

# Advocating Water Literacy

Yurina OTAKI<sup>1,\*</sup>, Osamu SAKURA<sup>2</sup> and Masahiro OTAKI<sup>3</sup>

<sup>1,\*</sup> Graduate School of Social Science, Hitotsubashi University, 2-1 NAKA, Kunitachi, Tokyo, Japan

<sup>2</sup> Interfaculty Initiative in Information Studies, University of Tokyo, 7-3-1 Hongo, Bunkyo, Tokyo, Japan

<sup>3</sup> Department of Human Environmental Sciences, Ochanomizu University, 2-1-1 Otsuka, Bunkyo, Tokyo, Japan

yurina.otaki@r.hit-u.ac.jp<sup>\*</sup>, sakura@iii.u-tokyo.ac.jp and otaki.masahiro@ocha.ac.jp

**Abstract.** *Current water use in our daily life is by no means sustainable, and the environmental and social problems come to the surface. To improve the current situation and to develop sustainably both for human beings and the global environment, we have to think out a new paradigm. As the centerpiece of the new paradigm, we advocate the concept of water literacy. Water literacy was defined as the ability to feel familiar with water, get actively involved in water and face the issue of water as one's own issue. Water literacy was divided into three categories: practical, living, and social water literacy. Water literacy enables us to re-evaluate local water systems and water usage. Furthermore, water literacy educates those citizens who are able to associate daily life with social issue, and contributes to the recovery of a variety of relations between water and humans.*

## Keywords:

Water literacy, water system, sustainability, local environment

## 1. Introduction

Water that human beings can use is unevenly distributed on the earth not only spatially but also seasonally, and global warming will contribute to this tendency. Uneven distribution of water causes differences in water availability and know-how on how to obtain enough water, as well as customs in water use from location to location. To live and to use water sustainably, it is important to manage water through approaches appropriate to the local water environment. A uniform and concentrated water supply and disposal system has been constructed in many developed countries. However, this system is not sustainable because it ignores local characteristics and requires an immense amount of energy, cost, and effort to build and maintain. People who can use this kind of system are limited and the regional divide is widening. Although some developing countries have imitated and partly taken on the system, this does not necessarily mean that its operation and maintenance are doing well. Examples of this are a water leak that was not repaired and water quality that was not stabilized, even though considerable cost and effort were spent. There are many places where people are forced to manage in difficulty. Even in developed countries, it is a

fact that environmental and social issues are caused by the harmful effects of advanced systems.

Currently, more than one billion people out of six billion people of the world population do not have access to safe water and more than three billion people cannot prevent water-related diseases because of the lack of sanitation. To improve the current situation and to develop sustainably both for human beings and the global environment, we have to think out a new paradigm, which requires a minimum of energy, cost and effort and fits the local environment. As the centerpiece of the new paradigm, we advocate the concept of water literacy.

## 2. Definition of Water Literacy

Here, we define water literacy as the ability to feel familiar with water, get actively involved in water and face the issue of water as one's own issue. Being water literate means understanding how the water we use daily is delivered and treated, as well as knowing the quality and safety of that water, how much water we use daily and exactly what we use it for.

Recently, the concept of literacy has been expanded to include other genres of literacy such as scientific literacy, media literacy, information literacy and environmental literacy.

The original meaning of the word 'literacy' was the ability to read and write. At the beginning of the modern era, the word referred to the ability to communicate effectively in a literate society, and was valued as a tool for personal success [1]. King [2] called this original literacy functional literacy. He suggested that a person who was merely functionally literate was essentially passive, even if he or she could fit into the preexisting structure of social life and perform its routine operations well. Over time, the meaning of literacy changed, and was used in a broader sense. UNESCO's definition of literacy includes not only functional literacy, but also the ability to engage with society and communicate actively. This means that the concept of literacy is no longer passive, and thus has been expanded for use in a variety of fields.

Scientific literacy, for example, meant the knowledge and understanding of nature and the concepts of science and technology. It is essential to have scientific literacy to

live in modern society, where science and technology have progressed very rapidly and have been used for imminent environment such as health, energy, resources, environment, food, agriculture, communication, etc. In this context, scientific literacy is not only the ability to understand science and technology, but also the ability to use scientific processes to solve problems and make decisions, and the ability to understand both the ethical and negative aspects of science. Modern scientific literacy includes behavior, functional knowledge and skill.

The concept of environmental literacy was introduced at the end of the 1960s in the context of environmental education. The term was mainly applied to scientific knowledge about nature and its processes. Those who were environmentally conscious were expected to behave in a responsible manner. Since that time, various definitions have been put forward for this concept. Roth [3] defined environmental literacy as an individual's knowledge about and attitudes toward the environment and environmental issues; the skills and motivation to work toward the environment, and active involvement in working towards the maintenance of dynamic equilibrium between the quality of life and the quality of the environment.

