



*Environmental education is aimed at producing a citizenry that is knowledgeable on the biological, physical, economic, and social issues that are created and/or associated with environmental problems and how the people can be motivated to minimize or mitigate for these issues by implementing environmentally friendly and sustainable solutions.*

William B. Stapp, *The Concept of Environmental Education*, 1969

## Abstract

Environmental literacy is an abstract concept and a subjective imagination. We see that this chapter discusses environmental education learning motivations, awareness and sensitivity, values and attitudes, mobilization skills, mobilization experience, environmental behavior, and aesthetic literacy in the cultivation of literacy. The above connotations of environmental literacy all need to construct the inherent goodness of human beings. We particularly hope that environmental literacy can be externalized to achieve changes in human-friendly environmental behavior. In other words, if the environmental literacy of the entire population can be strengthened, we can work together to form environmental cohesion, cultivate modern social citizens, generate environmental collective consciousness and awareness, and then based on the eternal belief in natural decision-making and

environmental protection. This could promote a comfortable space and a clean home for sustainable development. Therefore, from the process that human beings can perceive and understand the environment, we have experienced the awareness of environmental changes. We need to improve environmental literacy to form the transformation of the collective human consciousness structure, so as to be aware of the external environment, that is the learning process. If, literacy is the overall effect of a learning process, then our final collective environmental consciousness will change from thought to proper behavior. These changes will affect the stage tasks of sustainable development. Then, based on empathy and awareness of all things, we should realize the sense of responsibility and eternal value as human beings, protect nature, and accept the challenges of future environmental changes.

## 4.1 Introduction

In Chap. 1, we iterated that the ultimate goal of Environmental Education (EE) is to protect the environment, improve the quality of human life, and use our natural resources sustainably as we strive towards the goal of sustainable development. Therefore, as part of the education process, awareness of our (human) activities and the use of our natural resources are essential for identifying gaps in our processes so that solutions developed can be developed. To change human behavior and move towards a more sustainable society, people need to know where these resources are from, how they develop, and how they are obtained. Understanding these elements helps the public develop solutions for environmental problems and fine-tunes the process of environmental education so that the people are presented with the correct information in order to move towards a sustainable society.

The International Union for Conservation of Nature (IUCN) uses the environmental education expert, Jan Cerovsky (1930 ~ 2017), in the definition of environmental education used in their *Handbook of Environmental Education with International Case Studies* (1976). Cerovsky's definition is as follows:

Environmental Education is the process of recognizing values and clarifying concepts, in order to develop the skills and attitudes necessary to understand and appreciate the interrelationship between humans, cultures and their biological and physical environments.

Therefore, environmental education is an introspection effort and a decision of free will. We should want to live in a healthy environment because this is what we want, not because this is what we are being told. For this reason, we explore environmental literacy in much greater depth and define environmental literacy as the process that shapes or develops a person's environmental values and ability to solve environmental problems. This, however, implies that the process of environmental education is globally unified and not geopolitically motivated. We can't have people from one region/country incorporating sustainability practices into their

day-to-daily lives while its neighbors are following different practices.

To begin, we should all know agree on the concept of environmental literacy and what it means. The word "Literacy" was coined in the early fifteenth century and refers to the person who can read and write. The meaning is broad and includes personal education and common skills, but does not involve moral or value judgments. However, environmental literacy is associated with value judgments and environmental ethics. The term "Environmental Literacy" was coined by Charles E. "Chuck" Roth (1934 ~ 2016). Charles E. Roth cited in this paper, *Environmental Literacy: Its roots, evolution, and directions in the 1990s*, for all processes he detected (Roth 1968, 1984, 1991, 1992), confirmed this opinion. As a teacher and a senior research/development associate at the Education Development Center, Newton, Massachusetts, in New England during 1992. Charles E. Roth has been served as the Director of Education for the Massachusetts Audubon Society from 1968 to 1988, also actively working in Drumlin Farm (Scopinich 2016).

Later, the 1990 *National Environmental Education Act* (Public Law 101-619) in USA has brought environmental education back to the attention of many educators and environmentalists (Marcinkowski 1990-91). Meanwhile, Disinger confirmed Roth's idea, published in one of their papers, *Environmental Education Research News*, represented their conveying information about environmental literacy (EL) (Disinger and Roth 1992).

In Roth's previous discussion (Roth 1968, 1984, 1991, 1992), he provided a detailed explanation of the concept, but the definition is quickly clouded by consideration of the cognitive process, societal norms and values, policy, culture, psychology, geographic, and economic elements that comprise a person's daily life (Roth 1968). Nonetheless he ultimately defines environmental literacy as "A person's environmental sensitivity, knowledge, skills, attitudes, values, personal investment, responsibility, and active involvement". He refines the term later in the paper by subsuming environmental sensitivity,

attitudes, and values under the term “affect”. We believe that this modification is important because attitudes and values are shaped by societal norms and values, so what society deems to be important at any point in time is really a reflection of the people’s perception of environmental issues, their sensitivity towards these issues, and how they should be managed. Roth (1992, p. 10) believed much of the environmental degradation that has occurred in the past and continues today, is the result of the failure of our society and is educational systems to provide citizens with the basic understanding and skills needed to make informed choices about people-environment interactions and inter-relationships. Since the term first coined by Roth (1968), its been re-defined (e.g., Hungerford and Peyton 1976) to meet the needs of the world’s population, spatially and temporally, but conceptually, the concept and its associated terms and components remain applicable in the modern world. Hungerford and Peyton (1976) said environment literacy is “*reflected by human beings who have the knowledge and ability to communicate the need for environmental action strategies and be willing to use these skills and knowledge to develop and implement strategies to remediate and/or address environmental issues.*” The big levels of the environmental literacy are listed as follow (see Fig. 4.1).

