Virtual Water and Japan's Hidden Dependency -education and eco-anxiety-

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Abstract

Japan is currently the country with the most virtual water imports, yet we aren't informed of this situation. As high school students living in Japan, we believe the lack of education regarding water imports at a young age is what is leading people to overrating Japan's access to water. Therefore, we would like to use this opportunity to look into the education of water in our country, along with what we can do to improve it. Targeting elementary school children who have flexible mindsets, we will first visit schools and give lectures on virtual water and the current situation in Japan. We will then also introduce "Virtual Water Awareness Week" to the schools and students where they will be able to incorporate daily-life actions that could be done to reduce the amount of virtual water we use. With the cooperation of Prof. Oki from The University of Tokyo, we hope to spread awareness and accurate information towards this problem so our next generation could be more aware of the status quo and Japan's hydrological cycle.

Keywords

Eco-anxiety, Virtual water, Education, UNESCO

1 Introduction

1.2 Background Information

When we think of water we think of rain, rivers, taps. We think of showers, flushing toilets, and rumbling washing machines. We don't think of water used to create the clothing we wear today and we certainly don't think of water cows feed on, water used to grow the grains the cows nourish, and water used for package making until they are officially sold as beef. According to the definition from Water Footprint Calculator, "hidden" consumption of water, officially known as virtual water, is water embedded in the products, services, and processes people buy and use every day. Although the trading of virtual water is compulsory to keep the commerce

of finance going on a global scale, inequality that occurs due to over importing virtual water is becoming an issue that needs to be addressed for the future.

1.2 Analysis of Present State

Currently, Japan is known to be the country with one of the most virtual water imports in the world. Other developed countries such as the US and China are also called upon as responsible. However, because the two countries export just as much as they import, they are not as blamed as Japan, a country that fails to pay the same amount back to the countries they import from. As high school students living in Japan, we believe that importing virtual water itself is not the core problem but that not being informed about the situation is. Despite the position Japan is in, the Japanese are not educated on virtual water nor Japan's position in the trade. According to a survey taken by AquaLuck, 71.2% Japanese have never heard of virtual water while people living in countries outside of Japan were 62.1%.

Therefore, we decided to start spreading awareness among the Japanese community, targeting the elementary school fourth graders since they are educated properly on water for the first time when they reach that age. Throughout our investigation we hope to implement a new insight to Japan's educational system regarding virtual water to prevent further ignorance from occurring.

2 Purpose

2.1 Purpose of the Research

Although both may seem like entirely different topics, environmental issues and virtual water are deeply connected. This is because what is done to reduce the amount of virtual water, we use in our daily lives connects to what is done to be eco-friendly. According to UNESCO, the organization has set a goal to make environmental education compulsory

in all countries by the year 2050. Our current generation is targeted to be educated on environmental issues more than any previous generation. However, because we are continuously stressed on the urgency of the situation and how fast we need to act, many of the children are facing consequences by developing "eco anxiety". According to a survey conducted by Nature in September 2021, the results claimed that "most respondents were concerned about climate change, with nearly 60% saying they felt very worried or extremely worried". 45% of the participants claimed that their emotions towards climate change impacted their These children stated that their emotions rooted from government inaction as well as the devastation of not knowing how to contribute to environmental issues in their own ways. Considering the side effects of educating the young generation on issues that cannot be solved by only one individual, we came to a conclusion that we need an educational system that isn't too stressful but one that informs properly.

As mentioned earlier, the education regarding virtual water as well as climate issues is not enough in Japan. To educate the Japanese children more on the matter as well as preventing eco anxiety from occurring, we believed that the idea of high school students becoming teachers and introducing actions that could be developed from everyday life activities would provoke curiosity and eagerness from the children. The purpose of our investigation is to ensure that even the smallest movements could connect into an adequate shift — that two high school students educating elementary school fourth graders to change the educational system would eventually escalate to that of a wider scale.
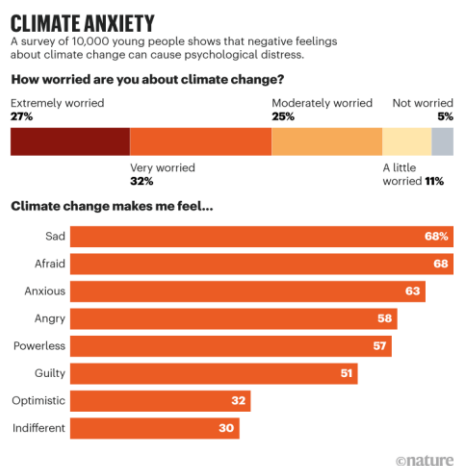
2.1 Hypothesis

Through research on virtual water and our own experiences with eco-anxiety, we finally decided to combine the two topics and to carry out our project. In doing so, because we do not know the reality of the current environment education system, we formed 2 hypotheses.

