuff you can learn kids and we don't in Sweden right now. We don't.

Such as what?

You don't have to do with the wash shop. You don't have to clean. You know you have a lot of... How should I say, you have a lot of advantages, but you don't have to take responsibility for so much during your life because if for one example if one of the students are mad at the teacher, the parents call them up and asks what has happened and when I was a kid in school my parents didn't talk to the teacher. They said "behave" so they get away with a lot of stuff and that's in school and that is a way in society also and they get lazy, they have a lot of rights, but they don't have so much obligations. That is a problem.

There is a different way of like the roles that hold power somehow it's different than what it used to be. It's probably also related to like how politics changed as well like the role, you know the way we be... Where's my English? The way we, not behave but you know not even communicate. Maybe behave with others based on hierarchy because it's normal that at some point we have a hierarchy in some situations. It's needed. I think it has changed from the governments in the first place like there's not as much trust as there was before and also in the school like I can see that in Italy as well. The teachers are not as respected anymore because the students are either on their phones a lot. I don't know, but also hasn't that always been the case like older generations saying that the new ones...

It has but I've been in school for almost 30 years, and there is a difference actually there is and and it has to do with society and it has to do with the rights and obligations and it has to do with a lot of other stuff also, but you never have to fight. Last summer I was talking to a former colleague of mine. She's grown up in Poland and when she grew up and she was in this age our students are right now and there were, they didn't have electricity for 24 hours a day, they had they had electricity for 12 hours a day and that means when you have to do homework that would be no heat in the house and you've had mittens on and and the hats and your winter jacket and you were doing homework in front of the candle lights instead... you know? It was harsh and she said Swedish kids she's been in Sweden for 40 years or something and she said Swedish kids need a disaster, something needs to happen and I was like "tell me more, I don't know what you're meaning" and she said everything is so easy if you want food you open the fridge, if you want heat to turn it on if you want to see a movie you can choose for 100 different channels, if you, if you, if you, there are easy answers everywhere, but you never have to fight for anything. Everything is just there served, being served for you and and that is a problem and what that means slowly cooked down to your first question is that "no I don't want to participate in the aquaponic system. I want to watch a movie instead or I want to make fun of my friends" instead, then I do because there will be no punishment and then I don't have to do anything because if I don't get punished I don't have to do anything.

Okay. I have two things to say. The first one is that something that I saw has changed their approach a little bit is that in the beginning they thought that it was just for a small group and then when time passed by and I started going with almost everyone, they were more flexible around it like I guess maybe they felt like as if there was a bigger sharing of the experience maybe, so that I think it helped but it's true that like they don't get punishment or they don't get grades for these parts at least. So grades it's probably something that could be integrated but again, like what we were saying also yesterday... in this semester we didn't have as many activities because the subjects, you know, they were not as compatible so maybe for next year for sure to have activities with grades, but more that... and maybe include as many people as possible in with regards to you know the phases like if it's a phase when you can have more people than do it because it's more of a shared experience then.

Yeah.

And the second thing about like kids needing a disaster. I was just thinking by listening to you like have you ever heard about the Maslow pyramid? It's the one about our needs... so like you can reach...

I need people telling me what to do “you're so good”, then I could do anything.

The base line of the pyramid when you have your physical needs met, so when you can eat, when you can go to the bathroom, when you have heating and a roof to stay under. Then the second one it's your... I think is sense of safety but from the social part and then you can start working on yourself. The other ones are like about your self-esteem and then even higher it's about spiritual stuff and connection. And I think those higher ones are the ones that are more helpful with improving the society, so like what I'm what I was thinking was that maybe it is true like where's the limit you know to be, to have everything already served and then not to have to do anything in order to reach those ones and, to just, where's the limit to just instead appreciate the fact that they already have that part and then can like you know take these stairs by themselves to just the last floors.

And maybe some years ago people reached those levels earlier in life I think, because they had to, when you had to work on the farm together with your parents and grandparents you reached that level quite early and you you got your own family really early and now you have to do a lot of other things first and you don't have to take responsibility for those things and then you do other things instead so I think that, I know a lot of young people that aren't moving home until they are like 25 or 30 because it's easy to stay at home.

Here in Sweden?

You don't have to take response. That's take responsibility, so it's not for everyone of course, but it's too common and you need to take responsibilities in those of those things also and and I think that can have something to do with a Maslow stairs of course but I don't know, I don't know... it's too easy and we have two groups of how good our students are in school according to grading which is one way to see it. And the grading system is as you know from A to F and if you have an F, you've failed so actually the grading system is from A to E and and we have we have A, B and F. That's roughly you can say. So many of the students have A and B and they are super super good and they will be splendid society members for the rest of their lives of course and then we have some people that are struggling. We need to help them. That's what Society is all about, but the rest is not doing very good and it is like 15 people maybe 20 people of our 75 that are...

That's a big percentage.

Yes, that are under achieving what they are really really supposed to be doing because they are walking out of the classroom doing something else, seeing this as some social experiment where you can just hang around day in and day out and not participating the way you are supposed to. Too many, too many. So teacher 1 had a really hard test the other week and if we have 75, 15 of them have problems. They are not there right now to take part of high grades, if we take those away we have 60 left and of out of those 60, we had 20 scoring A and B and that is really high grading so one third is actually on the higher half, really high half, so that's super good.

How do you how do you deal with that like, in your subject?

I have, I'm in luck you can say because everybody in Sweden knows English, it's even the guy is up here with the low intelligence or low self-esteem or whatever, they learn English. So that's that's kind of easy.

The other day students from Fourth grade I think started speaking to me in English and I was like shocked!

Yeah, they're really good and for home economics most of them are interested and down there everyone can cook, very good.

As you were telling me yesterday or some days ago, when we were talking like you said that down there they're different people, like they're calmer and they behave better and it actually feels the same when we are here (biology room) because it's very similar like you have to do things with your hands, so you just sort of calm down.

And you're out of of your comfort zone, meaning that everyone around isn't someone that you have to do something fun for or about or with or you know. You're in a different setting right there and right now. I need to show you a picture. I want to see a picture of Vincent eating his fish burger today.

Oh my god, of course I do!

shows picture It's like four fishes.

And he was so happy!

He made another one. He ate two of those. It's like a kilogram of fish!

I wouldn't expect that from Vincent! That's so funny.

Yeah, "are you always hungry?" "yeah!"

Is he?

He said that yep, what do you like this then? Sorry, just need to show you.

But that's true like you see different sides of them.

Yes and many of them are really really good, but what they... in their own settings or with their families and etc. They are, they have really really good sites, but together as a group, they are not that good as they are supposed to be.

And I guess that's normal too, right?

Yes, it's normal but it will fall back on them because they will get so bad grades, so they can't choose what gymnasium they want to go to and when they can't choose they will end up in some really poor with other not so well behaved students. So you see, it's the steps forward aren't that good for them, because they are tripping themselves and there are too many.

And of course if it's something it's normal doesn't mean that it's okay.

No, of course not and they are more here than I'm used to and and it's not according to the school, this group is special even in that opinion.

These eight graders?

Yes, but they are too many more than usual and...

Do you mean in this school generally or in the year we've been working with?

No, both of them. They are more and we have we're struggling to get them on track.

Why do you think is that?

I don't know it's been with this group ever since they went to first grade. So it's hard to break it and it's not like we are the first one trying. We are the last one trying.

That's also something like the image of yourself that other people have about you and they sort of push it to you. I'm thinking about the students and them in the groups right so with the peer pressure again. Because you say that they are the same for the whole from grade 0 until grade 9.

Yes and from 0 to 6 and they are 52 and then in grade seven we're taking 25 more that is like the "Frida concept".

Okay going a little bit back to the system: have you noticed any difference with regards to how much time to give it, depending on the syllabus to the project the interest or the energy level both for the students and for the teachers?

In my subjects I have, for homec, there is time to be done in the beginning and more at the end because I would like to harvest what we're having there now. So I think I have done what I'm supposed to according to the project I think. If I should do it again, I would do probably almost the same. Because we have talked a lot about stuff that's going on both inside the body and inside the environment and etc. So it's good to have the project because I would have talked about those things anyway.

But this way they can put it on something practical.

I think so and for English it's of course harder, much harder of course.

But then also just the fact that they have to speak English with me...

That's really good and I think a lot of them a lot of them do, I think.

And I see them changing as well like maybe at the start of the year, that without the maybe, some of them and the start of the year, they would just look at me and not answer and now they do, they answer and sometimes they also start the conversation!

That's good.

Sometimes.

That's good.

But, that has been a little bit of a barrier actually. So that is for the syllabus your syllabus, but what about the other teachers?

I don't know. It's hard to talk for others but I think that teacher 4 for one isn't keen on talking English and that's a problem for him in this project and I think for him as a person he also needs a lot of time to digest things and this is out of his zone, maybe not comfort zone, but out of his league anyway, so he needs to rethink and that takes him a lot of time. He also does that with a lot of other things in school, he doesn't say so much during meetings, but then he goes home and think and then he comes back with a good idea because he needs to think about it, but it's not so fond of speaking English and that's a problem for him in this project absolutely. And I think that he thinks that his schedule is full already and now this happens, so I think "oh no, I don't have time for that" instead of seeing what opportunities there are. I think absolutely teacher 1 has done a lot of this rethinking her syllabus and what she does during the year and I think she has learned a lot from it also because it's a new beginning for us also and teacher 3 struggles, she's cool. I think. She's like teacher 4 I think, in some way. It's hard to do, interpret the math also, you can do it, some things but not too much, some classes.

It is true that there are some subjects where it's just easier to have this included in. And I sort of understand what you've been saying as well. With teacher 4 I haven't really given it the much of a thought, like I realized that there was this disconnection maybe but probably because of the subject he teaches, I didn't really try to integrate it more and also like it doesn't have to come just from one side.

Yeah, he needs to want it also, you need to, but, it's a fun figure. He's quite special I think.

And what about for the students?

What about for the students? I think they have learned a lot. I was actually talking to one of the girls preparing lunch for us every day and she said that eighth and ninth graders never had so much salad or veggies as they do right now and I said maybe that could be a part of our project. I don't know. Wow! Uh-huh! I don't know, but they are eating really really much veggies and if I take a look at their plates right now. There are more colors then it is usually so, maybe maybe.

Maybe maybe yeah, this is one of those things that you know, to test it could have so many different variables that can be hard, but it could be considered just maybe one of the little things that are happening every time that we have lunch and I see maybe you know there's a plate. I don't know full of just eggs because I've seen that kind of stuff then I go like "where are your vegetables?" Or I don't know if I see a vegetable like the other day happened. We had like violet carrots or something like that and I had Jonatan in front of me and I was like "what's that?" He was like "I don't know" and I was like "I'm gonna try it" and he was like "huh" and I was like "try it! You as well".

They almost taste the same. They are really good preparing food with it because the color blends in with the rest of the stuff, so it's really cool.

But so in the end he had the carrots as well and, I guess that's very interesting to hear... I didn't know that.

No, me neither so I think it's good that we are all looking at their plates, but I'm also telling them that "hey come on. You haven't touched the veggies, you just passed by" "eww, its mixed with other stuff? I don't want to eat that" "okay. Why do you think they mix it with other stuff?" "because it's good for us?" So the latest...

I could see so many students faces in that, you know!

Yeah, exactly! "someone thinking for me? No... no I don't think so..."

"Is there a reason for the things we do and they do? Naaah"

And that is so fun. The last project we did before the big test we had last week was... I called the lessons for "food is medicine one two three four". Food is medicine, and I think I got through to them, I think and that's not something you can do in a couple of lessons. You need to do what we have done last year so maybe maybe maybe that also can be something about that they are eating more veggies. And now I had everyone for making their fish burger and I thought that that was going to throw away lot of fish because they wouldn't need it but it's it's actually less than 10 persons that didn't need fish at all. So I was I'm surprised and I'm happy. Yes, that's good.

Yes. Good job! That's nice to hear!

students pass by and start talking

They passed the Spanish test, they just wanted to say that. They're cute... in some way. Sometimes, I don't like them... and sometimes they don't like me!

It can be mutual. Oh, it is actually.

But I need to be hard on them sometimes and nice sometimes.

I've seen the two, like with you the nice part specifically like.. I don't know, I've noticed it during the year, like the way you care for them. It's very... like you can see.

That's good. That's what I want to visualise perhaps.

So, with regards to these past months, January February March what if we change something what would that be for you?

What did we call those Områdesarbete? You know what I mean?

Working all together?

Yes. I think we should have had one of those sometime here. I think we should have one in the beginning and maybe two during the way and one at the end also. I think we talk about it yesterday also, during our meeting but I think that's one way to keep focus, it doesn't have to be like three or four weeks. It could be one week or two days or something but something.

And not just focus for the students, but also relieve the stress from you as teachers because then you are helped and supported by this project, which has been the case for the first semester but for the second one not really for now.