This paper aims to advance the new concept of water literacy and to discuss its implications. Although Ewing and Mills [4] used the term to mean knowledge regarding water in the context of environmental education, they did not define and examine its meaning and importance.

Water literacy seems to be a different kind of literacy from other genres of it. For example, of media literacy, there surely exists the question, "What is media?" because media is always changing. However, there is no need to ask "What is water?" because water,  $H_2O$ , is a universal substance both physically and chemically. Water needs literacy in spite of this fact because its value and what it ought to be is socially determined by people's consciousness of the relationship between people and water. Thus, water exists socially, which makes it the subject of the literacy concept, as is information, media, science and the environment.

In this paper, water withdrawal, use and disposal, were assessed as a unit, and this was called the water system. Industrialization brought efficient water systems with it, especially in urban areas, and this was called the modern water system. This modern water system was composed of treating water, supplying water via pipes, disposing of waste water through sewage systems, and collecting and treating that waste water in sewage plants.

### 3. Classification of Water Literacy

As mentioned in the Introduction, to use water sustainably, it is important to build and manage a water system that fits the local environment. Requisite water literacy varies depending on the local environment.

Thus, we have divided water literacy into three categories as described below.

#### (1) Practical water literacy

Safe water is a matter of life and death. It is essential to ensure that water is usable. Practical water literacy means having the knowledge to ensure the vital amount and quality of water. This is necessary for human survival. Practical water literacy includes such aspects as knowing not to drink unsanitary water and understanding the importance of hand washing.

#### (2) Living water literacy

Living water literacy means the ability to use water wisely in the home and social space in one's own backyard. This is necessary to ensure an adequate supply of quality water so that everyone will have enough to live healthy lives.

For example, if people use collected rainwater, living water literacy would involve things such as removing stains from roofs where rainwater is collected and allowing sufficient time for sedimentation. For apartment dwellers in urban areas, living water literacy would involve keeping water tanks clean. For people who use septic tanks, it is their responsibility to keep them functioning properly.

#### (3) Social water literacy

Social water literacy refers to willingness to act responsibly and make reasonable decisions for society as a whole in terms of water usage. To find optimum solutions to the water issues in our modern society, we have to think from the point of view of politics, economics, society as a whole, technology and the environment. We have to think about water resources, water treatment, water delivery and waste water treatment from various angles. Citizens' ability to monitor water resource management of municipality and their ability to suggest practical improvements are important aspects of social water literacy.

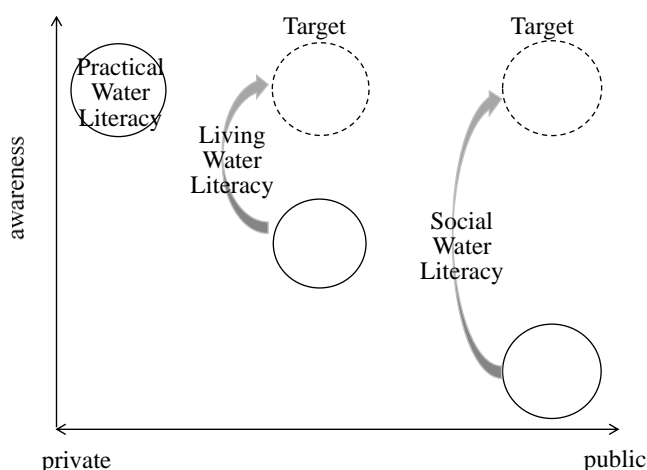
Although practical and living water literacies are both necessary for daily life, social water literacy is not. Social water literacy involves thinking about water from a broader perspective. For example, where there are closed water areas such as lakes attached to a river, a typical environmental issue is eutrophication, an abundance of chemical nutrients caused by nitrogen and phosphorus discharged into water from sewage. Social water literacy needed there is not to discharge food residue, which is the source of nitrogen and phosphorus. Meanwhile, in urban areas without enough water resources, water saving is important. Social water literacy there is, for example, to use water in multiple stages and to turn faucets off frequently.

These three types of water literacy need to be taken by all people. However, the priority of and the concrete actions for each type of water literacy vary depending on the situation of the habitation area. We show the intended spaces and some example of the concrete actions in Table.1. Figure.1 explains the concept of three types of

water literacy. Awareness for water decreases as the space shifts from private to public. The water literacy will act as a catalyst to raise the awareness to the target level.