1. In the current Japanese educational system, information about virtual water and Japan's hidden dependency is not mentioned as much as it should be, and that's what causes Japanese people believe they are naturally gifted with water by nature
2. In the current Japanese educational system, they tend to share the risks and problems of the current world but not enough specific resolutions, that either causes eco-anxiety or underrating

Through actually visiting the schools, we hope to prove our hypotheses to be correct, and to simultaneously be able to solve these problems, both short-term and long-term.

3 Method

3.1 Making of the Lesson

Researching was the first and most important stage to making our lesson. Starting off by researching online, we incorporated useful sources that were already created by reliable institutions such as the water footprint network, official website of the Japanese Ministry of the Environment, and Aqua Luck. We also watched multiple educational videos and documentaries on the topic. What we devised when researching was to look for information both in Japanese and English. By using our privileges of being able to speak both languages equally, we read and watched sources from multiple countries such as Japan, US, and England, to see the different views each country had on virtual water and the trading of it. Since we are working in pairs for this project, we also thoroughly shared our sources with each other and made sure we have the same amount of understanding of the same information.

We moved onto selecting and adjusting what to include in our lesson and presentation slides after we had enough basic

information to create a lesson of around 30 minutes. Considering that we were going to educate the young children of elementary school, we made sure to break the vocabulary into easy terms, putting in examples children would be able to imagine easily, and making the explanations simple but detailed. Since we both had previous experiences of making presentation slides and lessons of 45 minutes as an English project, we didn't face difficulties in particular once the base of what we wanted to say was clear.

One thing that distinguished this investigation from our previous English class projects was finding a reliable and knowledgeable person or committee to ask for guidance and cooperation. Approaching schools with only two high school students with a presentation about something they didn't know would be reliable was certainly not going to work. Therefore, we decided to approach Professor Taikan Oki, hydrolysis and professor from Tokyo University. Professor Oki had previously come to give our school a lecture based on developing technologies that could coexist with water and our future. Thanks to his kind acceptance, we were able to make several exchanges of emails and have some precious time to share with him our tentative lesson. We asked questions on whether our information was truly correct and whether there was any supplemental information that needed to be added. Because we were able to have quality time with him, we understood that the young generation not being educated on virtual water was the issue rather than the trading itself. After our conference with him, we were able to add new aspects to our lesson such as worksheets for the children to calculate and learn how much water they usually use, as well as actions that could be easily developed from everyday activities.

3.2 Choosing the Target Audience

When we originally thought of educating the Japanese people about virtual water, we immediately chose to focus on the young generation. This is because the young generation has a relatively flexible mindset compared to those who have lived for many years with the same common sense. Focusing on those who will be more affected by virtual water in the future, we believed that educating the target generation from the earliest stage possible would be most effective. In Japan, the first time the children learn about water properly is in elementary school, grade four. Thus, we decided that our target audience for our lessons would be fourth graders where we could suggest implementing virtual water as one of the programs for the education on water.

We chose the schools to teach in from the list of UNESCO schools. UNESCO schools are schools passionate to participate in education for sustainable development, global citizenship education, and inter-cultural and heritage learning. Since our school, Shibuya Junior and Senior High School, is also a UNESCO school, we believed that our investigation should take place in the elementary schools that are in contact with our school. We also hoped that our movement starting from a few schools on the list would gradually start spreading to all schools on the list, and eventually to all Japanese schools in general. Targeting a specific audience was crucial to make our actions spread in the most effective way possible.

3.2 Going to the schools

Before actually going to the schools, we created an introductory video for the children beforehand, to provide them with a quiz as well as an activity of calculating how much water they use in their daily lives.