Maybe it was hard for us in the beginning to have an open view for everything that was going on.

And it's also true that like for these things like, maybe there is something, we realized that there is something that could be implemented in the second semester as well, but then it should have been taught from last year.

Yeah, probably.

From last last year because it would have been different for the seventh grade as well. So like what I'm saying here is that it takes time to understand the right way to do stuff, so it was great that we managed to do it in and we had like the opportunity to do it in the first semester and the second semester was not really there, but it could be.

It could be, yes, I think.

For the next year.

I appreciate the dinner we did for the parents. I think that was really good. I think it was. It was good timing in the project because they could talk a lot about it for their parents when we when they were up into different classrooms and showing what they have done. That was good.

It could be good to do something similar when the fish is here and for the parents to come back and see the system.

Teacher 1 was actually down (in the biology room) with her youngest (son) yesterday. Maybe maybe we could copy that. How they do it? How the six year olds does it? Because they had all the students, the six-year-olds, had their own schedule saying "hey mom and dad and my siblings, welcome! And this is what I have been doing. This is a flag from a country" and they walked around and then they fika, of course. And maybe our students could do that also: "this is our system here are the fishes it's tilapia and blah from Africa temperature good feeding fish blah blah and these are our veggies. We have the blah blah blah blah blah" and then we can fika.

Yeah!

Maybe that could be something.

How could that... how long would that be in your idea?

They could have an open house one day, the parents can come from two to four whenever they like and meet up with their kid and their kid will show them around and they can sit down and have a fika and meet us teachers or if you want to be here. So, maybe that could be something, it's not that hard.

It could be May... probably.

I think so, during the end.

Because April we need to settle.

Exactly.

And then in May we could do that.

Maybe we'll talk to the others.

That would be very cool.

And it doesn't take that much of our time... it's quite easy.

And, you would give a sort of closing not closing maybe opening instead, but for the parents as well, because the students they saw it but the parents they haven't and from what I heard most of the parents are excited about this, but some of them were skeptical so like "hey, see? we've done it!" to show them.

That could be cool maybe.

Okay, so that was for the past. Now, considering that we're gonna enter a different phase that needs a different distribution of responsibilities among the students and a clear calendar and daily taking care of the system. How do you think it's the best way to keep going with this project? Like to decide who has to do what and when and...

You mean hands-on for the project?

Like you know how to...

Actually they need to schedule. That is that it's like the first thing and one group can't depend on people that aren't being responsible. They are probably going to be down here by themselves, so that'll be responsible persons every time. I don't know... everyone is not supposed to be involved, right?

No.

Just the persons you ever had so far.

Yes, the idea is because they are a lot like they're 75, so the idea was to have, to see who was more interested and then in this phase with the one with just the plants like to show to as many as possible of them so that also, maybe, the ones that are not interested, but you know maybe once they do something they get interested, then maybe they can join also in the last part, which is more like... how to say it, like it's daily and it needs reliability and responsibility. But so, it was before to give to as many of them the same chances, but now it's going to be more depending on who's interested and also who we think can actually do it, because for example if student 10 says "I want to do it" because it could be, I don't know, then maybe we think okay, but let's see with who we put student 10 with.

That's good and I also think that teacher 1 needs to be like in charge for who can be down here and who can't and when, because at last it's her classroom. I wouldn't let anyone into homec if I wasn't

happy with it or comfortable with it, so I think she needs to be in charge of the parameters there, I think.

That could be, and we were talking with teacher 1 that like in the last phase right it's gonna be the students doing the, maintaining the system, but it's also true that like either me or her will always gonna be here if they have any questions or if anything happens.

They need to have someone to contact in that way and also the classroom needs to be empty at that time, you couldn't have a class at the same time. So, you need to find, daily basis "on Mondays we can be here at that time since that time".

For now when I've done the activity, I was always lucky actually: either there was no class or it was teacher 1's class or I asked and they said that it was okay, and then we just went quiet because honestly like. Maybe of course you disturbed their focus because you enter and you do stuff, but like you don't... once you know what to do you don't really have to talk. It's just walking around and doing stuff and you don't have to be loud either with the moving around and but, it is true.

Tell that to Student 10. "You don't have to be loud." "Yes, I do."

It is true that, we are all different. Okay, and then the last question it's what's your name gender and age.

Oh, you don't know that?

I do but I always know I always need them... actually okay now you have to tell them. I think it's like from the ethical part.

My full name my name is Johan Tedbrant, and I am 50 years old that's crazy and I see myself as a male.

Okay. That's, it was the end of the interview then. Thank you.

I talked too much, didn't I?

Appendix G, Teacher 3, SSI 2

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. In this conversation, there's mutual trust and respect just as in all the conversations we have.

So these interview's gonna be about the second phase that we just lived so from when the system arrived until now: January, February, March. So what we've been doing is... The system arrived, then we built it, we decided which plans to put and which not to and we understood that we didn't have them, so that we would work with the seeds. We planted the seeds and some plants, then we had the field trip to zoologen. We added the bacteria to the system and then we've been taking care of the system, not daily but twice, three times a week to check for leaks, how the plants are doing and if water parameters are okay. So this is the phase that we just started and considering that we're gonna

enter a different one, that's gonna need like... when the fishes are gonna be here, we're gonna have to take care of the system daily and to have a clear distribution of the responsibilities and a calendar that says who has to do what when. How do you think we can make like this transition more fluent as possible?

I think we need to involve the students to see that these assignments, to check out the fishes and do the tests and stuff like that, doesn't impact on the other studies so that they feel understand and that they have the time to do it. I think that's very important.

And how... that's actually something that I've been seen as well. That some students are interested, but they feel like they don't have time, because they need, like they either have tests or they need grades. So it's like, how do you think that could be... How can we get them? You know in a safe way for them to feel safe?

I think we need to just talk to them and see when it's the best time to do it. When do you think that you have the time to be this involved with it? And what type of lesson you miss so that's...

And how could we do that? Because it's 70 of them, do you think...? Because we cannot speak one on one, because it's 70 of them.

Will take a lot of time. I wonder if we can do something, do anything in Google like a ...[?] or something like that, but I don't know how to... what type of question we can use to do that. But I think we need to talk to them, to find a time, but in a more... Okay wait, because we can't sit down with everyone, but maybe like talk to student 1 and 2, who are reasonable... we can do that.

Because I was thinking, it's also true that not all of them want to be a part like or you know are not that interested. So I don't know if it's needed really to have all of them to have this conversation.

No.

I don't know...

It may be to talk to some of them and see: "what time is the best? When do you think that you don't miss out on stuff?"

But how could we do that?

How many days per week are they doing the test and stuff like that? Is it every day?

Twice a week

Now it's twice a week?

Yes.

And when the fish comes...?

Everyday.

Take their schedule to see. What time or lesson they have and that it's not always on math or stuff like that... that depends on... and it will not be that many times.

Exactly.

And be really clear with them that this will happen like once, twice. It's not more than that, and that's then they can see that's okay. I can miss this, is not that big a deal for me to miss this.

And what about, for the phase we just lived now. Do you feel like it was clear for the students what we were doing and how...?

I think it was clear for them, for those who are listening to the information. You have some of them that didn't want to hear or didn't hear, what we told: "listen, you will miss perhaps some lessons", then they told us that you want to be in it.

Okay.

But it's good that now it's things that like they can touch and stuff like that. It's really good and they see the plants, they see the water and everything and that's good.

I agree. I agree as well, like today with student 1 and student 2, they, and I also had student 4 and 5, but then at the end student 1 and 2 they said that they understood what we were talking about, like for the first time for real and what needs to be done to take care of the system and that is because they saw it, hands-on.

I think that's really important.

I was thinking about maybe having an assignment for... this is just a very you know in the air idea for now, but like to have maybe just in one class? Because 70 of them it's too much, but to have an assignment to ask them to explain how it works and what to check for the system and to see to compare the ones that already have worked in the system and the ones that haven't to see if there's any difference. Do you think that could... [work]?

Yes.

And talking about the students. Do you... have you noticed any difference with their approach to the project in the in the last months?

Uh some of them are... think that we have been working a lot with this aquaponics system and it has been good that we now for a little bit of time that we have not been doing that much that there have been resting from it.

Some of them are tired?

Yes. Someone was tired of it. So that's good. Now it's the fun parts. Because you can see it and see how much it's growing, that's really good for those who have some stuff like home that they use to have the seeds and grow and stuff like that. See how much faster this way is, compared to the original thing, when you have soil and stuff like that. That's really cool.

I agree. Do you feel like the students that got tired are... what kind of students would you say that got tired more easily than the others?

I think those students that gone all into this with every assignment we have done, they've done everything they can, really work with assignments and put a lot of energy in them. For them it's more hard right now to...

Okay, I was thinking... that's of interest like the difference of one perception, right? I was thinking maybe the others... [the ones that haven't worked that closely with the project]

But they haven't been for last phase that we have done. It's just a couple of them and those students have done a lot of stuff right now and the others haven't done. Not as much, so that's a big difference. If they... this group that's been doing the testing and planting and stuff like that, it's hard, see. That's good. You have to just think about it.

And so, in which way do you think the students could be driven to participate more, even more, since some of them now are tired and like in this space... I've been seeing them... like a different level of energy and also a different kind of space, of time for them to do it, because now it's more having tests.

Yes, it's really much for this week, last and next. So really we have a lot of those tests and assignments right now.

So how do you think they could be driven to participate more in this specific time? Because we had more or less a similar time in the first semester, in December, but then December we didn't really have to do anything because we were waiting for the system and we went... was it December that we went for the field trip? Maybe November.

Yes, November/December.

But like they didn't... it's getting crowded here.

Should we... see if it goes...?

Let's see how it goes, if it gets too loud...

So you can hear. That's difficult to... Because when we have other assignment in other subjects and stuff like that. It's easier I'm talked about grades and all that. With this we don't have the same...

Structure?

Yes. It's harder, because this is something that they need to want to do.

So I guess it's or it could also be how to integrate this like for real, with grades. The same way that we did in this the first semester.

Because then we have a lot.

Because I feel like for now the first semester was more about theory so we had some tests for the students as well, but now it's getting more practice, hands-on, which is also when they learn but I still think they should have some assigned. Probably they should have some assignments too.

Yes, to connect to this, to the subjects, because then it would will be easier to do that.

So that they are gonna get graded and they feel driven to participate in that.

Because of the grade.

But it's also true that we had this meeting with you, like with you the teachers at the start of the semester on how to integrate the syllabi and we saw that it was more... like less options with the syllabi, so this semester for the syllabi to be integrated in the project. So maybe this semester it could be more science again, but more on the system per se, as in, how it works and...?

Because that could be a way to get the students more involved, that want to be more involved because it can generate a good grade for them as well, so as well as a knowledge and stuff like that, but it's fun to do this!

So maybe, like I'm thinking the different phases, right? The first one was more theory, and they had the grades; the second one, now, it's more practical but they still need the grades.

Yes, and I think it will be easy when the fish comes, because and with the plants in because they can see they see what we are doing and this arises everything for them. That's good.

We're gonna have an activity this Thursday with teacher 1 and all of them actually. We're gonna have them to put the seeds like the plants into the system, finally! So that's gonna happen, soon. I was actually thinking to postpone our interview after that, but I feel like now it's no time to postpone.

No, because we really need to just do everything .

So okay. This is for the students and have you noticed any difference with regards to how much time to give it depending on the syllabus, the interest or the energy level? We've talked about this already a little bit. Have you noticed any difference?

For the students?

For the students.

A little bit. Mostly because of the time and they have a lot of other stuff that's going on right now, but a lot of them wants this, they like to see it's growing and stuff like that and want to be involved with it and that's really good.

Ok, so you've noticed that...

Some of them. Some of them are things it takes a lot of time right now and they have a lot of tests and other assignments and they're divided on how to divide their time into this different things right now. That's the same for some of them that really like this, that want to be a part of and they like to go down and do things with you. That's really good.

And what about for the teachers? Have you noticed any difference with how much time to give to the project also based on the syllabus or the interest or the energy level?

Right now, it's really much with every subject. That's I think it's the same for us right now and we are it's like this every year, where we just realize that it's not that far until we have to grade them and everything, but we should do, but the time is running out. It's like this everywhere, every year, with everything. So, we're going tired as well and stressed out. Definitely... I was talking to teacher

4 this morning about how much things that we have to do, but... just read the stuff they have been written and test we are going to have tomorrow and stuff like that. Just to manage everything.

And do you feel, how do you feel like this project can support that or you know go along with that without putting more pressure?

I think so.

No, how...

How? I mean, like, we are going to talk in SO about revolution, stuff like that. We can find stuff like in this, to say what we can do and learn from it to make our society better and how to... what type of technology that we need to improve to make our life better for right now and for the future. And that's really good because this is something for the future. And in history. We have this lines we're going to see, look back in the history and what have happened and future, and that could be really good in this, just to see what have been doing... what we need to do to have a world that we can live in.