Water Literacy	Intended Space	Examples
Practical Water Literacy	Human beings as individual	<ul style="list-style-type: none"> <li>• Judgments and behaviors directly linked to human survival ex.) -Not to drink unsanitary water -To wash hands -To avoid to wash filthy matters near kitchen</li> </ul>
Living Water Literacy	Home life and accessible social space	<ul style="list-style-type: none"> <li>• To contrive ways to get stable quantity and quality of water and to maintain sanitation ex.)-Rainwater collection and use -Maintenance of water receiving tank -Maintenance of septic tank</li> </ul>
Social Water Literacy	Overall society and government	<ul style="list-style-type: none"> <li>• Appropriate and reasonable judgment and behavior for overall society</li> <li>• To oversee the government and suggest some concrete improving plans</li> </ul>

**Table 1** Classification of water literacy



**Figure 1** Concept of water literacy

#### 4. Need for the Concept of Water Literacy

Here, why the concept of water literacy is essential for sustainable development is examined by reviewing the historical transition of our relationship with water.

##### 4.1 Reviewing the Historical Transition of Our Relationship with Water and Formation of the Modern Water System

We cannot live without water. It is not simply necessary to sustain life, but is one of the very foundations of human life. Our relationship with water has always had a

great effect on where and how we live. For example, ancient civilizations emerged and developed near great rivers. The regulation and utilization of water was a great challenge for ancient citizens and rulers. Water in ancient Rome was supplied from distant springs using aqueducts. People could not live in Rome, if there was not the technology to construct aqueducts. Meanwhile, qanats were a common water management system to provide a reliable supply of water in arid regions such as Iran and parts of Spain. Qanats were constructed as a series of well-like vertical shafts, connected by gently sloping tunnels. Because water flowed underground, loss by seepage and evaporation could be avoided. Furthermore, people living in Suzhou and its neighboring area in mainland China actively used its abundance of rainfall, storing rainwater in large jars and flowing water in channels. In ancient times, people had the practical water literacy necessary for survival, living water literacy for daily life, and social water literacy to survive as a balanced community.

The industrial revolution, the technological advancements of modernization and the spread of capitalist economies have changed people's lives significantly, especially in terms of their relationship with water. Various technological developments, such as the regulation and utilization of water by damming and efficient water delivery, have enabled us to live in areas far from water resources. Therefore, the places where people lived became diversified. The cholera pandemic in the 19th century, when people were concentrated in urban areas and when national and international trade expanded drastically, accelerated the implementation of the centralized modern water system. At that time, investigation into the cause of cholera was complicated; various incorrect theories were put forward and correct action was not taken. Afterward, the discovery of vibrio cholera in 1883 and the decrease of water-borne diseases, such as cholera and typhoid, by the supply of filtered water resulted in the accelerated spread of a modern water supply to many parts of the world. Because of this great transformation in the 19th century, the standardized modern water system is used similarly in developed countries.

#### 4.2 Merits and Demerits of Modern Water Systems

##### 4.2.1 Invisible Water

Most of the processes involved in modern water systems are not very visible to the average person, and this negatively affects people's relationship with water and thus their water literacy. In fact, there usually is no need to know how and from where water is delivered and how and to where wastewater is transferred. People see water only when they use it. This causes that they do not actually know much about water, although they use it every day.

Before modern water systems, people could not help thinking about water every day. For instance, they had to contrive ways to obtain clean water from rivers, which were often muddy when rain stirred up the sediment. Thus, people filtered water through sand to remove impurities. In periods of limited rainfall, they would restrict the amount of water they used. However, when communities started to become free of such considerations, they did not have to be so conscious about daily water usage. It can be said that sanitary water can be secured, even though people have no awareness of the processes used to supply water; it can also be said that the priority to the hygiene side causes no conscious and huge gap between water and humans. This causes the mistrust and uncertainty about water, as well as heavy consumption.

#### 4.2.2 Mass Consumption and Its Effect

Modernization spread mass production and mass consumption. With regard to water, uniform water use by modern water systems resulted in mass consumption of water. Intensive and rational production prevented people from seeing the true nature of the issues, and the problems at production sites are exactly the same as invisible water.

Social needs for sanitation forwarded the construction of modern water systems; their essential objective is to supply enough quality water to everyone. Judging from the decrease of water-borne diseases, it is obvious that healthy and safe living was promoted by this water system. On the other hand, "enough water" continued increasing, and it was changed from the "essential amount" into "as much as they want." For example, in Tokyo, the average water consumption, which was about 100L/p/d at beginning of the 20th century, reached about 400L/p/d at the end of the 20th century. In other words, it quadrupled in 100 years, along with the development of the modern water system. Of course, in the background, the water demand has increased according to economic developments. However, it was the modern water system that has achieved an increase in the supply in order to fill the demand.