- Level I: Ecological Foundation;
- Level II: Conceptual Awareness of Issues and Values;
- Level III: The Investigation and Evaluation of Issues and Solutions; and
- Level IV: Citizenship Action and Participation.

How then are the “cornerstone, keystone, stepping stone, and capstone” elements illustrated in the model presented in Fig. 4.1 related?

Level I: Ecological Foundation and Level II: Conceptual Awareness of Issues and Values are much like cornerstones, serving as first stones laid in the constructing of a masonry foundation. Level I and II have been considered the most important elements for building environmental literacy because all the other stones that follow are laid in relation to Level I and II. Levels II and III are the keystones for the model. Without these elements the model would be meaningless.

In Level III is focused on Investigation and Evaluation of Issues and Solutions. Level III provides the philosophy, process, business proposition, or principles to support citizenship action and participation before moving to Level IV. The four-level model proposed by Hungerford et al. (1980) was later divided into a more complex Environmental Literacy Model (Hungerford and Tomera 1985). In this model

**Fig. 4.1** The level of environmental literacy, which is one of the goals of environmental education (originally adapted from Hungerford et al. (1980); pp. 42–44, revised and illustrated by Wei-Ta Fang)



citizens with responsible environmental behaviors to be citizens possessing environmental literacy was considered (Hungerford and Tomera 1985).

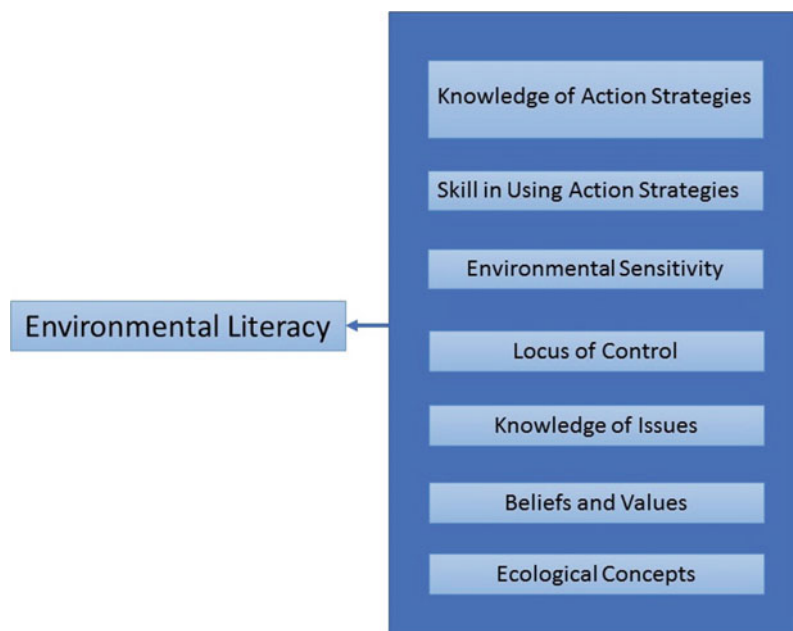
At this time environmental literacy models were the subject of research and new models were proposed. Wilke (1985) described competencies in Environmental Education should include the following elements: Level I: Ecological Foundations, Level II: Conceptual Awareness, Level III: Investigation and Evaluation, and Level IV: Environmental Action Skills. The model centers on cognition, affection, and skills in taxonomy such as Bloom (Bloom et al. 1956), and belongs to the field of cognition with “environmental knowledge to the problem,” “ecological concepts (cognition),” “environmental sensitivity.” The areas of affection include “attitude,” “values,” “beliefs” and “control concept”; those in the field of skills adopt “environmental action strategies (skills).” The above seven variables are interconnected. Here, he moved from four levels to seven variables in Fig. 4.2.

The environmental literacy model in Fig. 4.2 is based on the study of environmental behavior and a retrospective of environmental education as

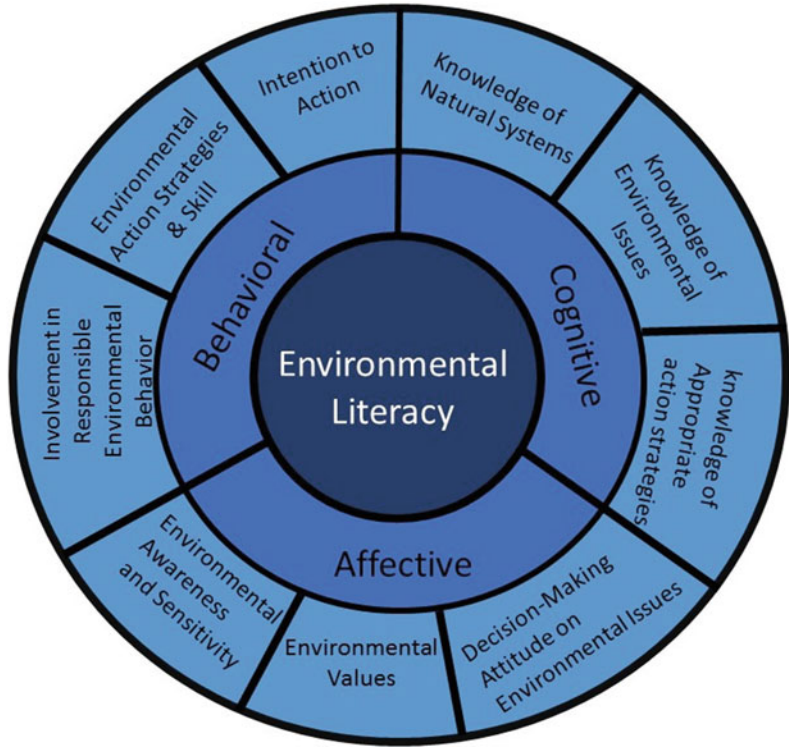
it relates to today’s issues (Hungerford and Tomera 1985; Hungerford and Volk 1990; Hungerford et al. 1990) (please also see Box 4.1: Tbilisi Declaration). How relevant will these models be in 10, 50, and 100 years? We suspect that we will see impacts in the next 20 years when seawater levels start creating major flooding problems in our coastal cities. Are our models and environmental education process and we deliver such messages equipped/prepared for such change? For example, people living in coastal areas are going to care a lot about sea level rise, while people living inland aren’t really going to care unless it impacts their supply chain/ way of life.