The quiz question was:

Q. How much water is included in the bottle of coca cola?

    1. 500ml

    2. 1.5L

    3. 3L

    4. 4L

We provided them a few days to think before we went to meet them in person. We also handed out worksheets for them to calculate how much virtual water they use in their daily lives. To keep them curious about what they were actually calculating and to keep the calculations fair, we made sure to hide the fact that we were making them count the amount of virtual water they were using. We did this by making the units points instead of liters. We hoped to achieve

a game-like entertainment for the children to make the topic interesting and something to look forward to.

We went to two different schools on two different days. The first school was Kogaya Elementary School in Yokohama. There were four classes in total with thirty children in each and we did separate lectures for each class. Since our main aim was to engage the children in the topic and lesson, we made sure to make the lesson participatory by frequently asking questions to the children. For example, we asked them whether they had brought their water bottles to school that day, linking it with how a simple action like that would contribute to using less virtual water as an individual. We also asked around 7 people per class what their total points were from the worksheets we gave them beforehand. We explained that the "points" actually referred to how many liters of virtual water they were using and how the number could turn out bigger than expected.

The second school was Minami-Tsurumaki Elementary School in Tama. This school had 2 classes for the fourth graders but instead of doing the lectures separately, we had them gather in one room and take the same lesson at the same time. The style of the lesson corresponded exactly as Kogaya Elementary School and the responses we received from the children were similar as well.

Below are the worksheets we made and gave to the students beforehand the lesson, which includes the activity of calculating the amount of water usage in everyday life:

Figure 1: Worksheet one

Figure 2: Worksheet two

Figure 3: Worksheet two (continued)

4 Results

4.1 Short-term effects

After the lessons, we conducted a survey on the teachers from both of the schools we visited, with the main aim being to see how effective or informative our lessons were. Additionally, we also read over all of the questions or comments that the students had given us as feedback, and wrote back to any questions they had. The questions, results, and analysis of our survey are as follows.

Question: If you were to have access to the lesson materials used in the lessons, would you be in favour to include this lesson in the school curriculum?
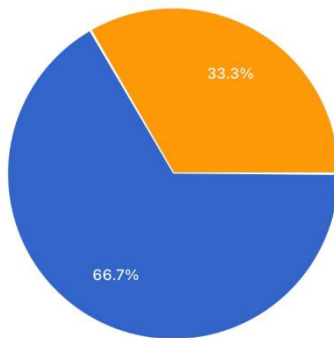

Figure 4: Data for qs.1

(blue: agree / orange: do not mind / red: against)

The amount of positive feedback we got from both schools was unbelievable. However, when it comes to whether or not the lessons are worth continuing, it becomes a whole new problem. The graph above shows how many teachers are in favour of adding virtual water as a new part of the curriculum, with blue being in favour, orange being neutral, and red

being against. We are confident to say that our lesson has a good number of supporters, and that our lesson or at least any lessons about virtual water will be successful.

Question: How sensitive or active were you in terms of living eco-friendly pre/post 'environment week'? (For the teachers)
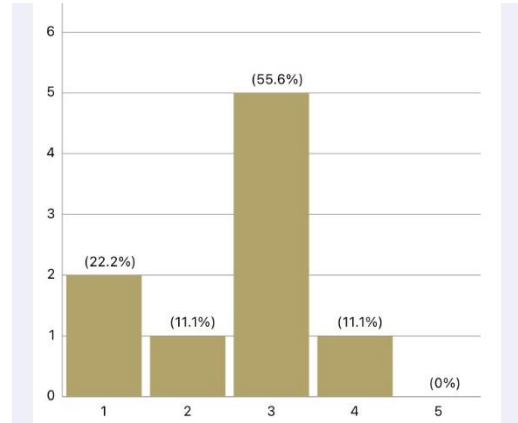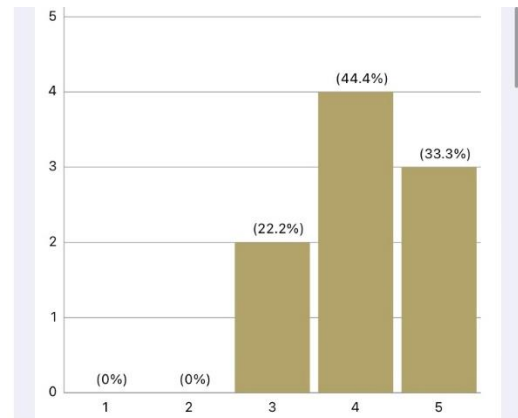