That's true.

And this is a really practical way to see a new technology, pretty new.

But what about for you as teachers, to take some of the stress out and the pressure away... like I was thinking that even just you know having the students participate in this project, it gives them a different kind of energy so an interest maybe so like... So maybe that could be of help as well without, you know, doing anything more like for them to see that it's important, that there are different kind of learnings and, they are part of this. Maybe that could be of help by itself. I was just wondering if maybe there are other options or possibilities through which this project can help to relieve some stress or you know just go hands in hand.

It was like we did last semester when we did assignments. One assignment that we looked at out of many subjects we have and that's really good because that type of work is really helping, because you can [have] students do one assignment and mean more things. Teacher 1 and teacher 2 and teacher 4, everyone can look in this same and grade them, and then science and then we save a lot of time. And that's really good.

So maybe I'm thinking to do the same but for the more practical point as well, which could be done if for example the activities from more years are changed like let me explain. teacher 1 told me that in seventh grade she did already the seed activity so for example that could have been part of this part and to be a bigger... to help that. And or with mats, I don't know if you have like anything about flow rates or volumes.

Volume did we last semester, but in seventh grade we did lot of statistics.

That could be!

That should be in this year, right now.

Exactly!

It would be great because...

For example how to see the plants grow differently and or what are you thinking?

Like that and do the... I can't find the words...

What's... The change, the difference?

To see the change, how much and present of that and what happened in different weeks and stuff like that. And that should have been now in the Eighth grade.

Okay.

If I thought about it last semester, then I would just take that and put it in eight instead.

Last year you mean? But you didn't...like these... I think it's important for us to...

And, if you do it again, I can do this in this project. And then it will be a lot, you can save a lot of time.

So either to...

Like, when we did the volume. That should be in the ninth grade, but we put it in there.

So either to do it in one year, you know and we have that, the same work that we've done in the first semester and then this similar work in the second semester, or to have it spread with more years, but I think if we do it again, it could be easier to just start with one, with the same year.

I think so because I think it will be hard for a student to do this in two years.

It could be also...

For the interest.

Exactly I was thinking...

I think they would... when it'll be the fun stuff like we do now, we have lots of interest.

If it's too spread out...

I think it's good that it is in one year, but you have to prepare more to see what time are we going to do and connected to.

I agree but I also think, what I wanted to say is that it's important for us to like remember that this is the first year that we're trying this and it goes with trial and error, but, it would be cool to try it next year.

But it's a good thing to remember, to plan it.

As well.

And to that we talked in the group interviews, ehm in the workshop interview to see, just put it together and see what time and subjects can you connect to this project?

Yes.

It's really good. And in seventh grade begin planning it, so that you don't do anything that could have been in this.

Exactly. So maybe a step could be to have a conversation with the principal and talk about whether doing this, next year and if so, to have it planned already for the seventh graders' teachers to know not to do some stuff and the eighth graders to know to do that kind of stuff and the ninth as well. And also like the fact that it will be, if, that it could be in one year doesn't mean that the other years don't learn about it. Like, there could be, but again, either at the end of this year or when the system it's more embedded in the school, there could be like some activities for example as the noble dinner. You know like this kind of soirée or you know when you have more people seeing what's going on, like to have a dinner maybe it could be an opportunity.

You have to involve the parents to make them understand because we have one mother for one of our students that told us: "this is really hard, how can you do this with Eighth graders? That's not reasonable to do that. I work with stuff like that. It's too hard."

Oh, she does?

No, I don't know what, she just told us: "these young people can't do this. It's too hard", but no.

Hmmm, I wanna talk with that mom. Just out of curiosity, to know what she's been doing.

I don't know what... it's student 15's mom.

Okay. But, actually like, there are other example of these kind of projects having been done already and also with elementary school. And honestly you can teach them anything, it depends what kind of... how deep you want to go.

And that's how the students can do a lot more than if you just give them the opportunity!

Exactly.

To do it and believe that they can do it.

That's true, and they and it's a different way of learning, so it's actually beneficial. Of course it can be hard. It's gonna be hard, like we've seen that there are, you know? Different types of obstacles that can get in the way, but...

You can make it suits for them.

Okay, so, this is a way through which not just students, but also teachers could be driven more into the system or like into the project. Okay, but that of course requires more organization beforehand. Okay. This is almost the last question. With regards to these past months, so January February and now the start and the first half of March, what if we change something, what would that be for you? When I was writing down this, sorry. But when I was writing down this question, I also realized that again this like misbalance, because in the first phase I could ask, with these interviews, I could ask to you more things because you had more activities with the syllabi, but I feel like with this phase it's

been more me and the students... having activities then you and the students, about this project. So I feel like I still wanted to ask you this because I feel it could be useful but, I was thinking that it could... [be complex for you to answer]

I don't know.

Understandable *hmm. Okay and then... This was the question I had, and then the other one it's your name, gender and age, again.*

Malin, female. What's more?

Female gender and the age.

I'm 38.

And that was it.

Thank you Chiara.

Thank you. I hope that we can hear or I can hear from this one.

Appendix H, Teacher 4, SSI 2

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. In this conversation, there's mutual trust and respect just as in all the conversations we have.

So, in this interview we're gonna talk about the last phase that we lived so in the last months after the prototype and the building after the prototyping phase so from January until March, what happened was the building phase and maintaining the system so the system arrived and we built it then we decided which plans to have and we realized that it was not possible to have the plants so we decided to start from seeds, then we planted the seeds and some plants as well. We had the fieldtrip to zoologen and then we added the bacteria and we started maintaining the system: so with groups of students we went to check water parameters, if there were any leaks, if the plants are okay and about the water levels as well. If you needed to add some water or not. So talking about this phase, have you noticed any difference with the students' approach to the project, in this phase?

No, I don't think so. The only thing that the students have talked to me about is that they sometimes feel that it takes a lot of time and that they have like other things to do besides this project and that it stressed them up a bit.

That is something that came up, that came out also with, like I realized when taking them from the activities some of them, usually the ones that are interested in their grades. They maybe don't want to lose the lessons because they and also this time like the last two weeks and this week it's full of tests, right? So it also goes in flows for them, because we had that similar period in December but then in December when you had to grade them because of the what's the name. You had to have the

grades, but in December we didn't have the system so it was like we just took it more easier in that time and then it was that was it.

And then... I used to say that the spring in the 8th grade are then most stressful period for the students because they have a lot of things that they need to do in different kind of subjects and to be able to like have good results on the test, they need to be on the lessons and... So, I think that there's one reason that they feel it a bit of stressful.

It's reasonable. I understand I felt like I have one comment and one question related to that. The comment is I feel like there are some subjects, of course I think that they are all important the same, right? But then in the school some of them are more important than others like there's some kind of hierarchy, for example with PE and languages, so I felt like the students usually when I come during languages classes (they are more approachable and less stressed). So and then in relation to that, I also felt that sometimes when they had like a test in the language classes, what would happen was for the teacher for example to send the presentation to the students, so that even if they would lose that class, they would still have the presentation. But of course it's not the same, but, I'm just thinking how that could be managed you know for the students not to feel like that. And of course a way could be for them to have grades on the activity that they do downstairs, but that can happen only if all of them do the activity and it's not possible with all of the activities in the system because some of them, since they are 70, it's not feasible to have all of the students doing that. Which is actually what we are trying to do in this moment like we are trying to have smaller groups of students from the start of March, I started at the start of March and it's gonna be until Easter like more or less 8, 10 students a week. They will understand how to take care of the system how to check the water parameters and, generally how to, what to look out for when maintaining a system so that teacher I can also take that into account and use it somehow in her class, but like I'm just wondering how that could how, that stress can be relieved from students. This could be a way: grading them. But again it's not easy because it's not always possible to do so.

The possible thing or the impossible thing is that we have like in if you say in Swedish, we have like 14 knowledge points that need to be checked and in the SO it's, I think it's more things. If you take Swedish you can test it in many different ways, but if you have like SO, we have history that we're doing now and we need to do the industrialisation and of course we just have had a time to prepare, we could have some more things connected to the project but it's... if we would have done it like that, I think that we would need to like start planning it about one and a half year...

I get what you're saying and this also came out in other interviews as well. Like the fact, because in the first semester we did manage to combine the syllabi with the aquaponics, but in the second semester we realized that it was not as doable because there was not this planning ahead, but before the Eighth grade, not just the eight grade but also in the seventh. For example with science, it could have been, because teacher 1, she had an activity on planting seeds in seventh grade and that could have easily been done with the system in the eight grade, if it was thought as you were saying before. So, it's something too... and of course this year, it's important for all of us to remember that this is trial and error, like, of course it has already been done somewhere else, but it was the first, it's the first time here. So like we... I think it's important to like understand, to be compassionate, like to understand that next time we can do it, we can think it this way like we are learning from this experience how to manage in a better way, and what also came out from a different interview is that

the Eighth grade, it's like, to work with this project, with the aquaponics, we thought or we were talking about whether it was the best to have it in just one year or more years and we came out we came up with the idea that it was better just to have it one year, probably the Eighth grade, so that they don't feel like, they don't lose the interest over too many years, too much time and also in this way like, if it's thought ahead then it can be a very powerful tool, because then you can actually create them and do also in the second semester activities there are related with the syllabi. But I wondered for now or like for next year. Let's say next year you manage to have it here again and you manage to, or the teachers that are gonna be the 8th graders, then to keep the system going, I'm wondering what could that, what can be changed for next year given the knowledge that we have, since you know the seventh graders already did the activities probably anyway. It's always, it's for sure gonna be different, in the sense that we already have the system here. So just for that part like times are faster, but yeah.

I think that the most important thing is to start up with the project directly after the...

Christmas break?

No, summer break because then you can like have a plan for the whole year and you can also like plan other things that the students need to do.

Yes. I agree and like maybe could also be for example. It doesn't have to be the whole year either like it could be maybe two months in the first semester and two months in the second, you know? More spread out in a way that it's also a relief for the teachers and the students as well. So maybe when it's less... like not in December or not in March. Maybe more in January and October September, that's true. Okay and then another question I have is in which way could the students be driven to participate more?

I don't... we talked about it at the beginning and I think, one thing is you should have like more maybe more subjects. And with subjects I mean if you could like have some more things connected to the Swedish subject maybe and some other subjects in SO and NO, English you always have like English in everything you do.

Yes.

And what it would be for things... I don't know but I think if we should like have this kind of project in the future. We need to think it through so that we can have like more, different types of subjects knowledge, I don't know the English word but knowledge. Because you have like a list of things that the students need to be, that they should have like learned before the 9th grade and if you could like have more, you can have done more of those lists. I don't know I...

No, I think I'm getting what you're saying, like you have some goals that you have to reach.

Yeah! And if you could like getting more of those goals I think that we had like saved more time and It wouldn't have been so stressful for the students. I think.

So the same way that we managed to have it in the first semester?

Yes, but do it more.

But then again either more preparation as in, okay in seventh grade "we already know that we're not gonna do this activity because we're going to do it in the Eighth grade" or more because I feel like when we had the meeting we tried to have as many things as possible, so I don't know how we could have changed that.

If we like, when we have... When we like, when we started up, I think that we would have liked more meetings in the beginning and then do...

Hmm, to structure things.

Yes, I think so.

I feel like it was such a, how to say this, like this whole project at the beginning like if you think about it. So many teachers didn't really know what we were going to do, like it was so not clear, right? Like you learned already so much about (aquaponics). So it's hard to talk about stuff when we don't know them in the first place.

Yes, but now I think that we have when we, we have done it now. So then we know more things and I think that we could have more SO maybe in this project and talked more about the global goal and shipping.

Yep, you're the expert on that and that's also like a way we can see the way that more stakeholders come together as in I am the expert from the aquaponics side, but you are the expert on the syllabus, so you and like different knowledge comes, they have to come hand in hand and work together, because I don't know what your goals are or, you know better that part. So now that, as you were saying, you have a little bit more knowledge of the apoonics side and maybe I have a little bit more on the syllabi I think it's easier. That's true. But it's, of course, it's also up to one, like, each single part to try to be active in the process as well.

But then you have like because in the beginning you do a schedule about things that you should do for one year and if we had like talked at the beginning, I don't say that we didn't talk, but if we like had, if we had known these things that we know today, we could have like saved some things and do it in this project.

Yes, I agree. But you're still thinking about seven grade as well?

No.

Eight?

Yes, eight, because in the seventh grade I don't think that they would have managed to do.

No, I'm thinking more for the, what they learned in science and math. So math, they did statistics which can be used for like how much the plants grow, that stuff and in science, the seeds.

Yes, and you can like prepare them in the seventh grade and because if you do so, I think it would be would have been more easier for them to manage to do the things in the Eighth grade, I think.