Since then, environmental literacy has integrated the fields of cognition (knowledge), affection (attitude), and skills (behavior). In 1990, the United Nations designated the “Environmental Literacy Year” calling for “human environmental literacy” to strengthen basic knowledge, skills, and motivation for learning to strengthen sustainable development. This is a good point from UN’s declaration, but this is developed some decade ago. Is it relevant today and/or in another 20 years? We therefore, developed a new model shown in Fig. 4.3.

**Fig. 4.2** Variables affecting the environmental literacy. Each variable interacts with one another (adapted and modified from Hungerford and Tomera (1985); Hungerford and Volk (1990); Hungerford et al. (1990))



**Fig. 4.3** In the study of environmental behavior, the scale of environmental knowledge and environmental attitudes needs to be considered. Modified from Hungerford and Tomera (1985), Hungerford and Volk (1990), Hungerford et al. (1990), Liu et al. (2015), Liang et al. (2018), Cherdymova et al. (2018) (Illustrated by Wei-Ta Fang)



**Box 4.1: Tbilisi Declaration: Another Literacy Cited?**

According to Hungerford and Peyton (1976), it is believed that environmental literacy includes three components: (1) cognitive knowledge, (2) cognitive process, and (3) affective processes. Environmental literacy means that a person has the ability, knowledge, and skills on environmental issues and is able to teach others. In 1977, UNESCO proposed five characteristics of “environmental literacy,” include: (1) awareness and sensitivity to the overall environment; (2) understanding and experience of environmental issues; (3) possessing values and feelings for the environment; (4) possessing the skills needed to identify and solve environmental problems; and (5) the ability and

willingness to participate at all levels to solve environmental problems.

When people emphasize sustainable development and generational justice, a correct attitude towards the environment, a concept of control, and a sense of personal responsibility have produced a strong intention of environmentally friendly behaviors, which involves environmental education and learning motivation, awareness, sensitivity, values, skills, and experience. Unfortunately, people will not react until it’s too late to save energies. Environmental Education (EE), however, can and should play a large role in managing environmental issues and sustainability, but the practice of sustainability is akin to masturbation. We feel good about what we’re doing, but it really isn’t changing much.

## 4.2 Motivation for Environmental Education

### 4.2.1 Pedagogic Reasons

EE requires pedagogic processes through which the concepts, skills, attitudes, ethics, and values of the environment and society can be used by the entire population to understand the sustainable use of resources, maintain environmental quality, and achieve ecological balance. In recent years, because the global environment is threatened by human development, the carrying capacity of the environment is limited (Sepkoski 1993). Sepkoski at University of Chicago who developed an algorithm for species longevity (Sepkoski 1993, 1997, 1998). He declared that the fossil record shows large variation. Rates of origination have declined through the Phanerozoic. This appears to have been largely a function of sorting among higher taxa (especially classes), which exhibit characteristic rates of speciation and extinction that differ by nearly an order of magnitude. However, a somber sub-question has been added: How many species are dying every year? We believe species longevity is only a few million years. This then puts adaptation into context because humanity will not be able to survive forever.

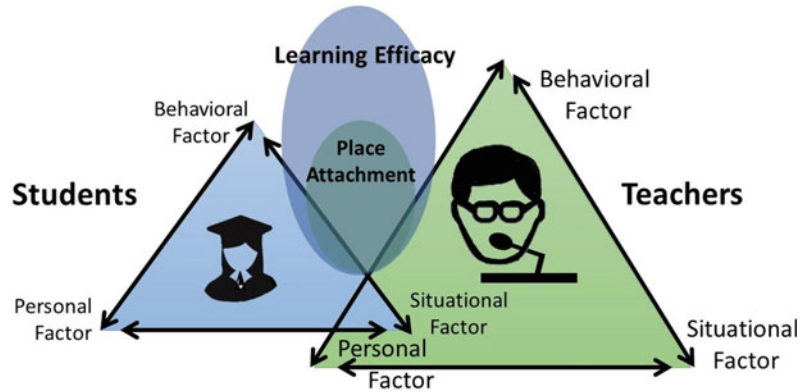
### 4.2.2 Social Learning Reasons

From a scientific point of view, we have an intrinsic motivation to learn about environmental issues. After all, we live on a planet where biotic and abiotic change is expected, which as an intelligent species provides us with the motivation to learn more about the world around us. Understanding the world around us allows us to promote additional learning activities, albeit incrementally, and identify the gaps in our knowledge base. The most recent pandemic is an excellent example of a gap that we missed or ignored given that there have been at least 17

pandemics since the 1300 s. It is also the direct cause and internal motivation of human behavior. Therefore, the learning motivation of environmental education is mainly composed of two factors: internal driving force and external incentive. These factors, driven by the “self-course,” have become a driving force for human beings to continuously seek knowledge and advance. Albert Bandura (1925 ~ 2021), a professor of Department of Psychology, Stanford University, is dedicated to exploring the “self-course,” that is focused on the study of personal goals, self-evaluation, and the thinking process of self-expression ability and belief, treating people as their “agents” That is, we can influence our own development, and not only analyze individuals, but also emphasize social impacts, such as how socioeconomic conditions affect human beings' belief that they can change things.