Figure 5: Pre-EnvironmentWeek

Figure 6: Post-EnvironmentWeek

From the question and data above, it's clear that 'environment week' had some sort of positive encouraging influence towards living eco-friendly, even for the teachers. In addition, when we asked whether or not the teachers had heard of virtual water before the lesson, all of the teachers answered no. Eco-anxiety might not be just a problem for the students.

Question: How much influence do you think the 3 days had on the students? (For example, did the lesson encourage them in any way to be more environmentally friendly?)
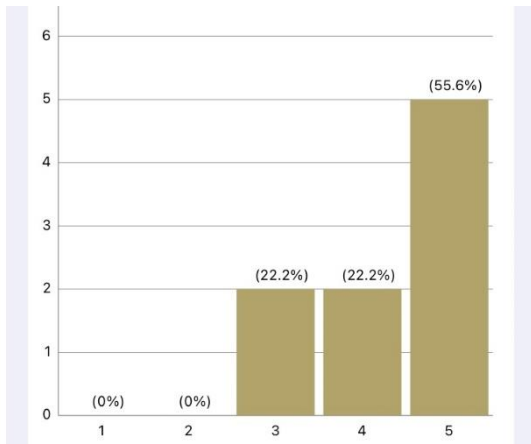
Figure 7: Data for qs.3

Figure 8: Data for qs.4

The numbers show, 1 being nothing and 5 being greatly, how much the teachers saw difference in the students' behaviour post-Environment week. Clearly, our lesson had a good amount of influence to the students.

Following this question, we asked how their behaviour specifically changed, and some of the popular answers we received were the following:

1. The number of water bottles brought in to school increased greatly

2. A lot of the students started to minimise leaving the school food untouched

3. Students started to stop the water whilst using soap

4. Since they had a research project coming up, a lot of the students actually said that they wanted to learn more about virtual water

5. Their parents brought up the topic too, and said that they didn't know about virtual water either, and that their child has started to ask more questions about the environment and global warming

We are very pleased with the reactions and answers that we got through both of the schools, and we believe we were able to carry the message effectively without causing eco-anxiety, but rather positive curiosity.

Question: How easy was our lesson to understand (for the students). Did they seem like they were able to keep up with the context?
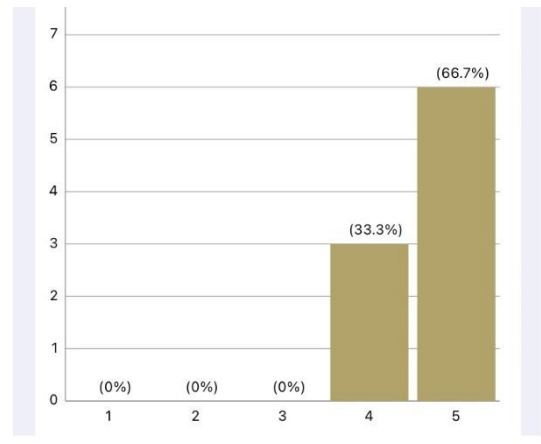
Question: How fun/entertaining was our lesson, considering the fact that our target audience is children?
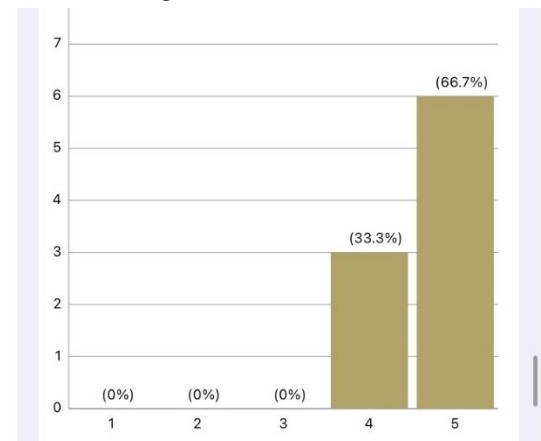

Figure 7: Data for qs.5

It was a true honour to receive this result. The numbers show 1 as not at all and 5 as greatly. The teachers had agreed that our lesson was both easy to understand as well as enjoy, which was our main goal all along.