Okay and it's also like now I'm thinking that, I very much hope that this project's gonna continue next year at least and but it is true that teachers are going to change, because you're going to go in 9th Grade and then the ones that are now in seventh grade they're gonna, if they accept, which I very much hope they do because it's such a huge possibility for the students and for the teachers as well.

But I think that you should, if you should be in this project for next year, you should talk to the teachers.

Yes, I think there should be some kind of exchange what I was trying to say is that you as teachers from this academic year, 8th grade, you have this knowledge now and if the school decides to keep going and at least the next year, then for sure there's gonna be a meeting with you and the next teachers that are gonna come and use this system, so that you transfer the knowledge that you gained during the last year. And of course, I would also love to be a part of this, but that's up to I don't know how much of my choice that is. But of course you can say that to the principal. I think now, but except for me and my future as Chiara, I think that it is easier to have a facilitator or to have someone that's more responsible for this, because we've seen it like working up until now. It is easy for you, you know, you have, this is not your main project. So it is easy just to forget or maybe something passes your mind so I guess it is very helpful to have someone else that sort of has the bigger picture of these project.

Yes.

Let's see what the principal says and teacher 5 as well, which is gonna be the science teacher the principal says that... oh, what did he say? I think he's gonna have teacher 5 call teacher 1 to talk about this, so I hope teacher 1 is gonna, let's see. Okay, so the next question is if you have noticed any difference with regards to how much time to give to the project depending on the syllabus or depending on the interest or the energy level, both for the students and for the teachers.

And here I would say is the tricky part because you have like so many different things that the students need to know and as long as you can like put it into the aquaponics you can like take some things, but then we have like things that you can't take into the aquaponic, for example, you have like the French Revolution...

I wonder how that... maybe like the fish can have...

Oh their own French Revolution and...

"We're not gonna work for you anymore!"

"No! We want freedom!"

And then we find them on the floor, dead.

Oh, so... That's why I think it's so important that we have like a schedule when we marked things that, if we do this on that day and then maybe it's gonna be a break for three weeks, then in the three weeks we can have like the French Revolution or other things.

Which is actually what we did for, when we had the meeting for the first semester and second semester, but then again we didn't have like, the knowledge we had was shallow, more shallow than

what we know now, but, that's true. It was not just the knowledge that it was more shallow, but also like the idea was to have, was to work with the system like once a week more or less or to have activities once a week, but you are right. It doesn't have to be that way if it is easier for the teachers and the students to have it like maybe one month and then for a month no, then that could be a way as well.

I think, yeah. If we like have it for one year, I think that it would have been a good idea because then we could have like work hard on the project for you know one week, or two weeks, three weeks and then do something else and then go back and keep on going and...

Also because the system take care, like it needs care, but once it's settled and like it just needs. Maybe half an hour every day to check the water parameters and that everything is okay, but a different kind of intensity, maybe. Okay and would we change something, the way that we lived these months January February March what would that be for you? Like to improve the experience.

I don't know right now. I don't know right now. I can't come up with something right now.

And that's okay, also because like I feel this period as opposed to the first semester when you had more activities, you as teachers, I feel like this period it was more of me with the students like doing water parameter things and so like it makes sense that maybe you don't have it, because I feel like they had more activities with me probably this period. But the last question I have before the demographic ones: considering that we're gonna enter a different phase that needs taking care of the system daily and a clearer distribution of responsibility among the students and a clear calendar on when and who has to do, what, how do you think that it's the best way to keep going with the system consider this? For the next phase, after Easter.

Don't stop to talk about it and then keep on doing things that will give a practical outcome.

Okay.

And with that I mean that as long as other people can see that things are growing and it will come out some things that you can do or eat or something else. I think that people would like to keep on going with it. I think.

Okay. That's true, because now that I think about it, the students haven't had like an activity where all of them were talking about this at the same time in a while now. I think the last one was maybe when I had the presentation on why we're doing this. Do you think it should be, it's needed to have some like one more before Easter at least? Because the way we've been working it's small groups of four students twice a week.

Oh, I don't know.

Because from one, like from one side I think of course it could be useful from the other one it feels like mmm it's not really the time for you as teachers and for them as students and for me as well or neither. And also like, some of them are still having interactions with the system. More or less eight or ten of them each week, so like the knowledge it's still going and flowing and they're still talking about it anyway. So maybe this is the right way for this period.

Yeah, I think so.

Okay okay, so the last question, what's your name?

My name is Mattias.

Yes, what's your gender?

Male.

And age?

40.

Okay, that's true, because you had your birthday. Okay and that was it. Thank you.

Appendix I, Teacher 1, SSI 3

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this conversation.

So now we're going to talk about what happened in the last months so from half of March until now. So what we've been doing is we've been maintaining the system. Groups of students have been coming downstairs to check on the water parameters, if there were any leaks, if the plants were okay, the water levels and generally how to take care of the system, and then last week the fish arrived and after that we've been checking on the system daily. So, this is what, the phase that we're gonna talk about. It would have been ideal to have more time with the fish in to talk about it, but that was not the case. So in this period of time have you noticed any difference in the students approach to the project?

Yeah, when the fish arrived a lot of them actually got more interested in the system again. "So finally the fish arrives!". Yeah, I guess it's... they were curious about the fishes.

I wonder how much that is related with also how it was spoken about from higher levels, like from the principles to the teachers...

About the fishes? The principles haven't talked about it at all because they are not involved in the project. I guess not.

Yes, but I mean more like... How generally something it's perceived from people above us it probably affect also the way we... of course it's also fun to just see the fish because they are alive and everything, but I was just wondering if that's connected to it, with that as well.

Yes, I have no idea actually.

And I don't think it's easy to also separate the two things. I was just trying to reflect how much that could have impacted or not. But do you think it's a spike in interest, like will we do this again maybe next year, or in a different school and would the fish arrive in January you would still see the spike

of interest, but then do you think this spike would continue or do you think at some point.. it would fade again or...?

Yes, I think so. I don't think that teenagers are generally that interested in fish and plants. They think it's cool that we did it and that they can see it. But I think the majority of the students just are used to it now, so " yeah, yeah, it's the aquaponics system". And the ones that take care of it are the ones that are more interested in it because they feel attached to the whole system.

So I wonder, for a similar project to be done again, the question would be how to keep going with the interest, how to always spice it up.

Yes and that's why the things that we have talked about in the last two interview. I guess: that the first term where we did a lot of assignments that it was connected with the system and we haven't done that this term because of all the things we already discussed in them. So if another class would do it, you need to connect assignments to it, in that way.

And probably also something like field trips as well.

Yes. We talked about that last time I guess that if you have it a whole year, work intensely with it for a couple of weeks and then maybe just do something else and then get back to it and do some intense stuff about it and then do something else in between and just continue to... I guess so.

And then the daily maintenance would still be there though. So I wonder maybe that would be easier to have someone from the outside instead of the students, like maybe the students could be, but that's for...

Or maybe more students that are involved in it and take care of it, because we have more students that could do it, but we don't have the energy or time to do that right now I think because of the class that we have right now and also we have like 15 students that it's not suitable to do this and we just want to keep them away as long as possible from the system. Because they will maybe break it or kill a fish or just destroy that. But we have like 25 more that could do a really good job.

Yes, but it's also true what you were saying about the energy like they could do it, but they would need again the training or you know the supervision.

Yes, so if the fish should had arrived in January, we could have like 30 students that can take care of it and maybe 10 of them to take care of it for two weeks and then another 10 could take over for some weeks and so on and then it wouldn't be that much work for just one student.

And also for us because we train them maybe the first two three days and then for the rest of the two or three weeks they go by themselves.

Yes, they can manage it.

Yes, that's true. Hmm. Something to remember if anything similar happens again. Okay, so that was for the students, but talking about the school staff, so kitchen staff, cleaning ladies, principals, just everyone that's involved in the school. Have you noticed if there's any change in their interest towards the project after having been hearing about it for almost a whole academic year and living it not really close because it's in the biology room but living sort of close?

Yes, some of them, I think a lot of them, don't even know it's existing, hardly. And some of them have asked me about the fishes "have they arrived?". Yeah, go come and take a look and so some of them, but not a lot everyone has so much to do in this time of year and it's hard. Yeah, I guess you see that as well. We are really tired now.

Yes, I see that and I feel that, yes. And maybe like as long as it... I also understand that if it's not related to their job it's even more, it's even harder.

Yes, and then they just want, if they should be interested then is because of their their own interests in their spare time and if they are interested in growing things and so on I guess this is very interesting.

Yes, so maybe like for next year in relation to this part of this group of people it would be more to understand who are the key roles for the project, so for example, maybe the chef because he seems very interested and also he could use you know the products of the system so how to include that could be a conversation for next year. And the cleaning ladies and everyone would come just after that, probably. You know with more people getting into the system and the project and then just... you start talking about it more.

The kitchen could actually write in the menu maybe that it's Basil from our aquaponics system.

Have you seen they did a post with me?

Oh yeah! That was nice, so we do that more often, and maybe when the paper and radio arrives tomorrow. Maybe someone else could get some more interest.

Yes, we are gonna talk about it at lunch because AH!

That's not my comfort zone in there. So maybe teacher 2 can do it instead of me.

I was just talking about this with teacher 2 before as well and he was like "Yeah, no, teacher 1 will do it". Yes, well, let's see. So now okay, so if no interest has been seen in the school staff. How do you think this could be changed to replicate the project? But we talked about this little bit, like understand who to integrate, to have a more meaningful impact and then you will come after that.

Yes, because, do everyone need to be interested in it?

No, that's true.

Everyone should know about it and I guess everyone too, but not everyone needs to be interested in it and take part of it.

In relation to that, how do you think we could... because now Helen is right in the article for the magazine but how do you think the school could have talked about this in a more open way? Of course the fish just arrived so...

Yes, I think we missed that our students should meet the teachers on Wednesdays when we all teachers meet, not every Wednesday but a lot of them, one of those meetings maybe some of our students could attend and talk to the teachers about the system. We talked about that with it. We didn't ever do that.

We talked about it?

Yes, I think about it.

On Wednesday, to have the students going and..

Some of the Wednesdays just to talk about the aquaponics system.

That's a very cool idea!

Right after we did the nitrogen circle, they were really really into it, the students, so when we did that they should have met all the teachers and talked about the system, but everything has been so spread over such a long time I guess. Oh, I don't know! Sometimes it's good that it's been spread over a long time, but sometimes not because it's hard to get the students interested and keep the interest up and also me, because I need to do other stuff and then it's hard but some of course I like it and it's really really interesting and I am almost in their everyday and see how it's going and say hi to the fishes, but it's hard when I'm not doing an assignment with students in it because I don't have time. I need to do other stuff.

Yeah, but this is good then that we're doing this as a prototyping phase because this is just the year where we understand how to do it and what to good to take from. And also from a same reality sometimes it could be good, sometimes you can take things that are good and sometimes... like the same reality in a different context would mean different not expectations but different outcomes. So for example, it is good that it's in the whole year because then you can have more assignments. But also to spread it in a different way. For the interest, but this is something very important: after the nitrogen cycle. And I feel like we do this or another school again, of course this context it's different from another one, but if they spread more the assignment, you know more focused in one week and then just leave it be, then it could also be more smaller projects for example a nobel dinner, but also at the end of the year, when harvesting or you know something like that.

Or maybe we should do two classes at the same time so 7 graders are doing some assignments connected with it and the 8 graders are... I don't know.

That's also an idea!

Yes, they are a lot of students though, but in another school maybe it's easier.

Yes, that's true, because here every year has like approximately 75 students.

Yes like 150 students.

So that's a lot.

Yes, it's a lot.

I mean it's a lot, if there's no one like my role, going around, because then really you don't have the time.

No.

This is not in the interview, but I think it could be helpful. How do you think... because I've been talking about this with the principal, how to have me in the school. So basically how to find money and I was thinking also in relation like to the radio that's gonna come here and you know talking about it openly. Maybe the easiest it's just to find private investors or something like that, because we've been searching together for fundings and... it's not, for the schools you don't really find some even more because it's a private one. Then I was thinking what kind of role can parents have in this? If any role, I don't know how it works.

None, I guess, they have too much to do with other stuff.

No, I was thinking more for investing by themselves in this.

Okay, money. Why should they? What to do they win? They're egoistic people.

A more circular and sustainable education for their kids, which is a lot, but I also understand... I guess it depends from everyone...

Yes, maybe one or two for each class maybe.

I'm thinking I'm gonna talk with the principal about this because I also don't know how it works.

Yes, you do that.

And then maybe someone that listen to the radio interview or something like that "Ah! I'd like to invest in that".

Maybe get this system even bigger so we can actually get more food from it?

But to have it bigger in the first place you want to have someone that can take care of it.

Yes, but just, if we had a bigger one we could get more food of it and then the restaurant could actually get some profit from it.