In the 1950s, Bandura recognized the motivation of human learning with “social learning,” which originated from “behavior/learning theory.” He began to shift his attention from animals in the laboratory to human behavior. Is this a journey of continuous interaction between individuals and the social environment? If so, then, most human behaviors develop through the learning process; since birth, individuals have been learning others' behaviors all the time. With the increase of age and experience, under the urging force of external environmental factors, human actions, thoughts, and feelings will gradually mature and become socially acceptable by the family and society. From Fig. 4.4, this series of learning activities involves social stimuli, so it is called social learning, and this type of learning is the main way that individuals learn social protocols. Finally, the name “social cognition,” emphasized on two important characteristics. First, the human thinking process should play a core role in personality analysis and second, the thinking process must take place in the context of society. That is, humans understand their relationship with the surrounding environment through human interaction.

**Fig. 4.4** Social learning motivation (Bandura 1977) (Revised and illustrated by Wei-Ta Fang)



**4.2.3 Better Environmental Protection Behaviors**

In the behavior research of scholars at home and abroad, elementary school students have the best environmental protection behavior, followed by middle school students, and college students become worse after they reach adulthood. Among college students, the environmental protection behaviors of girls participating in colleges are better than the environmental behaviors of boys not participating in colleges (Liang et al. 2018). Female undergraduate students exhibited a more satisfactory fit in environmental literacy than did male undergraduate students (Wongchantra and Nuangchalerm 2011; Cincera et al.

2013). The higher level of environmental literacy attained by females could be explained by their social status and norms expectation in the Eastern society. For example, females in Taiwan have traditionally been taught to love (Fig. 4.5) maintain cleanliness in their homes, saving energies, and an animal caring role (Fig. 4.6) (Liang et al. 2018).

In addition, the environmental behavior of civil servants in central government agencies is better than that of local civil servants because the local civil servants do not feel responsible for the environmental crises. These factors appear to be related to the age and qualifications of civil servants (Fang et al. 2019). The results indicate people’s attitudes towards environmental issues

**Fig. 4.5** The higher level of environmental literacy attained by females could be explained by their social status and norms expectation in the Eastern society (Photo by Wei-Ta Fang)



**Fig. 4.6** Females in Taiwan have traditionally been taught to love, maintain cleanliness in their homes, and an animal caring role (Photo by Wei-Ta Fang)



is more important than their level or amount of knowledge that they possess. Therefore, environmental education, like any other aspect of education, is part of life's education. The delivery of the material on environmental issues plays a much more important role in environmental literacy as opposed to memorizing the information.

In terms of teaching mode or delivery, environmental education should adopt an integrated teaching method, that strengthens the teaching mode from motivation theory, awareness, knowledge, attitude, and action skills to increase problem solving competencies. In addition, environmental education needs to use teaching strategies to focus on students as a teaching center, emphasize students' active learning, strengthen their sense of connection with the world around them, and use students' actual environmental action experiences to establish an interactive relationship between teachers and students (Bandura 1977).

We need to mention that students could learn in different ways to present information (i.e., visual, tactile, audio, or some combination thereof) and the delivery needs to take these learning styles into consideration so everyone gets to learn (Fig. 4.7). Use the relationship

between learning behavior, student personality, and learning environment as a causal relationship to practice what Bandura calls "social epistemology." If we look at the development point of view of students' growth, the methods for students to acquire knowledge and skills need to learn, observe, and control themselves through their own observations, and regulate personal behavior and emotions.

Therefore, in the theory of learning motivation, it is necessary to observe the process of students learning on their own. Motivation is strengthened by educational methods, and from this we can begin to understand environmental awareness and sensitivity, values, and attitudes, see Box 4.2.

#### **Box 4.2: Similar Environmental Nouns in Environmental Literacy**

In environmental literacy, we often see similar nouns, including attitude, awareness, consciousness, emotion, perception, and emotion.

##### **1. Attitude**

Attitude is the way a person feels about others, things, or situations, or generates behavioral intentions. It is also an



**Fig. 4.7** We need to mention that students learn in different ways, so we need to consider these learning styles, so everyone gets to learn (Photo by Wei-Ta Fang)



established way of thinking or feeling. Attitude includes mindset, viewpoint, beliefs, norms, affective dimension, and desire dimension. We logically assume that there is a positive correlation between cognitive and emotional attitudes. For example, in terms of environmental science, humans recognize that acid deposition will destroy the forest, but if humans themselves do not care about forest damage, then they will not care about the fate of the forest. In other words, environmental knowledge does not form environmental attitudes, because attitudes involve emotional evaluation factors. If you are interested on more details about scales, you can

also see **Appendix: Environmental Attitude Scales** at the end of this book.

- **Positive Attitude**

There are two components to a positive attitude towards environmental change. A way of thinking about the threat posed by changes in the environment and actively acquiring a defense model for adaptation. Another positive attitude emphasizes human health and wellness. No matter how bad the natural environment is, we need to face the environmental challenges with a positive attitude in order to solve environmental problems.

- **Negative Attitude**

There are two components to a negative attitude to environmental change. One is to completely negate and adopt the ostrich mentality to face the environmental issues of climate change. In addition, another attitude is a negative attitude that we should avoid. As for environmental change, people generally evade passively and deny the challenges brought about by climate change. They cannot get out of their predicament, find solutions to problems, and have no way to solve environmental problems. Since people are saturated with negative opinions about the environment. We hear about climate change every day and anything bad in the news circles back to the environment. It also erodes the public's faith in science, so people will follow anyone who "promises" they have an answer. Therefore, as the proverb is saying: "people are like cows, except cows are smarter most times."