In addition, we asked the students what they took out of the lesson, and how encouraging the lessons were, and received many comments like the following:

1. I'll try to eat the vegetables that I don't like, to not leave over food

2. I'll bring my own water bottles instead of buying them

3. When I go shopping with my parents, I'll make sure to not buy anything that I don't particularly need

4. I'll tell my parents and eat more food made in our own country

Although some answers were a bit extreme or slightly off the lines such as "I'll stop eating beef", all of the answers and

comments we received from the students were sweet and adorable. We hope that they'll carry the message and information on, to even people older like their parents as well as their generation and onward.

4.2 Long-term effects

Our project was successful in terms of those schools in particular. However, we also wanted to value how we can maximise our influence and power on to further generations. Therefore, after the lessons that we held in those primary schools, we took it upon ourselves to try and leave our footprints in the education system or curriculum today. The organisation we finally decided to reach out to was the UNESCO organisation. The UNESCO Associated Schools Network is an organisation that connects thousands of schools around the world to promote the UNESCO ideals mainly towards education and sustainable development. Our school, Shibuya Kyouiku Gakuen Shibuya Junior and Senior High school is proudly one of the registered schools, along with 1120 other schools from Japan. With the help from our tutors at school, we were able to connect with the people from the organisation, and finally got the permission to publish our lesson plan along with the teaching materials on the official UNESCO website without cost for all the schools to use as they like.

We believe that the problem regarding importation and exportation and virtual water is so deeply rooted within Japan's society, and therefore should be taught and thought about more across the country. The publication of our lesson material should help schools and groups that do not have virtual water included in their curriculum, and we hope that our publication will stir up some conversation on the topic.

Below is the lesson plan that we made to create our lesson, which we then shared to the UNESCO organisation. From the left, we have the estimated time, brief information and flow, key words, and the purpose/aim for each part of the lesson:

タイトル：
バーチャルウォーターって何？日本の水循環の現状と小学生への環境教育の改善への道
概要：
バーチャルウォーターと日本の現状、そして私たちが日常生活に簡単に取り入れることができる解決方法についての授業を2人の高校2年生が小学校を訪問し、小学4年生に向けて行ったものです。
著者：能勢あすか　河瀬咲弥
対象：小学校4年生以上
内容：バーチャルウォーターとは食料を輸入している国において、もしその輸入食料を生産するとしたら、どの程度の水が必要かを推定したものです。（環境省による定義より）現在、日本は世界において多くのバーチャルウォーターを輸入している国であるのにも関わらず日本国民が圧倒的にこのことについて知りません。この状態を問題だと感じ、私たちは比較的柔軟な考え方ができる「若い世代」に着目し、小学校高学年に向けたバーチャルウォーター教育を行いました。未来の日本の水や環境教育に私たちの授業内容も導入できることを目指して活動しています。ぜひ私たちの使用した資料をお使いください。
出版年：2022年
授業詳細：想定授業時間45分、対象学年小学校高学年、スライド使用

no.	所要時間	内容	キーワード	狙い
0	指定なし	自己紹介	-	親しみを持ってもらう
1	3min	【イントロ】 水筒持ってきてる人？ お水ってどこからくる？ お水って何に使う？ 【世界の現状（導入程度）】 水が汚くて飲めないとかっていう経験をしたことはないよね。 でも世の中には私たちより汚く少ない水でしか生活できない人もいる。 その生活をしないで済んでいるのは、日本が自然資源に恵まれているからではなく、ほかの国に助けてもらっているから。	水筒、水使用、日常生活、現状把握、世界	授業の導入のつかみ。自分の日常生活と繋げやすくするために、身近な水の使用例を考える。 日本の現状、自分たちの「当たり前」を確認。世界の恵まれない国/人々と比較。
2	3min	【コーラ問題】 1Lのコーラのペットボトルの写真を見せて、この商品ができるまでにどれくらいのお水が必要か聞く。 選択肢：1L、1.5L、3L、4L →答え：4L 　→この背景にあるのが仮想水	コーラ、仮想水、バーチャルウォーター	実際の商品で考えることで想像しやすくする。 考えてもらうためにも、クイズ部分だけ事前に出題するのも良。 1.5、3、4を選んだ人に、なんで飲める部分以上のお水が必要だと思ったか聞く。
3	7min	【仮想水（バーチャルウォーター）】 定義（環境省）：スライドに記載 簡単な説明(例:人参)： にんじんを育てるのには太陽とお水が必要だよね。にんじん1本を育	仮想水、バーチャルウォーター、人参、輸入出、環境省	人参の例で輸入出を考える。 クイズで授業に引き込み、とっかかりやすく。 一番基本的な知識の部分なので、頻繁に質問や確認をす