Yes, because for now they've been having herbs from time to time and they will have this, but this is going to be like, to harvest the bok choy that we have now it's gonna be maybe one home economics class for this year, not more... so. Or to have, maybe to keep this one and to have an hydroponics one downstairs. That's also an idea.

Yes, it's a problem as well as we have it in that room, because we need the room for other things and we can't make it bigger, and we really need to think about which students we send down there because they need to get into the "secret room" and we need to head other stuff there and there's a lot of dangerous stuff in there as well. They are locked by another key, but we can't send everyone downstairs there. So maybe if we were thinking of let the students in the 5th grade to take care of it, because they're not teenagers and it's easier then, but they are too small to be in there by themselves. Yes and so on, so... it's not a perfect place to be.

What would that be though?

Here it's the perfect place to be yes, we discussed that a lot of times and we didn't find any place except that, so for now is the best we could do.

Because, would you do something with hydroponics, it could also be downstairs, and it could be smaller you know like it could be vertical and like this big, but then you would still have water from time to time going around, so the problem would be... like it always happens if you're working with a system with water that it would spill or at least... and even if it's smaller it can still make some damages so.

Yes, but if we really should do then something about this, something that we could always do, we need another place for it. I guess because it takes up a lot of space and it's manageable, but it's not perfect. So if it's something that we want to do we should need another place, maybe in another place that are connected to grow some stuff outside as well.

That would be a completely different project like, super cool.

Yes, together! And we could grow stuff together with the kitchen. So they can cook something of it.

Yes, that will be super cool! Like maybe would be outdoor and indoor farming or just indoor farming, but then you need money a lot of money, because we do build the structure and...

But I see a lot of years in front of me and Frida is, all the schools are trying to be sustainable and this is a part of the project I guess, so... maybe.

Yes, I completely agree like in some years that could be a reality.

A greenhouse experiment in every school, together with the aquaponics system, really nice.

You know I'm gonna do an internship this summer and I'm gonna get some formation. It's an education on permaculture and maybe you're gonna end up with me anyway.

Yes!

But the principal was telling me about the fundings and the money and he said that he asked around to some people, sustainability strategist and the one that takes care for the Erasmus fundings and also the CEO and the CEO she said that she will ask around but she doesn't know if she will find it, but I think these kind of dream of course, it's good to have grass roots realities coming and start the fermentation of conversations and thinking about certain concept but then it's also necessary to have some regulations from top bottom, because at that point it's a different structure and it's easier, because maybe you have more time. Like, if they decide of course they're gonna decide, principals or you know someone higher on the hierarchy. They decide to do something like this and invest money, time and energies in this, then you as teachers, you are going to have some time to do this, because of course they're gonna think about that and then it's possible. I wonder... I don't know how that could be pushed or nudged for them to make that decision because now it's the time.

Right now we do as best as we can with the time we have and the place we have and the students we have.

Yes, okay, so since the project now needs the collaboration of more people working at the school to function, for example during the weekends and the holidays how could teachers not in the 8th grade be driven to participate more and help out more during this constant maintenance of the system?

I don't know just... if we can get some more of them to help us feed the fishes during the weekends and I guess that we will hopefully.

That probably comes with time as well and talking about it.

Yes and also I guess if you haven't been into this room and not seen the project, it's a little bit scary to go here and do stuff about it that you don't know anything about.

I mean it's a big responsibility.

Yes, it is because you don't want to kill the fish. "It wasn't me, it wasn't me!".

"But here it says it was you!"

"I didn't make it!" "Ah, so you didn't go to feed the fish that's why they are dead, they starved to death!"

"So it is you anyway!". So maybe to have but in the future like just rounds of education of teachers as well, how to take care 101 and doesn't have to be long maybe just half an hour or maybe just the guidelines.

Yes.

Okay, so knowing that there's no personal judgment from my side and that there's trust because we've been working together for almost a year and I think that we have a different relationship from the beginning. I realized that there's a different amount of time and energy that you as teachers from the 8th grade invested in this project which could either mean more interest or more tiredness or both of them; so knowing that, what is your honest opinion on how to have the teachers in the 8th grade to be driven to participate more when needed?

I don't know, it depends a lot of things that we are... it seems like we're not that into it now than how we used to be in the fall. We are tired, really really tired. We have a group of students that take all the energy away. So we are literally walking on our knees. It's hard to get out of bed in the morning, because you're so tired, so I don't think it has something to do with the system actually, we are just very very tired. I think that we don't get the help we need with the students right now, so we are fed up with...

And the school is indeed a stressful environment to work in.

Yes, very very much. But if I did everything all over again, I should spread it out during the years, so I had some biology or chemistry right now that were close to the system. Oh, now I had electricity, it's nothing to do with it. Yeah. We had a lamp or... and now I really need to do the sexuality stuff as well, because they need that now in the 8th grade and that's very hard to connect with the system as well. Fish and sex... no, that's not interesting.

And they don't work the same way that we do, and they don't need that.

No, not at all.

So maybe it's about, I understand the tiredness, and again there's no judgment, I'm just trying to reflect...

Yes, and I guess you see how tired we are as well.

Yes... and I'm feeling tired as well, but of course I have a different role, so... but now I'm just thinking maybe it's about like having more clear responsibilities like you take care of this and I take care of that. And of course if you need help or I need help then we're gonna talk about it, but maybe to have some more clear roles like for example "I take care of the schedule of when the students are gonna be and who's gonna be you know that day" and another one can be "okay. I can take care of the schedule for the weekends" something like that, maybe you have more clear response as well.

Yes, absolutely.

So to distribute the responsibilities and that way you sort of have to participate if you want to. Of course at the beginning there's gonna be a conversation around who wants to, and how do you feel like...

Yes, and I think that not everyone of us knows how much it is to do. And it's so little time and so much to do with everything else. It's true.

Yes, that's true... okay, last question. With regards to these past months so March and April now. What if we change something? What would that be for you? We sort of talked about this already.

Yes, we did but I can't think of anything more but just that it would be nice to have a project connected to the system right now, but I don't know what and when. If I did it all over again I should have done something in the second semester as well, like planting stuff from seeds and talk about seeds, but I did it in 7th grade so... it's a small part of the biology, so I can't do it multiple times, but maybe and my youngest kid is in the 0 grade they are planting stuff now, so could have done a project with the smaller kids and help them to plant stuff together and then when they got some small seedlings we could have put them in the system. I don't know if that's too late, but we can think about it, it's a good idea to do another year.

Yes, and then I'm thinking that these kind of connections, how to say this, like this project has different roles and each one of us, we have our own knowledge field and these kind of connections you as teachers can make that because you know about the different syllabi and whoever will take, if anyone like a road similar to mine, either they will have to study before the different syllabi by themselves and understand "okay, I can do, we can do this, this and that" for you know to have a conversation with teachers, but the idea would be to have not just one year connected to this, but the whole school, and not with the same amount, but maybe grade 0 could be just the seeds, then grade 1 could be to make a bracelet of the system with the different pearls being the different parts of the system like bacteria, plants, water, so that they get to know what we're talking about and it's like, but that would be in the future future. But for now that could also be an idea because we're gonna harvest probably in two weeks the bok choy. So after... who is the teacher in your son's grade? To talk about this with.

The teachers that will feed the fish this weekend, I think. Teacher 6 and 7.

Because then we can talk about that.

Yes, or maybe if they already feel "we don't want to do it again" and then some of the other younger students may be haven't been planting stuff and then they can do it. It doesn't need to be that class, but some of the youngest students.

But is it still teacher 7 then or another teacher?

Yes, and teacher 8 so, you talked about her...

Teacher 8, I think I know her...

Yes! Because she plants a lot of stuff here as well. Yes, but in dirt.

Teacher 7 I don't know who she is, but...

She's really tall, long long dark hair...

Dark?

Yes, long dark hair, but she usually has it in a ponytail, I guess something like that. But they are a lot outside, because they have really small kids.

And then the best idea to talk about this would be maybe just if you meet them to just talk about it and the same for me. Yes, maybe also without forcing it too much because at this time we're all covered and we also need to realize what's the scope of the project for this year. So of course it's good to have as many people involved, but then we also have to maintain the energies to have the core of the project alive and without giving too much away, because then we don't have the energy for ourselves... but that's a good idea. Okay, so that was it. What's your name, gender and age?

Erica, 42 and female.

Appendix L, Teacher 2, SSI 3

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this.

Now we're gonna talk about the last months that we lived, this is the last interview that we're going to have this year. So we have been maintaining the system, groups of students have been checking here for the water parameters, if there were any leaks, if the plants were ok and the water levels. Then we got the fish in the system... just a week ago, not even and then we've been checking for it daily. So this is what we've been living with. Have you noticed any difference in the students' approach to the project in this last phase?

No, I haven't and I think that this is depending on that I haven't been talking to them about the project. I haven't been involved in first, in the first row. So no, I don't think so. I'm sorry to say.

No, it feels like this last interview would have been more beneficial to have it after more time the system was up and running, but I guess that's how things goes usually, like if it's... we don't have the

time or... so I understand why, because things have been happening right now. There's not... you haven't been harvesting. We haven't been using the plants in your classes, that's probably gonna happen, but like maybe in a couple of weeks.

Yeah, and that's good because next week I'm not having any practical home education so we will have it in two weeks for the next time and then we'll do more of those pies we have been doing this week, so the herbs can really get in handy then.

And the bok choy as well.

Yes, of course.

How come you don't have home economics...

On Tuesday, is a special day, teacher 4 and teacher 1 are not with us that day and we have after launch, we have some fire education from the fire brigade something and me and teacher 3 has to take care of the rest of the class during the day, so we won't have any normal classes. We don't know what to do it... solve that on Friday.

Okay you have home economics just Tuesday and Fridays?

No Tuesday and Wednesday and so, since the rest of the group aren't having their classes on Tuesday we won't have any class on Wednesday either. So everything is in the same phase as it's supposed to be.

Okay, because I think they need to be harvested soon.

They can be on the system on Tuesday. There's no problem. They can be taking care of the system on Tuesday, and I'll be here on Monday so you have to show me.

Tomorrow?

Yes, I can do that.

And talking about not the students, but the school staff. Have you noticed any change in their interest towards the project after having been hearing about it and living it for almost one academic year? So like janitor, kitchen staff, cleaning ladies, principals...

Yeah a lot of persons are talking about it, but they don't have the full understanding of it. So they only know like 10%. So when you talk to someone they get interested, but they haven't still haven't been a part of it. So they don't have the whole picture.

I wonder how that could happen.

I think it's up to each and every one to have interest, otherwise we can maybe, you know the big TV screen we have down in the canteen? Maybe we could have a webcam on it and show pictures on that.

Yes! Do we decide, like who decides whose pictures are there?

No-one, anyone who wants. Ah, and the janitor is the one taking care of it of course, he is like the spider of everything here.

So then we can send him some pictures.

Maybe we should.

That's a good idea. Let's write that down.

Do you ever watch Swedish television?

No... should I?

For the 50th year in a row now, they are showing something that is called "The Great Walk about from the mooses or the elks" and they have a lot of cameras on different locations in the wild, just cameras on trees. And sometimes there are moose coming and walk by and they are sending this, broadcasting this for hours every day. For weeks and there are so many people watching and it's like nothing. I think I heard about this already. Yeah, and it's really really cool.

Have you ever watched it?

Yes and not just "sit down, let's watch the great moves walk about" no of course not but it shows like everywhere. I know classrooms that are having it on because the kids gets calmer and just the other day I happened to see a few minutes and I was like "what's that? It's a bear eating something!" and it was actually a bear because they left food out and this was just before the broadcasting was about to start, so they started it earlier because the bear was eating something in front of the camera and like no human beings in kilometers.

That's the thing with the system, the fact to be closer to nature relaxes people. Yes, just also having green stuff as in plants. It's good for mental health because it's like something with... how we are wired because we are animals and we used to be in the nature and then also for the air, like it purifies the air which is good because the fish...

Yes, it's really good.

And then also for the sounds like I mean not to this amount, but if you have bigger plants and more they lower the sounds as well, they take away... so it's good and taking care of them it's good for the students as well because they... it's a different kind of relationship the one with the plant then the one with a person, so for example, students with problems, it's even better for them to do this.

They have those trained dogs for autism persons among other things it's so cool.

We could have trained fishes... trained Tilapias... okay. So you said that you noticed some interest in the school staff, but not maybe a full understanding. How do you think that could be changed would we replicate this project? And I'm thinking, I don't know if it's needed in the first place, maybe it's needed only or mostly in the kitchen.

Yes, but I think, once again about the students and when this system is up and running younger kids can also participate in this, maybe they can't take care of the fishes, but they can do something they can write about tilapias. They can write about different vegetables. They can write about things

and paint and whatever, there are always things to do which involves the kids and once the kids are involved the teachers must be involved also because they get questions and they must be. They are forced to be interested, so I think once the system is up and running it's more easy to involve everyone yes, I think that is the key.

