Eight-Graders' Understanding of Hidden Use of Water and Their Action Strategies for Sustainable Use of Water

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Outline

-What is hidden use of water?
-Sustainable Water Consumption
-Significance of the Study
-Research Questions
-Methodology
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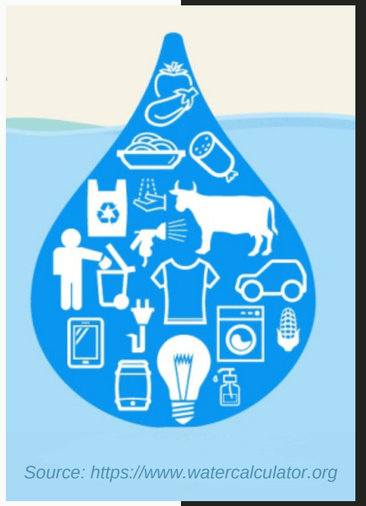
-Discussions, Conclusions, and Implications

There are vegetables in hamburger. Water is used when they are grown in the fields. Meat is produced from animals and animals drink water. So, yes. There is also water consumption in hamburger.

AN EIGHT-GRADE FEMALE STUDENT

What Is Hidden Use of Water?



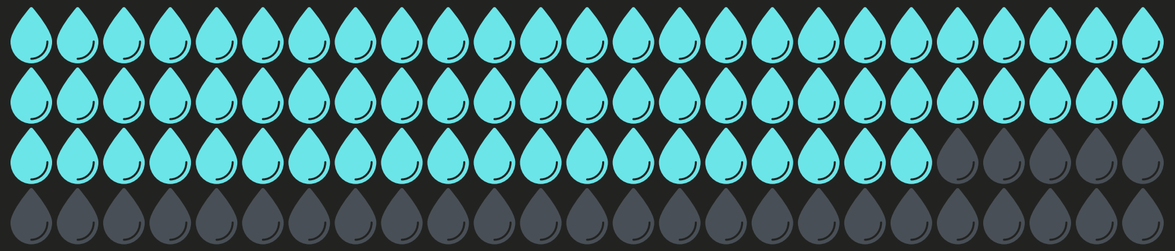
Source: https://www.watercalculator.org

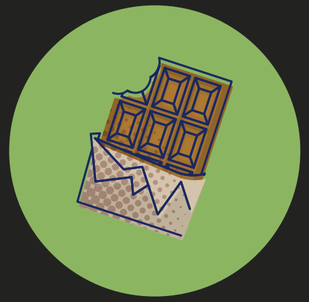
DEFINITION

Hidden use of water (or virtual water use) is defined as the amount of water used in agricultural and industrial products (National Geographic, 2014).

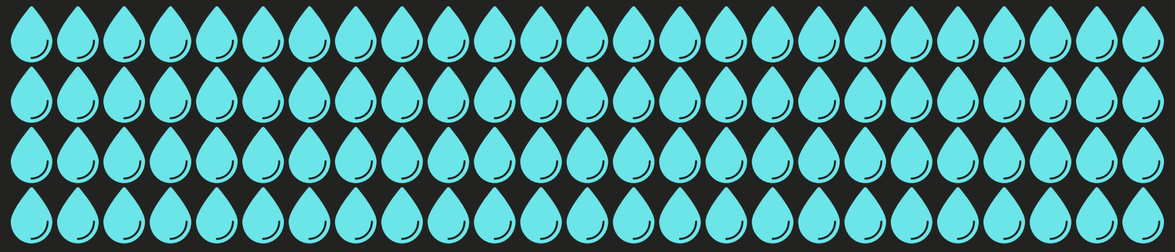
1 Tomato
50 lt

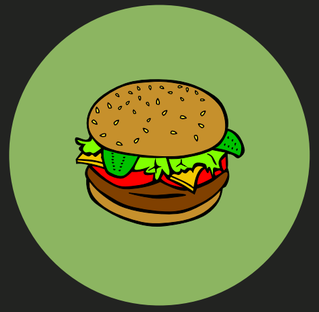
100 g Rice
249.7 lt





100 g Chocolate
1719.6 lt





1 Hamburger
2500 lt

SUSTAINABLE WATER CONSUMPTION

- It is one of the issues covered in the context of sustainable development (UN, 2018) within the Sustainable Development Goals.
- As water is a finite source on Earth and its renewal rate mostly depends on human use (UN,2015), it is essential to teach individuals how to use water sustainably within the context of education for sustainability (Benninghaus, Kremer, & Sprenger, 2017).
- To achieve this, the concept of hidden use of water is also an important aspect since most of our water consumption habits are correlated with our hidden use of water.
  - Thus, individuals shall have background knowledge on their consumption for monitoring their sustainable water use.
  - As stated by Reinfried (2006), if individuals do not have background knowledge on their consumption, they would not possibly monitor their water consumption behaviour sustainably.