		てるのに2L必要だとしたら、誰かからにんじんを買った2Lのお水をもらったのと同じになるのはわかるかな？ ∥コーラに戻る。 確かに飲める部分は1Lだけど、ペットボトルを作るため、パッケージする機械をきれいにするためにもお水が必要。それで合計4L。甘くするための砂糖を育てるためなどの、材料を含めるとなんと200Lも必要。		る。例えば、コーラの主な原材料といえば？など。
4	10min	【課題1】 お夕飯の獲得ポイントを聞く(数人)。 この数字は何だと思ったか聞く。 答：その材料を作るのに必要だと言われているお水の量。つまりその食材の「仮想水」。 【課題2】 これも夜ごはんのやつと一緒で、1分シャワーを浴びると12Lのお水を使うから12pt. 二つ目の課題の獲得ポイントを聞く(数人)。	夕飯、ポイント、課題、生活用水、仮想水	日常生活でどのくらい水を使っているか分かりやすく、想像しやすくするため 「獲得ポイント」などゲーム要素を入れることで楽しんでもらうため
5	3min	【ポイントの仕組み説明】 牛肉だけやけにポイントが高い。 理由：牛の餌/水分、管理、輸送 魚介類が表記されていない。 理由：水の中で生まれて水の中で育った生き物の食物連鎖なので、餌に水がほぼ含まれない。水分補給の必要もなし 🔲意外と日々思ってた数倍水を使っていることに驚いたんじゃないかな？	牛肉、食肉、魚介類、水分補給、餌、食物連鎖	この説明が終わった段階で、他の食材についての質問も受け付ける 魚介類の食物連鎖について説明するときは、図を描く。プランクトン的な微生物までさかのぼる 子供たちが驚いてたら、「だよね！？」ぐらいのテンションで向き合い、感情を共有する
6	7min	【日本の現状】 日本は見ずに困っていなそう。 一見資源に恵まれたからに見える。 でも実際は他の国に助けられて、これだけ贅沢な生活をさせてもらえてる。 例：にんじんの例に戻る。 　もしそのにんじんを友達にあげたとしたら、にんじんだけじゃなくて41L分のお水もほぼ無料であげちゃうよね。損！ 【理想＋現実】	資源、輸出入、損、平等、需要、供給、自給自足、効率	例えをするときは、特定の生徒を指して名前を聞いて例として登場させてもらうのが効果的…?想像しやすさ優先。 例え（消しゴムの話など）はちょっと大げさにした方が笑いにもなる。ばかばかしいくらい。ちょっと大げさな説明もあり。