Yes, when I was here these days teacher 8 would come and she showed the system to all of her students, but that comes from already existing personal interest, but it's true that once it's here... the students, they are curious, they come and see, they have questions and because for them it's just something fun. It's not, one more responsibility or one more thing to think about so it's true.

And I think that in the beginning when we started this project Carl-Johan told us that the kids were going to get t-shirts and we were going to get t-shirts and I think that also could have been a part of raising the interest because if we had a fun t-shirt and something on the back like "would you like to know anything about aquaponics? ask me!" that would also create interest I think.

Yes, for next year possibly at this point, but that's true, like small things... It's hard to stay on top of everything...

Yes, and the first thing we said was to keep the system in the cafe, that would have been the perfect spot for it because we will have vegetables in the correct area in school, not stacked in some classroom somewhere, where most of the school never comes to, it would be in the restaurant where everyone goes to all day, and this would have been easier for everyone to take part of it.

Yes, that's true, but also, when you have different stakeholders working together I also understand why the principal decided to have it here.

Yes, and I also understand that because we can't have water on the floor if something happens, so of course I understand it, but I think it's boring because this is not a good place for everyone to participate.

Maybe smaller, but now we already have this, because I'm thinking if we want to move it downstairs, maybe could be a bit smaller but then we already have this one so...

And you're already have water so... if we had drainage in the floor there it would be okay, but we don't...

Downstairs?

Yes, so that was the key point I think and it's really too expensive to install it so of course we can't have it there, but it would be great and when we first were thinking about it we googled some pictures of aquaponic system and we saw a round tank kind of big and so you can see through it and we could have it down there next to the sofa, right inside the sofa, would be really really cool to have it. So everyone could see when they enter the school.

Yes, but that would mean money.

Yes, of course.

Yes, but of course the location of the system itself changes how much people talk about it because they see it and...

Yes, I think so, I think so.

So since the project needs the collaboration of more people working at the school to function, for example during the weekends or the holidays as you know. How could the teachers are not in the 8th grade be driven to participate more?

They need to be integrated, if I wasn't part of this I wouldn't go in here on the weekends either, so I totally understand all of them, they need to be integrated. I think.

How would you do that?

Same answer as the last question: you need to involve the students. And then force the interest to the teachers, because I think if the teachers or the staff in school knew a lot about this, so they would feel so sure about it that they could be able to teach their own kids or husbands or wives or whatever, they could come here during the weekends and show it to other people. Families or whatever I think that would be, that would be the best part I think. Because if you're not, if you don't get a grip on it, if you don't understand everything. It would be just work coming here during the weekend also.

Yes, but now I was thinking how to get the students... like, just the presence of the system? You think that could be enough for the students to get interested?

Yes, I think so, but I also think that maybe you could give them hints on what to do in class, if you are in first grade you can do this, if you're in fourth grade you can do this, if you're in sixth grade, you can do this. I always think it's easier with the younger kids. I think the 9th grade will be like "whatever, I don't care" apart from those who are really really interested in science. They would be, they would think this is interesting, but for young kids. I think it would be awesome.

Yes, I agree and I also see like having been in this classroom specifically sometimes when people pass by they get interested and I see that, but if I'm not. I guess what I'm saying is if someone that doesn't do like... that's not a bridge with the system and how to talk about, if that someone's not here. How to do that? Probably it's gonna happen anyway, maybe in a different, for sure in a different way and it also depends again where the system is, how visible it is. But then I'm thinking, how much does it take, how many students does it take for the teachers to say "okay, let's do an activity on this"?

If the kids are young they can be "forced" you know what I mean. They are doing what the teachers tells them to do now.

I'm thinking more because you said how to get more, how to get the teachers more driven to participate in this and you said through the students, so I'm thinking how many students does it take for a teacher to get driven into this... but I'm not searching for an answer. I'm just reflecting.

I don't think I have a number... I don't know if there's also relying on the teacher to be interested, because if there are not interested. They won't do anything.

But for now the feeling I had was that specifically the science teachers, they were interested of different grades as well, but especially when now, when the system is up and they don't have to think about anything more. Which is understandable of course but also I think it's a clear point in seeing how much the school needs someone else, someone that takes care of this...

Yeah, the principal sent something to us, what did he write?

Yes, I guess the role of the principle is... how this is communicated from the higher sites, it's important as well.

Finally our fishes has arrived. There are 25 and like to be together in a small surface, if you're going to eat a tilapia. It's like a bass in taste.

I saw the email... "if you're lucky you're gonna meet Chiara".

Yes! And go say hi to the fishes is the message and he could also send another one which has "if you're in first grade you can do things like this with our class. Just don't go up and look take part... let the kids be a part of it". Yes, these are examples on how you can do it.

I was thinking that then it's also... let's see if it makes sense, if there are more people that share a responsibility then it cannot it can be harder to understand who has the responsibility went to do what so for example. He could do that, but then he would also say "Hey Chiara send me a list of activities that the teachers".

And maybe we can have the 8th graders go down to other classes and tell them about the system and "hey grade 2, fish pea and poo, nutritions, vegetables...", maybe.

But then to feel... like now the students are like already struggling enough. It feels like the students, I was telling you the other day, like some of them are already stressed just just by checking the system, so to tell them also to go... of course. I agree. I agree that it's a great idea, but now I'm thinking on a practical everyday life. I don't know how many of them would agree to that and how much it was stress them out and you know...

We canceled the Cabaret the theater thing we're doing. We cancel it and I think that is the best idea of course. So that means that at least the teachers aren't as stressed as they were a week ago, so I think that is good.

When did you decided that?

A couple of days ago? Yes and I'm just brainstorming here, so if we take like an afternoon for everyone we don't have any classes that afternoon: "you three are going to that class, you three are going to that class". Maybe that could lower the stress then, I don't know if that is even possible to do but I think it could be. That's like also a Frida way to do it.

Yes, how do you think... maybe we can talk about it with teacher I tomorrow at lunch?

Yes, I think so.

That could be nice and we were also talking the two of us. I don't know if you remember, to have the parents coming and to be involved like to have a fika after hours like that. That's one afternoon, from

maybe two to four and they decide when to come and the kid shows them along, but that I think you could also be maybe by the end of May.

Could be good actually, I forgot about that. I brainstorm and you keep it.

Yes.

Is that how we cooperate?

I mean sounds like a good cooperation.

I think it is perfect.

So we can talk about this with teacher 1 tomorrow.

Yes.

And knowing that there's no personal judgment from my side and that there's trust, we've been knowing each other for some time. I know that there's a different amount of time and energy that you us teachers in the 8th grade have been putting into the system, which either meant more interest or tiredness or both. So, knowing all of that, what is your honest opinion on how to have the teachers in the 8th grade to be driven to participate more when needed?

Oh, that's a hard question. I really don't think I have an answer to that, I think it's... It must be related to your personal interest, like this cabaret thing I told teacher 1 from the beginning "I'm really not participating in that; I can be behind you, I can take you back. I can take care of the 15 kids that aren't going to participate, so good and I can take care of them for two or three weeks when you are rehearsing and doing everything you need to be, that everything that needs to be done, but I can't participate in the theater and I'm not interested and I'm not capable so let me do what I can instead" so that has been my part since the beginning that I'm going behind and I think this is the case in this project too, if you're not interested. I think it's really hard to be forced into it.

Yes, and it probably has a connection with the subject as well.

I think so and often you are interested in your subjects and not so interested in other person subjects. I think so.

Maybe something could be to have them, the assignments spread out as we were saying so maybe September October sort of full immersion maybe just some days, and then after Christmas break we start from January with the system so fish maybe from February and then that way the teachers will have more support also during the second semester.

I think that would be good that way.

But also to understand that these flow of stress will always be there like every year.

Yes, it's the same, I think so, and it is a really stressful place to be in school. We're working with people and everything that is happening among them. It's a stressful environment. Of course it is.

Yes, so just to acknowledge it and accept it because there's nothing really that can change that it's just a flow of things.

Yes, sometimes students come to me and say "well, hey I want to be a teacher. What should I be thinking of?" and I say "are you capable of having five conversations going on at the same time?" and they're like "what?" "because you need to, that's like the number one key to become a teacher. Can you talk to five different people at the same time?" "no, no that's stressing me out" "don't be teacher". You see how it is. Everyone is coming to just talking.

Yes, that's true. Also another answer could be like "how have you been treating your teacher?"

Yes!

"Is that the same way...?"

That could be a good thing that you have been like the worst students "no one should be like me". You know I was the guy hanging in the back of the class leaning my chair to the wall. Talking without racing my hand first... that was me, for many years and then I figured "no... it's not so bright. I have to move up" so I move forward, so I was in the front row with the classroom. I never stop talking to the teachers, but they noticed me and I could talk about things that even slightly were involved to the lesson in during that time and when I was sitting in the back. I was talking about probably sports. It's better to be upfront.

Yes, I was in the back as well, but I never got smart enough during high-school... that's okay.

That's fine by me.

So, with regards to these past months half of March and April, what if we change something, what would that be for you?

Get the system running faster, I think so. And I know it involves a lot of more work. Of course it does but I think that's still the thing we are interested in.

I think it's not necessarily more work, but more experience or preparation beforehand, for example just with waiting for the seeds to sprout that was one month and then, we were sort of unlucky with the timing because there was Easter and then there was another week where they were not here so we waited for the plants but I still started. So maybe not... more insight.

I think so too. So I don't think we need to change anything else. I think we have the right students to help, I think we have thought of a lot of things... especially you have!

Yes, that's another topic. What about all of these thoughts if this head it's not here? Where are they gonna be? How are they gonna be used?

Yes, that is a problem if you weren't here, we wouldn't have anything of this of course.

I have been talking about this with the principal, about how to find money to help me stay here next year and let's see, because all of the fundings that we found together during the workshop, they are for not for the school and I suggested him to ask the sustainability strategist, but last thing I know it's that she didn't answer yet. And the other one, the one for Erasmus, but that's just for Erasmus, so if

they go for an exchange, so that's not on monthly payment. And then, the CEO, she said that she'll ask around but she doesn't really know... so I don't know.

I think I told you sometime that the school would be interested if you're not bringing any costs for the school.

Yes, I asked the university. It's complicated for them to have such a position because it's a lot of bureaucracy beforehand and then they have to have the position open for everyone. So it's not even... You don't know who's gonna end up getting the position... so from the University it's a no. From here, I don't know, I was thinking maybe... but I need to talk about this with the principal because I don't know how it works. Maybe some private investor or something like that? Maybe the parents could be a part of this but I don't know how it works.

Me neither, probably the private sectors somehow, but if we reach out both the papers and radio maybe maybe maybe... there'll be an opening.

I was thinking the same, maybe!

I hope!

Let's see... and that was it, so what's your name gender and age?

It is always Johan, I'm 50 years old and consider myself to be man.

That was it.

Cool!

Tack.

Varsågod.

Appendix M, Teacher 3, SSI 3

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this conversation.

So as usual just a brief intro of what we've been doing the last part. From half of March until now we've been maintaining the system with groups of students, they came downstairs to the biology room with me to check whether parameters, leaks, if the plants are okay and the water levels as well. And then just last week we added the fish, which is very soon to have this interview, but this is the time and now we started checking daily the system. So the first question is have you noticed any difference in the students' approach to the project in this last phase?

I think they are happy that the fishes are here and that's good to see what has happened with the plants and stuff like that. Like it's working! That's good, but they are tired... some of the students

feel it's a lot of stuff to do, not just in this project but in school in general, so they are a little bit stressed some of them.

Yes, which ones of them more or less?

I talked to Student 1 and she was just stressed, but she didn't know what to do, and Student 2 said "I can show you, this is just going to check the water levels and stuff like that" plus, so that's the easy part. So she tried to calm her down, it's not that much.

That's nice okay, so I try to divide them by... because I know them by now and I know how interested they are and their amount of energy, so I try to do that, like the more interested doing the heaviest part, which is like water parameters and the fish and then the other ones that maybe are not so into the project, just the easy part, so to check for the leaks and stuff, but it's so nice that Student 2 has given the support to Student 1!

So she was stressed about that she was alone, because Student 3 and some should be with her... and I don't remember who but it was very supportive.

Okay, then maybe we can add her name. Or like add something to the schedule to say to the students that if they feel that it's too much they can come and talk to me about it. Just be very clear about it. That's true. To consider the mental impact.

Yes, I told her to go to you, get the information, what she should do.

I can help, so student 3... and you said that some of them are tired.

Yes. It was Student 1 that I talked to today, but she was downstairs.