- **Neutral Attitude**

A neutral attitude to environmental change is another common attitude. There is no doubt that people who maintain a neutral attitude will not hold any hope to solve environmental problems. Humans often tend to ignore the problems in their living environment and maintain a peaceful attitude of "nature straight from boat to bridgehead." They wait for others to solve the environmental problems they face. They don't care about the improvement of living environment, they don't consider the complicated life phenomenon, and they don't care about others with the slightest emotion. They are lazy in heart and never feel the need to change themselves; they believe that they can live a simple self-lifestyle.

- 2. **Awareness**

Awareness is a kind of consciousness. It is also the perception or feeling of the

surroundings, or the awareness of events, objects, or states or abilities that can be perceived. At this level of consciousness perceptual experience is confirmed by the observer, without necessarily implying understanding. More broadly, awareness is the state or quality of knowing. Environmental awareness is often used for public environmental knowledge or understanding environmental social or political issues. Environmental awareness is a synonym for whether the public is willing to participate in environmental movements, or whether they agree to jointly advocate environmental protection.

- 3. **Concern**

Environmental concern is the degree to which human beings are aware of environmental problems and are willing to support the solution of these problems, or to the extent that human beings are willing to make individual efforts to solve these problems.

- 4. **Consciousness**

Consciousness is a state in which humans perceive their existence. Consciousness has characteristics of sentiment, subjectivity, and the ability to experience or feel.

- 5. **Emotion**

Emotion is the mental state of a person's physical and psychological experience. Emotion can be a combination of multiple sensations, which intersects with mood, temperament, personality, disposition, and motivation, resulting in a psychological and physiological state.

- 6. **Perception**

Perception is a person's interpretation of the overall information of the external environment stimuli received. These interpretations can be influenced by the recipient's experiences and ability to recall them. Perception reflects the overall sense

composed of the attributes and relationships of objects.

### 7. Sentiments

Emotion is a collective representation of a person's emotions and feelings.

## 4.3 Environmental Awareness and Sensitivity

The goal of environmental education curriculum is to improve a student's environmental awareness by training or improving their sensory awareness, which strengthens their skills in observation, classification, ordering, spatial relationships, measurement, inference, prediction, analysis, and interpretation (Gagne 1968; McTear 2002; Peuquet 2002; Auer 2008). Such skills can cultivate a students' situational awareness of environmental damage and pollution. It increases the degree of appreciation and sensitivity to the environment. In this section we discuss the implications of environmental awareness and environmental sensitivity.

### 4.3.1 Environmental Awareness

Once an individual understands how ecosystems function and the associated environmental issues, the fragility and importance of protecting our environments become apparent. So why is environmental awareness an important element of environmental education and the world around us? For people that are in constant contact with nature (Braus and Milligan-Toffler 2018), establishing and maintaining environmental connections are as easy as taking a walk in the woods. But for people who have lived in cities since childhood, opportunities to interact with nature are not easy or even available. If we haven't ever interacted with nature or since we were young, then we've lost the ability or skills to interact with nature. This phenomenon is called extinction of experience.

In the history of environmental education, environmental awareness began to attach importance to the nature in the second half of the twentieth century. Environmental education scholars believe that outdoor games are important for the healthy development of young children (Fig. 4.8).

Humans have become more aware of the environment because of their interest in biology and because children are naturally curious. Children are fascinated with nature and look for patterns or movement and insects are generally targeted because they can be easy to find. Interactions with nature help develop the plasticity of



**Fig. 4.8** Strengthening outdoor games is important for the healthy development of young children (Photo by Wei-Ta Fang)

neural networks and strengthen environmental protection awareness (Li and Song 2019). Children playing outdoors feel more comfortable interacting and being a part of nature because they do not consider themselves isolated from nature and perform better in environmental behavior (Fang et al. 2017; Omidvar et al. 2019). As our environmental awareness develops or becomes sharper, we become aware of all types of environmental information.

As children grow older, they develop an understanding of how the world works and form a “mindset.” We become more rational and build a framework around our perception of the world around us that is shaped by intrinsic and extrinsic factors/experiences. We ultimately develop a definition of this world and create models and develop ideas of nature that support our beliefs/concepts, which inevitably limit our ability to understand or interact with nature effectively. We consciously decide what is real, choose environmental signals that fit our paradigm, and filter out the parts that we either don’t understand, care about, or fit our model.

Understanding of the living environment depends on human experience. In fact, when humans are close to the environment, they feel related to nature and the world around them. It can be said that humans create environmental awareness in order to find the right affinities to their close relationships to nature. Is this a situation like a runner who runs because they experience the dopamine high? Or is it an alignment of their beliefs with their knowledge base? Are we reducing contradictions? Perhaps this sense of affinity with nature strengthens our neural network systems as they relate to perception. Human beings want to understand nature and gain more of a sense of security (Selye 1976; Chawla 2020). This is also a primal response because we know we are part of the environment and if we screw it up, we’ve screwed ourselves. When human beings live in the environment, they feel more satisfied with their surroundings and care more about the environment.

The interventions for the environment from humans are needed to increase and improve

green space, which can deliver positive health, social, and environmental outcomes for all persons, especially in urban environments (World Health Organization 2016).