What I want to point out here is not the increase of water consumption itself, but its various subsidiary influences. For example, dam construction, which aimed aims toward the new development of water resources to meet the increasing demand for water, has caused environmental concern in its disruption of the ecosystems of rivers where dams have been constructed, as well as social issues resulting from inhabitants' eviction. Dams are constructed at the upper portions of rivers, which are actually far away from urban centers. The ecosystems and citizens far away from the city make the sacrifice to fill the demand for water in the city.

In Japan in particular, as the main water resources are rivers, an increase in intake means a decrease in the volume flowing down the river. Although waste water returns to the river after sewage treatment, the volume of water flowing between the intake point and the discharge point after

sewage treatment decreases remarkably. In general, river pollution is caused by the balance of the river flow and the pollution inflow load. A decrease of river flow, even if it is temporary, may lead to river pollution, and thereby influence the ecosystem.

#### 4.2.3 Distrust for Water

There are many users of modern water systems who mistrust and are worried about the quality and safety of tap water. This results from the lack of knowledge about water the lack of and understanding the importance of water. People cannot imagine the processes involved in water delivery and do not understand or feel the necessity of having safe, clean water. Therefore, they cannot feel the reality for the safeness and cleanliness, and cannot understand the cost of clean water and the importance of water resources. In addition, this lack of knowledge and understanding contributes to inaccurate media reports. Shockingly, the media sometimes reports that tap water is dangerous. This might promote the cautious feeling about tap water more than is necessary. Furthermore, the increase of the issues we have to consider, such as traces of chemical substances and endocrine disrupters, makes people confused, and their mistrust and insecurity concerning the water supply are steadily growing.

Not to be manipulated by mass media and promotions, governments and experts should provide accurate information to citizens. This is the water literacy needed for governments and experts. It is also important for the citizens to have independent-minded attitudes in order to make judgments based on scientific proof. For that revolution in attitude, basic knowledge regarding their own use of water, the understanding of it, and the ability to judge and act according to knowledge and understanding are required. This is water literacy.

### 5. Effectiveness of the concept of Water Literacy

First of all, water literacy enables us to re-evaluate local water systems and water usage. From the perspective of modern systems, local water systems are apt to be perceived as immature and inferior, but they are nothing of the kind. Rather, they promote active living water literacy, as is proved by the Chiang Mai study. Each region and each city has a distinctive lifestyle. This lifestyle fits the available resources, including water resources, the climate, and the geographic character of the area. It is the lifestyle that enables inhabitants to acquire water literacy naturally in daily life. It might be a new method of development to refrain from transforming the local lifestyle to the new one by urbanization, modernization and system construction, but rather to maintain it and take advantage of the living water literacy.

Originally, modern water systems aimed to sustainably realize safe living, but currently, the method has been

emphasized and the system has become far from sustainable. The future, including water literacy, will promote going back to the original purpose.

Secondly, water literacy educates those citizens who are able to associate daily life with social issues. The whole of society needs the above-mentioned three levels of water literacy, although the concrete contents vary from one region to another. Behaviors, which fit for each water literacy aspect, are not specified universally; they appear in various forms depending on the local situation. Further, to think about human survival and daily life by practical and living water literacy, and to be conscious of the social water literacy that considers overall society enables people to understand the relationship between daily water use and problems occurred in the environment and society. Promotion of changes in the consciousness of citizens is necessary to reduce problems as much as possible.

Third, water literacy contributes to the recovery of a variety of relations between water and humans. Evaluating living water literacy and taking advantage of local customs and characteristics may lead to the retention of a well-rounded relationship between water and humans. Even in a developed area with a modern water system, a water system centering on social water literacy might recreate a rich relations between water and humans.

The 20th century was the age of the expansion of modern water systems from the West to the world. The diversification of the relation between water and people was lost, and at the same time, water literacy was disrespected. The 21st century is an age in which diverse cultures accept individual differences, and aim at coexistence and sustainable. The relation between water and people is the same. As the next step toward universality and stability, it is important to aspire to the coexistence of diversity. That's really the sustainable development of

global-scale. Thus, diversified technology should be introduced and various policies should be promoted that depend on the local environment and culture to maintain a stable supply of safe water.

The final goal of introducing the concept of water literacy is the construction of a water system that enables us to live by balancing our consideration of "existing as a human being," "living our daily life" and "coexisting in a society." Such a water system is not supposed to be universal, but should rather be diversified according to the local way of living and local customs.

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## Biography

**Yurina OTAKI** received her M.Sc. and Ph.D. from The University of Tokyo, Japan. Her research interests include micro-components usage of residential water, water consciousness and user-interface of water smart meter.