Hopefully, if we're gonna do this next year as well... Who knows... hold our thumbs or cross the fingers, whatever works, if we're gonna do it next year then the idea is to have the fish before, so the students... January February, so the students already know how to take care of it and it's not new for them at the end of the year because it is... Like now we are all, not just the students but also the teachers, and we are all more tired than what we were at the beginning of the year, I feel that they are tired, but I also see that the closer ones they are getting, they got like the boost out of the excitement and I think it can be good that we only have one month because this way they can... It's not too much. It's not too long and they can have the energy up. Yes okay, so you noticed some stress.

Yes, but someone, some of them are happy and exciting it exciting about the fish.

And let's see if someone more comes and asks to join the project, maybe.

Hope so!

Okay and have you noticed any change in the interest of the whole school staff towards the project after they have been hearing about it and living with it for almost one academic year? So the school staff, it's the chefs, the cleaning ladies, the janitor, the secretary, principals, everyone.

They have been there and looking for that to check it out and see what it is, but I don't know anything else.

So how do you think that this would be changed then, would we replicate these project? How do you think we could change and have a bigger impact on their interest as well? Not just as the teachers but the whole school staff.

I think it will help now with the... we have a schedule about feeding the fish that will help. Some of them already signed up for it, so that's good to see what it is and what we are doing. That's really good, that's one way to make them involved in this.

Yes, to give them some responsibility, but not too much, so that they don't feel the weight of the responsibility, but still they are needed, so it's good to have them. I was thinking also, for next year, we could have the same presentation that we had with Snuttan, Carl-Johan and me, but more... we didn't have it with the school staff. It was just the teachers, from six to nine grade, right?

Was it the whole...?

It was, yes, because teacher 8 was there.

And it was on Wednesday, so it should be the whole, but not those that you're talking about.

And they can be involved as well, because like the chef he's very into this and the kitchen is...

The janitor has been.

The janitor does yeah, but I was thinking more for the kitchen because it's very related to produce food and you know cook food, because the idea is to use the vegetables at some point. So probably for next year we could do something like that, either presentations or find some time in the schedule for them to also give ideas and feel more involved like I don't know "I would love to have these plant in the system" like the same thing that we did with the students but for them.

Yes, because what do they use in the kitchen?

Yes, what could be useful for them? Yes, that's true. Lettuce probably... we didn't start with lettuce because it was not the right time, they didn't have the baby plants, but we can do it next year. Okay, let's see. So as we were saying the project it's gonna need the collaboration of more people working at the school to function, for example during the weekends and the holidays. How could the teachers that are not in the Eighth grade be driven to participate more in your opinion? Because as you were saying before there are some that have signed up already. But I think that not all of the dates are filled.

No, not at all. So, yes, we will need help from them because it's good to be involved to see what we're doing in that. It's not that hard to do.

Hmm. So maybe the idea it's during this week I will send a memo to the principal, the same thing I've sent to you when you came here by yourself, the what to do list, so probably once or, hopefully, once he spread that to the teachers and they know... because I understand that if they've never worked with the system it can be scary like "what do I have to do? Oh my god? It's so big. I don't even know where to start" but if there's a guideline, not the one like in my thesis but just a simple one. That could work hopefully. And also for now the first three weeks are covered so maybe in the meantime you're gonna talk about it between yourself. Maybe, maybe not... I saw you just wrote your name!

I have to see when I have some spare time.

Okay, so probably talking about it. Now I'm thinking how to... more than just these small guidelines how to have more teachers know what to do. Probably, I saw the principal's email today to come and check the system to everyone, and he was like "if you're lucky you're gonna encounter Chiara", so something that I could do it's like if they come when I'm there, which is usually every morning, then I could just briefly talk to them about this and say in the weekend it's not too much. It's just about feeding the fish and checking that they are okay.

Ah, so not the water parameters.

No... during the weekend no.

Only feed, okay.

So that's a lot less.

Yes it is.

Not just with time, but also less complicated, and I think it could be useful for them if they stop by, for me to have the discussion over there, so that they actually see what we're talking about like with the fish feed in the fridge and everything. Any more ideas on how they could be involved more? Or any ideas on who you think could be more easily involved in this? Based on their interests, passions.

I think the kitchen as you said and also the science teachers and to involve them more to just show the students in the lower grades, because I think they will like to see the fish and the plants and how they coexist with each other, same water, stuff like that.

Okay, you mean during normal classes for the students to see that, so that they...?

You have to make "områdesarbete" like stuff like we have done, but then the easy way with the younger ones about the environment and to...

Okay, and you think to have the students, to have the teachers do that kind of activity for the students would lead the teachers to be more involved as well?

Yes, because that's a good way to just both show the students what we have here in school and how it's working and stuff like that and then the teacher has to know about it and the good example for it. That's not that it's easily done to make, make a change for us.

And I think that it wouldn't take too much time, like it depends from the teacher and how they want to do it. But one example was to have like, to make a bracelet with different colors, with different balls, and every ball has a different color and it represents a part of the system, for example blue for the water, green for the plants, and black for bacteria, whatever, and that could be an easy activity for the students in the lower grades. Okay, so knowing that there's no personal judgment from my side and that there's trust. We've been knowing each other for almost a year now. Up until this point I see that there's a different amount of time and energy that you already invested from your side which I think could mean either more interested or more tired. So the question, what is your honest opinion

on how to have the teachers in the 8th grade be driven to participate more when needed? And that's not a personal. It's just general.

I think one problem is that we have a lot of stuff that we need to do with the class in every subject that we have and that make us stressed now in the end of the semester as well with grades and stuff like that, so I think we have one thing that it's good to do, is to do a lot of stuff in the beginning of every semester because in the end of it we are stressed out about everything about the students and stuff like that. Then stuff that we have to do by the curriculum and stuff like that because this is a really good project. I think, but take a lot of time to do it in a good way. And so, do the biggest part and most of it in the beginning that will help a lot I think.

Okay, so that could be of help to get...

Like with did in the fall, we did a lot of stuff in September and October and then in November December it was broken. That was good.

Yes, but what if, we are living this period and you want like, how would you inspire someone to participate even if it's a... you know sometimes things just happened and it's like a stressful time, but we still need to do things, how would you handle that?

Yes, show them how much you can involve in like math, we have done a lot of stuff in this project in the fall about the volume and calculation like that. That's a big win and the students see a reason to do it, because we are doing this to be that way and do this calculation to see how much water and stuff like that we need, that's good.

But what about for the teachers? How would you... because for the students it's good when you see it practical...

Yes, but for teachers as well, you can because of the students get so involved in it and see the reason why to do it. It's easy for the teacher to do this as well and not that many discussion about why are we doing this and stuff like that. It's easier to make a lot of stuff in the short time because we are working with lots of teachers and do the whole "områdesarbete" and that's win win about the time. You save a lot of time by doing like that and you don't have to grade every students in every part because we can do that together: some of us, some check this and check other things and that's we save a lot of time.

Exactly that which again it means when you work as a group right?

Yes, when we do with the tanks and the model and stuff like that in the fall. One subject a lot of teachings...

One team and more subjects.

Yes.

Okay, and with regards to these past months, so half of March and April what if we change something. What would that be for you?

I don't know. I'm sorry.

Reasonable. That's understandable because in this last period it's been me mostly with the students.

Yeah, exactly so it's good.

Okay, so when I did the calendar, for the schedule for now for the students to decide who checks on the system when and who does what, so for example the fish the plants and the leaks. Before doing that, I asked some students "which way do you think" do they think it would have been better to do it. For example, I was thinking for them to write their names in the Google doc but that's not, they suggest me not to do that, because that would have not worked. So I just put the names in. But do you think that could have been different or like... we still don't know because today is the first day, but we needed to do the interview, so that's a little bit tricky. But do you think it's a good way of doing that? Like to include them, but also give them structure already.

Yeah, I think that and show them that their opinion is it's important for us and if we haven't suggest "let's do like this" and they don't know it really, it won't work. It's good to listen because it will probably not work if they say so. They know each other.

Yes, so probably the best thing is to still have them involved, to still ask before doing something either the students or you as teachers because you have already some experience with doing activities. So you know too.

We have, but the students that you have now in the group, it's good.

Yes, they have awareness of themselves, and how they work.

And that's good and awareness of each other as well. Yes, because they have known each other for some of them for eight to ten years now, so. That's good as well.

Wow, which was one of the same... something similar, I was looking again at the last interviews that we had to write about them and one thing that came out was that it was good for you as the four teachers in the Eighth grade, it was good the fact that you already worked together before doing this because there was already a support. You know each other.

And that's good.

And there's a good balance as well, in your group.

Yes and the same for the students; they know each other and they haven't, they don't need to show us different side of them because they want to impress someone. They already know each other.

Okay, so that was it. So, as always, what's your name gender and age.

Yeah, my name is Malin Björnqvist, female and I'm 38 years old.

Thank you, Malin.

Thank you.

Appendix N, Teacher 4, SSI 3

This interview will be a part of my master's thesis, therefore if it's ok with you I'll start a recording of it. There's mutual trust and respect in this conversation.

So just to bring back some memories of what we are talking about now. We're talking about from half of March until now. So what we've been doing it's maintaining the system, with groups of students coming downstairs with me to check water parameters, leaks, if plants are okay and the water levels. Then just very very recently we add the fish in the system and we started checking for it daily, because that's what the law says. So the first question is: have you noticed any difference in the students' approach to the project in this last phase?

No, some of the students get stressed because they need to, in their way to see it, they think it takes a lot of time and the time that they are downstairs with the fish they miss things, other things that we do in the lessons. But then I think that they still think it's funny to do and that they think it's a good way to learn I would say.

That's interesting. What happened was that yesterday I had an interview with teacher 3, and she said something similar but about one specific student, so I just told her... like the idea is that they feel as safe and that they can trust me as much to tell me if they feel like this is not approachable for them and I understand that they have a different relationship with you than they do with me, so it doesn't really matter to who they speak, it just matters that they do and then if it gets too much or you know not bearable then we can talk about it, but I also believe that the more they'll do it the quicker it will get, they will get more used to it and also like some students, they've been coming down just during the breaks. So they don't actually miss classes and the activities with the system, they are separated. There's one person that needs to check for the water level. There's one person that needs for the fish and then one person that has like the general overview of leaks, water levels and the plants so like these three activities separated like that. It doesn't take that much out of a student because they don't have to do everything. So I understand that it's, maybe they perceive it a stressful, but I would say it's more like a new responsibility and of course that can mean stress, but it doesn't necessarily mean that the stress is related to the amount of responsibility because it's splitted in three people and, then again they have the support anyway because this is a transitory phase right now because they didn't do it all by themselves until now, so now they're actually starting to understand "okay the system needs daily care and that kind of stuff" but of course it's important to notice if they are stressed or if anything's going on with, if they're not happy with something or if they don't feel comfortable with something. Do you remember who was the student? Or it was more...?

There were maybe four or five students. But if I say the name I don't want you to talk to them, then they will know.

No, I'll not go and talk to them, I didn't do it yesterday when teacher 3 told me either, that's not the idea.

So, student 5, 6, 7 and then we have like I think 8 and 9.

But was it now, like after the fish arrived or before?

Some people talked to me yesterday and then it has been not this week, but the week before, so last week.

Okay, just to understand if it was since the fish arrived or before... so it's a bit of both. The other question I have is: have you noticed any change in the interest of the whole school staff towards the project after having been hearing about it and living it with it for almost one whole academic year?

No.

Okay, then how do you think this could be changed, would we replicate this project?

Same thing that we talked about the last time, that we need to have... we can do it but then, we can't like have it ongoing for a whole year, because for example in SO we have much other things that we need to learn the students and many of those things you can't put into the aquaponic system, but otherwise you can maybe you can have it more in NO and HKK.

Okay, so in order to have the school staff more integrated and involved you would say to have it in phases, like the system as we were talking about so that they...?

And maybe involve, I don't know teacher 1's subjects more or more, but...

When I talk about school staff, I'm referring to the chef, everyone that works in the school, not just the teachers.

And the other ones actually, I don't know because I think that... I don't think I have any good answer. Actually, because I don't know.

Okay, so since now the project needs the collaboration of, now more than ever needs the collaboration of more people working at the school to function, for example during the weekends or the holidays... How could the teachers not in the Eighth grade be driven to participate more?

I think it's up to the principal and the other principal to spread the word and then help us and to spread the word to the other people on this school. I would say.

How do you think they could do that?

Talk about it and then show the meaning of doing it and stuff like that.

Like having presentations or just...?

Yeah, one thing is presentation another thing is to like show them the meaning to do it and show others maybe.

How would you show them?

I don't know. In some way? I don't know actually.

Because it looks like here at the school it's not easy to... or, you always have so many things going on like so many other meetings and side projects... Like maybe something could be during the Wednesday as we've done as well with Carl-Johan and Snuttan. Maybe they could do something like that. But for this year I feel like it's a little bit...

I think one way to do it it's like if Carl-Johan and I don't know Snuttan would have been here more than they actually are to promote this thing, because it was a long time ago Carl-Johan was here.