Empirically, life determines the sculptural elements of nature; however, intellectually, the school’s curriculum is based on books. These are theoretical explanations of the environmental experience. But, in the end, we rely more on life experiences to initiate environmental action, remedial measures to practice sustainable agriculture, repair community ecosystems, and develop ideas or concepts to protect our fragile ecosystems that help shape our lives. Charles Percy Snow (1905 ~ 1980) talked about the dissatisfaction between the natural and social sciences and was saddened by the gulf between scientists and cultural intellectuals.

In 1959, he delivered a speech entitled *The Two Cultures and Scientific Revolution*, which sparked widespread and heated debate. He then used *The Two Cultures and Scientific Revolution* to explore the breakdown of communication between the sciences and humanities. Snow believed that the quality of education worldwide is declining. He wrote:

A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice, I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. “Yet I was asking something, which is the scientific equivalent of: Have you read a work of Shakespeare. I now believe that if I had asked an even simpler question – such as, What do you mean by mass, or acceleration, which is the scientific equivalent of saying, Can you read? – not more than one in ten of the highly educated would have felt that I was speaking the same language.

Snow mocked political leaders:

So the great edifice of modern physics goes up, and the majority of the cleverest people in the western world have about as much insight into it as their Neolithic ancestors would have had.

Since being fired in 1959, his lectures condemned the British education system because the

Victorian era over-rewarded the humanities (especially Latin and Greek) at the expense of science. In his opinion, the practice of these deprived British elites (especially political, administrative, and industrial) is well prepared to manage the modern scientific world. Snow believed that:

In contrast, schools in Germany and the United States are trying to promote science and humanities in an equal way and prepare for the way civil society thinks. Better scientific teaching methods make these countries. Rulers can compete more effectively in the age of science.

Later Snow's discussion of *The Two Cultures* tended to focus on understanding the differences between national competition systems in British school education and social class systems. If Snow was worried about the basic science of physics, then the understanding of modern politicians on global climate change, such as the speech of US President Donald Trump (cognitive bias), might look like the breakdown in communication between the sciences and the humanities in the modern world. This was again illustrated when Trump iterated "*The kidney has a very special place in the heart*" at the Advancing American Kidney Health (AAKH) event on July 10, 2019, which again illustrates the complete failure of American health, science education, and environmental education systems. US President Trump signed an Executive Order, AAKH, that could significantly change the administering of kidney care to double the number of organs available for transplantation by 2030 (Knight 2019).

Understanding environmental issues can promote environmental sensitivity and cultivate the desired environmental ethics and values. Environmental awareness is the foundation of environmental education because it provides students with the ability to become environmentally aware on many levels including:

- Improvement of sensory awareness (observation, classification, ranking, spatial relationship, measurement, inference, prediction, analysis, and interpretation);

- Appreciation and sensitivity of the natural environment;
- Awareness of environmental damage and pollution;
- Situational awareness including the natural and social environments;
- Awareness of the impact of our behavior on the natural and social environments;
- Awareness that human beings are closely related to the environment, natural resources, society; and culture;
- Awareness of the environmental responsibilities that we should bear; and
- Awareness that the everyday operation of society is reliant on natural resources.

Kuppusamy and Mari (2017) investigated the correlation between environmental awareness and environmental knowledge using "AKASA" Model, which is based on awareness, knowledge, attitude, skills, and action (Fig. 4.9). The study was based on responses from 234 s- and third-year students of architecture from five private universities in Malaysia. The UNESCO-UNEP commitment on the evolution of environmental education identified five essential components and from these, the objectives of environmental education were targeted. However, Kuppusamy and Mari (2017) only looked at environmental awareness and environmental knowledge. The purpose of the study was to investigate the relationship of between environmental awareness and environmental knowledge. The results show that the relationship between these variables is positive and strongly related (Kuppusamy and Mari 2017).

### 4.3.2 Environmental Sensitivity

Environmental sensitivity describes the ability of an individual to perceive and process information about their environment. A classification could be explained the definition from the environmental sensitivity which providing a concise summary as follows.

**Fig. 4.9** Environmental awareness and environmental knowledge with questionnaire matrix, the dots = yes for each item (Kuppusamy and Mari 2017) (2020 University of Reading’s institutional repository, CentAUR; Illustrated and redrawn by Arba’at Hassan)

Environmental Literacy	Environmental Awareness		Environmental Knowledge	
	aware & sensitive	make the right decision	capability of basic understanding	assess impact & consequences
Environmental Education in Architecture				
Creating Environmental Awareness	•	•	•	•
Understanding Building Ecosystems	•	•	•	•
	•	•	•	•
	•	•	•	•
Ability to Design Sustainable Buildings	•	•	•	•

**4.3.2.1 Orienting or Directional Sensitivity**

Orientation sensitivity includes changes in how a person’s perceptions and thoughts change with subtle changes in their environment. A sensitive person can be aware of low-intensity environmental change or detect the emotional stimuli of others. These relationships come from feelings and consciousness. People possessing strong orientation sensitivity can perceive subtle environmental factors and trigger association and response.

**4.3.2.2 Chemical Sensitivity**

Chemical sensitivity includes a variety of sensitivities to products such as food, paint pets,

plants, fuel, molds, pesticides, detergents, fossil products, electromagnetic radiation, cigarette smoke, fragrance products, and cleaning products, which can trigger allergic reactions. Chemical sensitivity varies between individuals and is now an important workplace concern.

**4.3.2.3 Aesthetic Sensitivity**

Humans respond to the external environment and the mode of emotional response or overall impression is used to judge their aesthetic taste. The importance of the concept of aesthetics is difficult to assess, measure and discuss because aesthetic sensitivity is a non-verbal manifestation, that can only be understood from an individual’s point of view. We have different views

on aesthetics and while these views vary within a population, they can change in an individual or society over time. It is not uncommon to despise an artists' work as a young adult and later become enamored with their work as one matures.