Previous Studies...

- When the accessible literature on the hidden use of water was examined, it is seen that limited number of studies investigated this concept.
  - Fremerey, Liefländer and Bogner (2014) conducted a survey related to the students' conceptions of drinking water. They reported that only a minority of the students had a proper understanding on hidden use of water.
  - Benninhaus, Kremer & Sprenger, (2017) examined the students' notion of virtual water and found that substantial number of participants had lack of understanding of virtual water as well as the water consumption in the production of chains.

Significance of the Study

- In this study, we aimed to explore Turkish middle school students' understanding of hidden use of water and their action strategies for sustainable water use.
  - Determining their action strategies may provide us hints about their notion on the context of hidden use of water.
  - As there are a limited number of studies, this study could have a potential so that further studies can be encouraged on this subject.
  - This topic is not covered yet in Turkish national science curriculum. Therefore, the findings of the study may provide some insights to the ones who does not include the terms of hidden use of water in their curricula yet.

Research Question 1

RQ1: WHAT ARE THE UNDERSTANDINGS OF EIGHT-GRADE STUDENTS ON THEIR HIDDEN USE OF WATER?

Research Question 2

RQ2: WHAT ARE THE ACTION STRATEGIES OF EIGHT-GRADE STUDENTS FOR SUSTAINABLE USE OF WATER?

METHODOLOGY

RESEARCH DESIGN

We intended to explore “what meaning they attribute to their experiences” (Merriam, 2009, p. 23).

PARTICIPANTS

- 4 districts from Ankara, Turkey with purposeful sampling method.
- Convenience sampling method for determining schools.

Basic qualitative research was chosen since we tried to understand how students interpret the phenomenon (Merriam, 2009), in this case, hidden-use of water.

- A total of 358 eight-grade students (44.7% male, 52.8% female, 2.5% missing) from five schools .
- Six students were interviewed to elaborate their notion of hidden-use of water.

METHODOLOGY

Three steps were followed to frame the context of the study.

1. Compiling a literature review chapter related to water context in middle school level
2. National science textbooks and its specific objectives (MoNE, 2018) related to water context were listed.

- The researcher prepared an information sheet for the experts and a template to enable them to give their feedback in a standardized format.
- Two of them had experience on teaching and assisting the course of ‘Measurement and Assessment in Education’ were reviewed the questions in the data collection tools.

3. All the questions within the data collection tools were refined based on the steps.

Data collection tools were sent to four reviewers to have expert opinions providing an indicator for content-related validity evidence.

- The other two experts reviewed the data collection tools in terms of its content and compatibility with the grade level.
- These reviewers’ research interests were mainly ESD in science education.

INSTRUMENTATION & DATA ANALYSIS

The written task (4 questions) and semi-structured interview were developed by the researchers to evaluate students' understanding of hidden use of water and their action strategies for sustainable use of water.

Two other questions were essay items associated to action strategies. These questions were prepared based on a text about the percentages of water usage in Turkey. Then, it was asked to write suitable action strategies to reduce water use.

- First question was asked to identify if students differ products that requires much water among the alternatives.
- Second question was asked to identify if students differentiate sustainable water consumption behaviour.

In terms of data analysis, we used descriptive statistics for multiple-choice items. For the essay questions, we used content analysis. Inductive coding was used to determine codes.

Trustworthiness of the Study

TRANSFERABILITY

Rich and thick description and maximum variation were made to portray participants' profile.

DEPENDABILITY

Inter-coding agreement was calculated and were 99.12% and 86.36% respectively.
Intra-coding and audit trail were also implemented.

CREDIBILITY

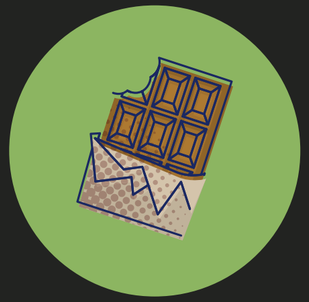
Adequate engagement in data collection, reflexivity, and peer examination were employed

Findings

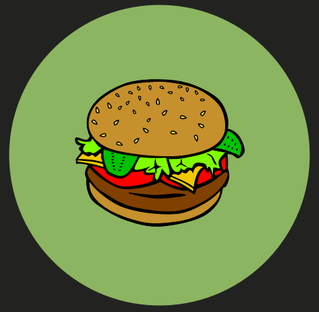
The frequencies revealed that most of the students had lack of understanding on hidden use of water. For example, Besides, more than 80% of the students named **rice** and **tomatoes** as food requiring much water than chocolate and hamburger.