But you mean, for who?

For the school and to show the meaning of doing it and the connection to...I don't know.

So you're talking about again like during Wednesday's presentations?

For example, but it can be workshops, maybe? It doesn't necessarily need to be on a Wednesday but then if it is possible to do... I don't know.

No, I was thinking that workshops like as you've seen with the teachers from the Eighth grade, just the four of you and me? And we've been working closely so we also have a different kind of relationships, you know closer and it has been very very difficult to find a spot to have just three workshops during the whole year, so... that's why I said I was thinking Wednesday mostly.

Yeah, but then it's up to our school leaders and then other I don't know people to decide if we should do more or less, and if we should do more then we should involve other people then they need to find space for us to do it.

I see, so how to get it, like to get it deeper in the system (the school system) and if so, how. Okay, I was talking with the principal about this and he said that basically the school doesn't have any money to invest in this now, because at some point it's also that part also need to be considered, so I wonder if that can happen or if so how. Because you know, then it would be someone already working here or for frida... I don't know who could that be then. I don't know maybe the sustainability strategist or... but then it's also more difficult to actually do it in practical because maybe they don't have the knowledge for now. They haven't been working with this. Yeah, so I don't know. That's a tough question actually, how to integrate this, how to embed this on a deeper level and maybe for now it's not necessary to do it on a deeper level, maybe now it's more the time when people need to get interested about it and to understand in the first place because I get like what I've been seeing with the students as well during this last year it's that the interest gets together with the knowledge, they go hands in hands. So the more knowledge... usually the more you know about something the more interested you get into it. And it feels like lots of the teachers, they still don't know what we've been doing in the biology room, so probably also time is a factor that needs to be considered more. Yeah, but it would be good to have like some... it would still be good to have some continuation even if not with the fish, you know, even if just with the plants. At least next year, in order to have the topic still going and the people to have this time to understand what we're talking about. Do you think that could work better like to give more time?

I think so. Maybe I think so.

I don't know, I was just reflecting here. I'm not... you know the school and how it works better than I do, or you have more experience.

I think so maybe... if other people have the interest I would say it would work out and I hope that they have the interest to start up with it after the summer again.

I hope it as well and then again it doesn't have to be with fish, it can also just be easier with plants and maybe less activities or... like it doesn't have to take that much time. So knowing that this was with regards to the teachers that are not in the Eighth grade, but knowing that there's no personal judgment from my side and that there's trust because we've been working together and knowing together for almost a year now. There's of course a different amount of time and energy that you already invested in the system, which could either mean more interest or tiredness from both the students, but now I'm talking about the teachers in the Eighth grade, so what is your honest opinion on how to have the teachers in the Eighth grade to be driven to participate more when needed?

It's a hard question because right now, I'm really stressed because we have much other things that we need to do so I can't answer that question right now. I would say so. I don't know right now.

Because it's not like to participate more, it's not just about how much... maybe one solution could be what we were saying already like to divide the activities more, so to have more in September October, then November and December free. Then to have more January, February, then March it's free and then you know, you keep going but more light because March it's hectic, but next year you're gonna be in nine grade, but now I'm thinking still eight graders, right? So March more free because they have lots of exams and grades and then April and May, but you still take care of the system, and then April and May you still take care of the system, but with less activities. Maybe that could be an answer. For the teachers as well. And of course I guess it comes also from personal interest and...

No, it's not the personal interest, it's about the curriculum that we have, in History we have like 11 knowledge steps that we need to exam the students in and we have geography, we have religion and some of the things you can put in in this project, but other things it's hard.

Yeah.

And there is the issue that I see, because I have an interest of doing this, but then we have like other things that we must do that are not connected to this project.

Yeah! I was thinking that, I totally understand that, I was thinking how to still combine these two things and maybe one way could easily be to have the class downstairs if it's free, to be closer to the system like physically somehow because that's also something that I've noticed that when you're close when... it's actually a concept in design like when you have an object it can become a boundary object when you have a conversation around it. So for example, I noticed the difference when the system actually arrived physically here at the school, then it was a different kind of conversation that we were having with the students and with people in general because you could actually see it in practical life. So I guess that could be a way maybe, just to have it there and then you never know like also how a student's brain works. Maybe they make a connection or something. But yeah, I understand that it's... that that is a difficulty: the contrast that you have of personal interests, but then, yes, personal interest from more sides. As a teacher that it's not in STEM and then as a person, as an individual. Which, how do you think could be those two could be crossed together?

I think that you need to talk to others and see how they have done it. I would say.

Usually... While similar projects have been happening in different schools, usually the subjects there are integrated more are the ones from STEM so science, technology, math. But yeah that could be an

idea to try and see if there's anyone from geography, history and of course there are topics that can be discussed as well like in history as a I think I told you at some point, like this is actually so old. Aquaponics. It has like 3,000, it started like three thousand years ago, but that's probably not in your syllabus then anyway, so maybe you can talk about it, but when students are in 4th grade or something like that. So yeah, I see like the... how to say this. Not the contrast but like yeah.

I don't know the word, I don't remember the word.

Yeah, but you know what I mean.

Yeah.

Hmm. Okay and with regards to these past months so half of March and now April, what if we change something, what would that be for you?

Maybe, I don't know. Actually, I don't know. I don't have any good answer to that question.

If you feel like you need or want to have the time to think about it, you can just tell me if anything comes to your mind in the next days. And then last round as always what's your name gender and age?

My name is Mattias and I'm male and 40 years old. And it's not you... it's not you making this stressful... how to say this. It's more like all of these things together.

Thank you for saying that!

Thank you.

Prototype dayyyyyyyyy

let's get it started

Why are we here?

Understand the basics of the various aquaponics systems and...

... discuss together which one is the best fit for our school

Today's structure

Morning

- Presentation
- Individual research

From 10:30 to 12 and from 13 to 14

- Group work based on previous research
- Choice of a system
- Sketch of the chosen system
- Prepare a presentation on why you chose that specific one
- Start building a model of it!

What to consider
when choosing an
aquaponics system

Purpose

What is the purpose of this project?

What could *your* purpose with this project be?



Location

Proximity to what needed: water source, spare parts, light, etc.

Accessibility

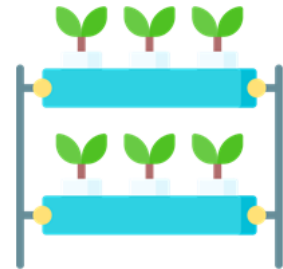


Space

How much space does the location offer?

How much are we allowed to use?

Is there any specific way you would like the space to be used in?



Environment



Daily temperature fluctuations:
outdoor \neq indoor

Water source:
quality and quantity

Environment pt2

Lighting



Water spillage



Humidity (natural evaporation)



**Different types of
aquaponics
systems....**



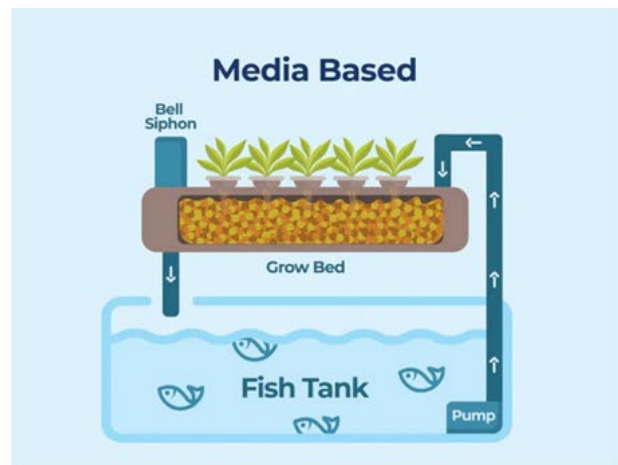
Source: [Bathtub DIY Kit](#)



Source: [Inspiring Aquaponics Designs You Can Do-It-Yourself](#)

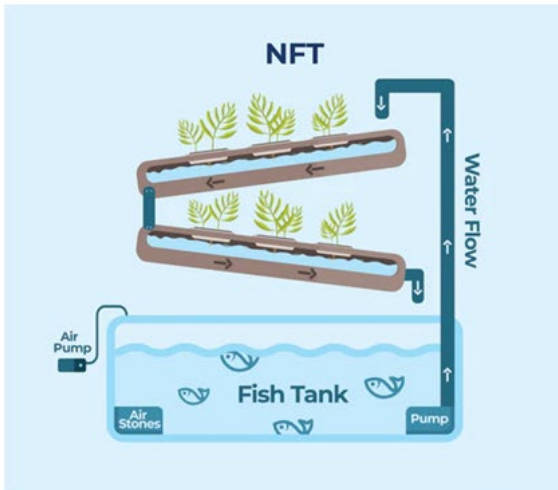
Various kinds of AP systems: Media Based

- Grow bed or container filled with grow media (gravel, lava rock, or clay pebbles)
- No additional filtration needed nor air pump
- Worms could be added to break down the waste



Source: [The Ultimate Aquaponics Beginner's Guide](#)

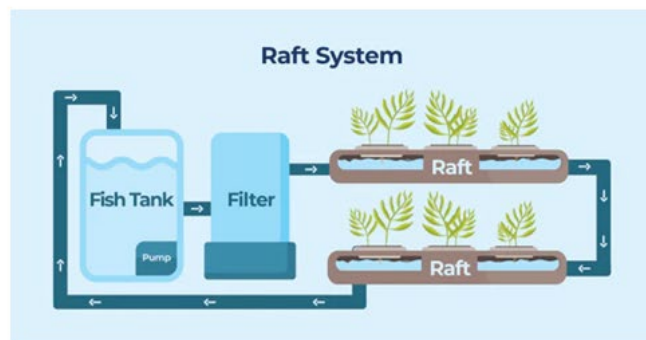
Various kinds of AP systems: Nutrient Film Technology



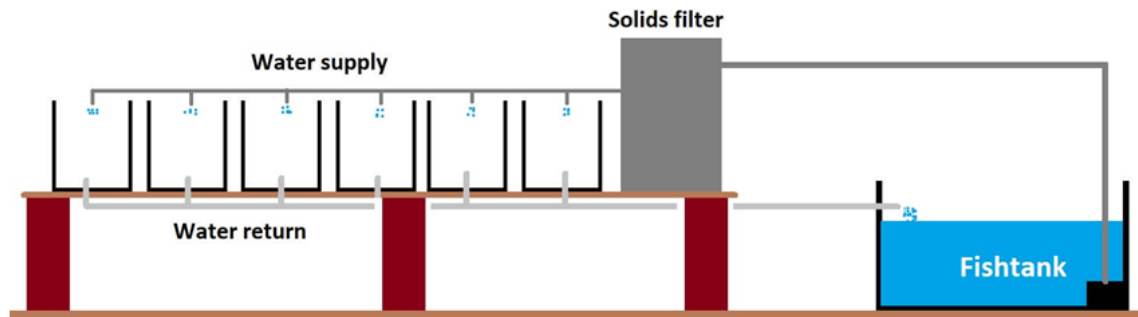
- Water going in pipes for plants
- Most efficient with a biofilter
- What could a pro of this type be?
- And a con?

Various kinds of AP systems: Raft System or DWC

- Plants in polystyrene bricks floating on the surface of a deeper water container
- Usually raft tank separated from fish tank
- Pros and cons?



Various kinds of AP systems: Dutch Buckets



- Central line connected to fish tank
- Serie of buckets w/ plants

Source: <https://www.howtoaquaponic.com/designs/dutch-bucket-aquaponics-system/>

Some more
knowledge

Technical capability

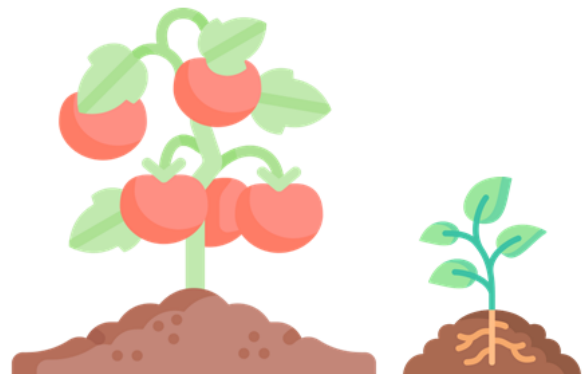
- Usually fish biomass 10 times (or more) less than plants biomass
- How much biomass do we plan to produce?
- How much plants should grow



Type of plants

Affect the choice of system because:

- different roots
- different sizes



Just FYI



- Insurances (water, electricity)
- Temporary or permanent feature

It's almost your turn now, get ready for it

Today's goal:

start a conversation
around types of AQ

1. Individual research on pros and cons of different AQs' types



Today's goal when in groups

2. Discuss different findings
3. Decide on one system
4. Sketch it
5. Prepare yourself to pitch it to us
6. And start building a model of it!



**Now it's up to
you!**

Surprise us :)