These sensitivities contribute to an individual's sense of belonging within their respective environments, as well developing care and respect for the environment. When we have emotional concerns about the local environment and try to resolve problems, we feel that we are part of the community and made the effort to care for its resources. In other words, we tend to respond spontaneously and develop environmentally friendly behaviors because our actions negatively impacted the environment, and in some cases human health and well-being.

Louise Chawla (1949~), emeritus professor of environmental psychology at the University of Colorado, believed that environmental sensitivity and environmental awareness are the reasons that we take responsibility for our activities in an effort to minimize impacts to the environment, and help children and youth to plan their sustainable communities (Chawla 1998; Derr and Chawla 2018). When we have a sense of environmental sensitivity, society has higher requirements for environmental protection. It is hoped that the government will take more remedial measures in response to environmental problems. Therefore, improving human environmental awareness and sensitivity is a way for humans to properly participate in environmental steward and create a better future. Through environmental education, we can arouse, or better yet, ignite our responsibilities and obligations to respect nature, understand the fragility of ecosystems, and develop solutions to solve the environmental threats and problems we created. At the same time, through discussion and communication, more people can reach a consensus on the environment, and at the same time instill hope for the future to inspire people.

## 4.4 Environmental Values and Status

In environmental literacy, environmental values and decision-making attitudes on environmental issues are also an important part of environmental attitudes. In the field of environmental philosophy, value is an ethical concept, a belief formed by the concepts, systems, laws, and symbols shared by social groups. If we talk about environmental values, then it is then a mentality under human consciousness, and a product of the interweaving of the natural ecology and human culture against the environment, which results in the judgment of the environment and behavior in individuals and societies (standard).

### 4.4.1 Environmental Values

Environmental values are the criteria by which humans judge the worth of an environment. Western philosophy has endowed the internal value dispute of environmental ethics and environmental moral judgment; because environmental ethics is not to explore the validity of intrinsic values, but to observe all of the values we have. Currently, we bring together the contributions of philosophy, economics, political science, sociology, geography, anthropology, ecology, and other disciplines that we attempt to monetize the value of past, present, and future environments on an anthropogenic point of view. This provides us with a sense of responsibility and justification for our actions, good or bad. In this process, the clarification of environmental values, through the verification of basic disciplines, deals with the relationship between the conversion of the environment into currency and the basic principles of public accountability. Therefore, with the development of social economy, environmental values have established a new "man-land relationship."

Stephen R. Kellert (1944~), Honorary Professor of Social Ecology at Yale University,

explores biology from the perspective of social ecology in his book *The Value of Life: Biological Diversity and Human Society* as the practical importance of diversity to human society. He divided the important values of nature and wild animals and plants to us into ten basic types, which are used to evaluate the universal existence of human beings on the ecological environment (Kellert 1996). Kellert believes that humans are not the only creatures in nature and judging nature cannot be based solely on human needs. At the same time, we should consider the laws of natural development and these laws do not necessarily depend on human development. There is a crucial relationship between survival and development, given the importance of life. However, human decision-making has had many serious environmental and social impacts that are based on economic or social environmental development. He developed the basic values of life and described these biologically based values and based on human culture, learning and experience.

Kellert (1996) summarized how we can assess natural differences in these values by gender, age, race, occupation, and geographical location. How does human activity in the ecological environment affect changes in values between species? How to show the significance in different cultural policies and ecological management? Kellert argues that the protection of biodiversity is fundamentally closely related to human well-being. He clarified the importance of biodiversity in human sociocultural and ecological psychology, and proposed his ideas as follows:

#### 4.4.1.1 Aesthetic Value

Nature has aesthetic value, because the beauty of nature is everywhere (e.g., mountain peaks and moons, scorching flames, lush forests, lakes and mountains, autumn sky, choppy waves, roaring deer, lonely sunsets). It is a naturally rich mysterious aesthetic experience because each person has a point of view that is refined by personal taste and experience. One person's most beautiful sunrise/sunset is just another sunrise/sunset to another person.

#### 4.4.1.2 The Value of Domination

Since ancient times, we've have wanted to dominate nature. We use nature to grasp and control the world's diversity of plant and animal species. We hope that "man will prevail in the sky" and have the right to dominate the natural world. It is given to mankind by the Bible, such as the Bible. "The Garden of Eden - Genesis 1:26" and God said, "Let us make man in our image, according to our likeness; and let them have dominion over the fish of the sea, and over the birds of the air, and over all the wild animals of the earth, and over every creeping thing that creeps upon the earth." The term "Dominion" is controversial. Many biblical scholars believe that the true meaning of the Bible is to require humans to take care of the earth and its beings, and that God has the so-called obligation of human beings to care for all beings. Therefore, because of the challenges of dominance and care, people face the modern society with decreasing biodiversity. They need to break away from the man-made method of mankind and control the narrow values of nature.

This concept is highly anthropomorphized because our species, *Homo sapiens* (300,000 years) is a recent addition is a relatively recent addition to the planet's inventory of plant and animal species that have a fossil record that can be traced back about 3.7 billion years.

#### 4.4.1.3 The Value of Ecological Science

This observation is based on the ecological structure, function, and time series of nature. Science reveals the position of humans and all other species in their respective environments. Ecological value is the interdependent relationship between species. Ecologically speaking, we are just another species in a long list of species that inhabited this planet. In some cases, we happen to be smarter. But as a species, our time on Earth is measured.

#### 4.4.1.4 The Value of Human Nature

Values depend on our culture and experiences. Culture preserves our values, including fairness and justice, compassion and charity, obligations



and rights, and the protection of species for their survival, and human well-being. When choosing environmental values, we tend to consider the comfort and convenience of the economic or social environment as opposes to our own beliefs, which is also a part of human nature.