1 Tomato
50 lt

100 g Rice
249.7 lt



100 g Chocolate
1719.6 lt



1 Hamburger
2500 lt

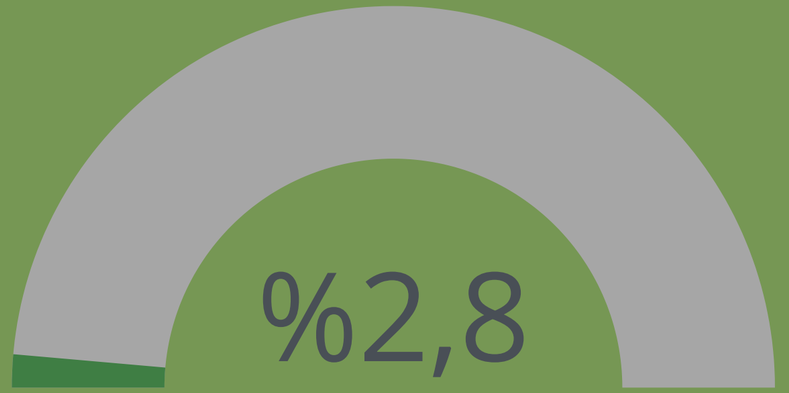
35.8 % of the students

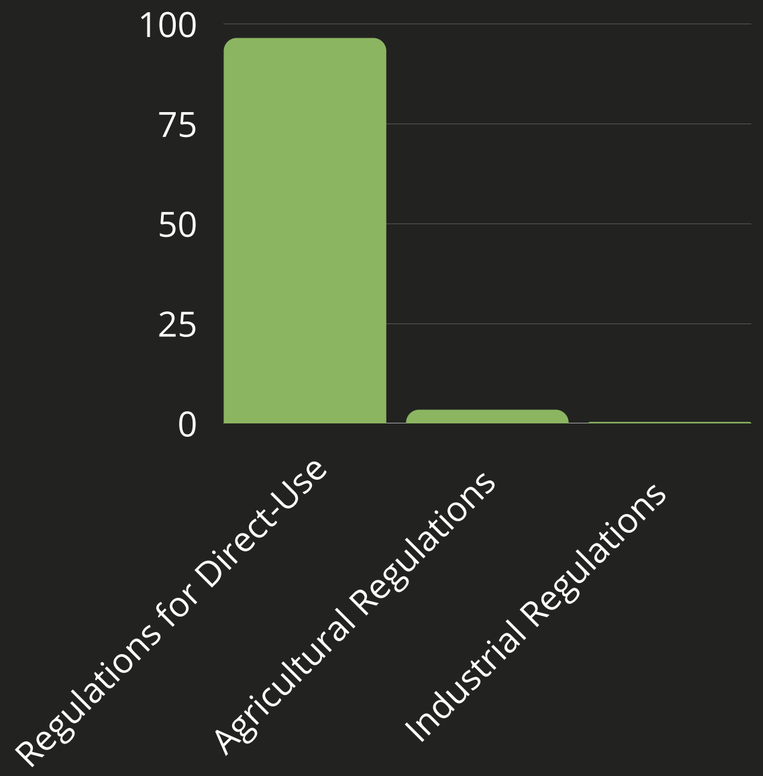
RESPONDED THAT EATING LESS HAMBURGER IS **NOT** ONE OF THE EXAMPLES FOR SUSTAINABLE WATER USE*

*The other options were; (1) preferring tea instead of coffee; (2) buying local products; and (3) shopping from the supermarket **(C)**.