		自給自足 ↓ その国でしか育てられない食材/穀物もある。お互いがお互いの需要を満たす手助けをするのが効率が良い。 例：今日消しゴムを忘れた。テストなのに困るなぁっていう日があるとしよう。そしたらとなりに20個くらい消しゴムを余らせてる友達がいる。でもその子は鉛筆削りを忘れちゃった。自分は持ってる。貸す代わりに貸してもらう、「需要供給」に基づく解決方法が生まれる。やらないのは損でしょう？		
7	30sec	【自分事】 これだけ日々私たちは海外からの材料/素材を使って生活している。なら、世界の水質汚濁も他人事じゃないよね。	水質汚濁、自分事、輸出入	できるだけ身近な説明をしたのちに、しっかりと世界へとベクトルを広げる。 「自分事」というキーワードを大切に。
8	5min	【なぜ問題なの？】 輸入をしすぎることで他国の水問題を悪化させてしまっていることになる 頼りすぎてしまうことで日本にも影響が出る（洪水や干ばつにより価格上昇など） ただ、バーチャルウォーターの輸入をいきなり止めることはできない	水問題悪化、各所への悪影響、悪循環	多方面が苦しむ問題であることを述べ、いかに全員が協力しないといけない大問題かを考える。 「悪循環」という概念について考える。 難しい単語（干ばつなど）が結構な頻度で出てくるので、反応を見て逐一説明をする。
9	3min	【私たちにも出来ること】 環境や社会にいいものを買うように心がける 買わなくてもいいものは買わないようにする 日常生活に簡単に取り入れることができるものを紹介	環境、社会、日常生活、エコフレンドリー	エコ不安症の防止。 問題提起をするだけにはしない。 世界という大きなスコープで見つめたあとは、しっかりと身近なスコープに戻す。 具体的な行動を述べ、効果を述べることで実現性/効果を実感させる。
10	3min	【食べ物を大事にすること】 一番実践しやすく効果も大きいものである 食べ物を大事にする＝水を大事にする＝地球を大事にする 牛肉のバーチャルウォーター量の紹介	食べ物、食品ロス、食べ残し、牛肉	一番実践しやすく効果も大きいものを一つ強調することで記憶に残りやすく。 授業の場である「学校」にもつなげる。（eg. 給食、水分補給）

		世界には1日につき牛肉10g分のバーチャルウォーターよりも少ない水で生活している人がたくさんいる		
11	1min	【これを踏まえて】 私たちにもできることを踏まえてこれからも水や環境を意識してほしい	-	この授業がきっかけに多くの子どもたちに日常から水やバーチャルウォーター、環境について意識してもらうため

Figure 9: Lesson Plan shared on the UNESCO hp (4 above)

5 Reflection and analysis

There were countless areas of improvement and adjustments found, both from our own reflections and from the survey we took. Personally, we first of all genuinely had fun interacting with the children and getting to know them. Bits of the lesson that they most seemed to have enjoyed was the little question-answer sections that we set throughout the lesson. They understandably seem to be more engaged with the topic when we connect it to everyday situations or actions. Although 9–10-year-olds are just a few years younger than us, we still were able to see prominent differences in how imaginable or how compassionate they can be with global issues as such. More strategies and thoughts need to be put in how to direct

We were able to talk about many different topics regarding sustainability and development, as their social study classes have started to cover such problems over the past few months. However, we felt that they only have been introduced to problems in countries so far away, that they don't seem to have the understanding that those types of problems are actually happening. For example, although when asked about 'climate change' or 'sustainability', they mention South African countries and their current state, when asked about solutions or what Japan can do, they have no idea. This type of behaviour was exactly what we were worried about. These types of problems are very complicated yet so common these days that people, especially young children, end up just knowing that the problem exists. This connects to the idea of 'eco anxiety' mentioned in the few opening paragraphs of this report.

Furthermore, after the lesson we asked the children to write down any questions they had about the topic, so that we can get back to them after the lesson ended. In the questions listed, some were very personal like 'what is your favourite colour' which was adorable. However, nearly all of the questions and comments about the water problem were what they as 9–10-year-olds in Japan can or should do to improve this problem. This made us confirm our hypothesis to be true, as they seem to be curious yet untaught about what actual actions to take. Specific advice and guidance is crucial especially for younger children, and even the teachers at the schools mentioned the fact that we included real life solutions in our lessons to be something that is 'unique and helpful'. Just pointing out and listing problems that something as big as the whole world is facing now is way too harsh and irresponsible.

In terms of our hypotheses, we believe that both hypothesis 1 and hypothesis 2 were proven true. The amount of ignorance towards virtual water and importation was actually much severe than we expected, as we thought the adults would have at least heard of the terms. When we asked the teachers and parents at the school whether or not they have heard of virtual water, only one of them said yes even though

we asked approximately 10 people. Furthermore, eco-anxiety also seemed to be a problem, as the teachers that didn't know the terms like virtual water knew about Japan possibly running out of water, but not why or how. Similarly, the children's comments on what they want to change in their daily lives and how they were taking specific actions clearly shows how children are indeed eager to take action if they knew how. We are glad to say that our lesson had successfully dodged that problem, and made positive change.

6 Acknowledgements

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