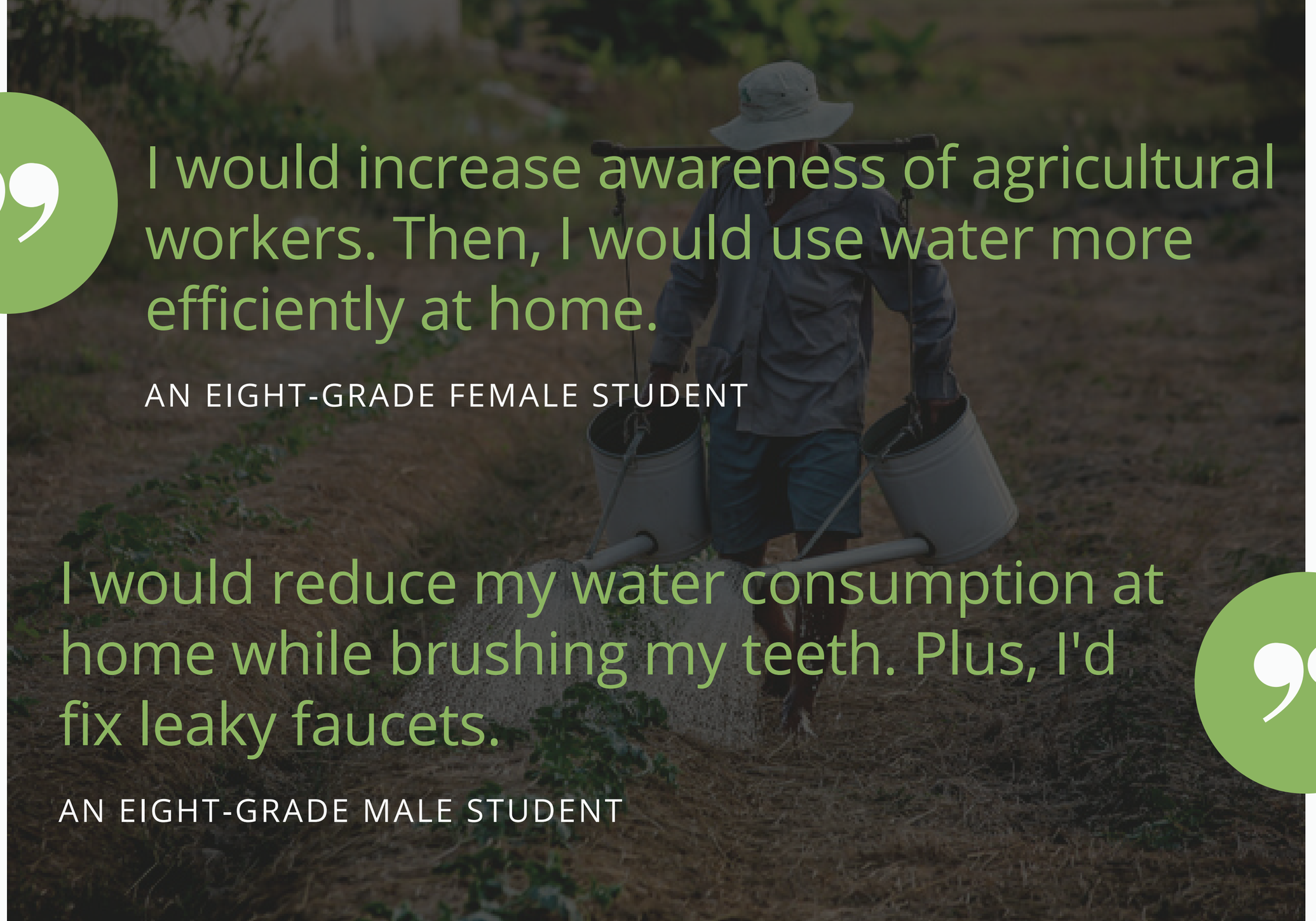
ACTION STRATEGIES

Students were asked to share their action strategies. The most-frequently actions written were related to reducing domestic use of water. Only 2.79% of the respondents suggested strategies to reduce hidden-use of water.





The latter question was about what they would do if they were a governor. Similarly, majority of the responses were about the regulations for direct-use of water. Agricultural (3.35%) and industrial (0.30%) regulations were in minority.



I would increase awareness of agricultural workers. Then, I would use water more efficiently at home.

AN EIGHT-GRADE FEMALE STUDENT

I would reduce my water consumption at home while brushing my teeth. Plus, I'd fix leaky faucets.

AN EIGHT-GRADE MALE STUDENT

WHY?

These responses can be indicators for limited understanding. They may imagine direct-use of water while responding the written task.

To elaborate their understanding, six students (3 males, 3 females) were interviewed.

Interview Findings

- They reported that they have not heard about the term “hidden-use of water” before.
- When we asked the steps water is consumed during hamburger production, the responses were mainly derived from direct-use.
- They did not include the wastewater as well as the water for growing animal feed.
- These responses are compatible with findings from the written task.

DISCUSSIONS, CONCLUSIONS, AND IMPLICATIONS

- It is essential to teach individuals how to use water sustainably within the context of education for sustainability (Benninghaus, Kremer, & Sprenger, 2017) and hidden use of water is one of the essential concept to achieve sustainable water use.
  - However, participants of this study have never heard the term "hidden use of water" before.
- These findings were compatible with the literature (Fremerey et al. ,2014; Benninhaus, et al., 2017). These studies already mentioned that K-12 students' conceptions of water were naïve and mostly declarative.

DISCUSSIONS, CONCLUSIONS, AND IMPLICATIONS

- These results implied that lack of understanding on the hidden-use of water could be a limitation to raise informed-decision makers for the sustainable use of water.
  - Thus, revising curricula based on the students' lack of understanding is essential.
  - Curriculum planners and teachers should be aware of students' lack of understanding on this concept.

References

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