#### 4.4.1.5 The Moral Value

Value is a moral code based on behavior. The fact that we have a relationship with nature is related to our responsibility as good citizens. Moral values underline the sense of loyalty and belonging in a group. However, when faced with environmental ethic issues, we are usually reluctant to take expensive actions, but resort to convenient, fast, trouble-free, and selfish actions. Therefore, the throbbing of ecological protection has a positive meaning because it is backed by a firm moral claim and needs to sacrifice human convenience. This new theory of moral behavior shows that if individuals do not act in accordance with their own interests and make the environment worse, and individuals will not benefit from it, they need to encourage everyone to put on moral conscience, advocate altruism, and further choose to take effective action.

#### 4.4.1.6 The Value of Naturalism

Value can be framed in economic terms or its importance to a person. From an ecological perspective our respect for nature comes from caring for nature. The value of naturalism is to add people's feelings for nature. Therefore, when appreciating nature, our senses can play a large role in what we value.

#### 4.4.1.7 The Negative Value

Nature causes negative emotions such as hatred and fear. The development of economic and social conditions may cause many of us to ignore nature and the damage to its environmental value. On the other hand, the lack of understanding of the environmental impact negates the value of nature, leading to cumulative negative problems in the environment and consequently acts that damage the environment.

#### 4.4.1.8 The Spiritual Value

The spiritual value of nature is where we experience the spiritual connection with nature. Zhuangzi's *Theory of Qiwu* (《莊子·內篇》齊物論)(Theory of Equality) points out a concept of "satisfaction with oneself," which is also the state of *qiwu* (齊物)(equality or egalitarianism). There is no difference between human beings and all things. With the spiritual power of nature, he explained:

The heaven and earth live with me, and everything is one with me.

The basic structure of human relations is the ultimate goal of adapting to nature in the course of human evolution. From the subjective consciousness of nature, the establishment of an integrated spiritual realm that connects me with the world is the foundation of all ecological cognition, judgment, and evaluation, based on the spiritual beliefs of nature and spirituality.

#### 4.4.1.9 The Symbolic Value

When nature is an identity of a primary bearer of value and, secondarily, a bearer of value itself, then it has symbolic value (Davis 2019). The meaning of the symbols in nature leads to the metaphorical symbols in our experience. The symbolic value of nature refers to the semantic and cultural universe linked to it. Maybe we use this simple notation and often take it for granted. But symbolism in nature is quite subtle. We can find deeper meaning from the symbols hidden in nature. But we must take the time to find and promise to accept the symbolic information of nature. When we borrow everything in nature to express our thoughts and emotions, that is, in our hearts, we regard nature as the transformation and sublimation of symbolic meaning. It is, even representing an important a symbol as a marker (Davis 2019), although it has little practical effect. A place or a public good, therefore, can have both economic and symbolic value. Scientists are trying to make is clear how to answer the questions "What is the nature of meaning from her value" (Mills et al. 2010).

#### 4.4.1.10 The Value of Pragmatism

We obtain tangible substances from the biological world. The basis of these values seems to be the biologically practical nature of human beings. These values are influenced by human learning and experience, and if they are not developed through a connection with nature, they may undermine human sustainable development goals. Therefore, we should recognize and respect this natural and practical value of the environment and change some traditional values that are not conducive to the environment. For example, we believe that some environmental resources are inexhaustible and this is wrong.

A case in point related to Table 4.1, Covid-19 is nothing but a strand of RNA and it doesn't think, have a family, go to work, or pay taxes, but it has brought the human species to its knees. That is, which species has mastery and dominance over another? This is a real "redneck value" of what we want to say. We should be concerned with living in harmony with all other species rather than being overlords.

#### 4.4.2 Environmental Attitude

Environmental attitudes are the psychological tendencies of a person that manifest themselves as preferences for the natural environment or an evaluation response to dissatisfaction.

Environmental attitudes are a potential construct of human beings, so we cannot observe them directly. What does this mean? Is this an evolutionary response to assess the safety or suitability of an environment for our survival? In other words, is the selection of a suitable environment hard wired into our genetic code? This is a relatively new ideas for our attitude towards the environment. This also presents considerable challenges for the study of human health. That is, environment can impact phenotype and vice versa (Ralston et al. 2008). Environmental factors and genes form a fully interactive system at all levels (Schneider 2007). Behavioral genetics become increasingly important as the full complexity of gene–environment relations. Behavioral analysis, therefore, both contributes to and gains of how nature and nurture really work.

Humans can infer the likes and dislikes of environmental attitudes based on survey responses. For surveys of environmental attitudes, we can use direct self-report methods for measurement or use hidden measurement techniques, such as observation methods (see appendix).

##### 4.4.2.1 Navigating Environmental Attitudes

There are several methods that can be used to measure environmental attitudes (Cotgrove 1982; Wiseman and Bogner 2003). Opposition of

**Table 4.1** Ten ecological values in Stephen R. Kellert's *The Value of Life*

Value	Definition
Aesthetic value	Appreciate the charm and beauty of nature
Dominant value	Mastery, physical control, and dominance of nature
The value of ecological science	Appreciate the structures, functions, and relationships in nature
Human value	Humanistic; strong emotional attachment and love for nature
Moral value	Moralistic; caring for Nature with the Principle of Land Ethics
The value of naturalism	Naturalistic; enjoy immersed in nature
Negativistic value	Negative value, such as fear, aversion, and alienation
Spiritual value	Spiritual transcendent feelings; respect for nature
Symbolic value	A symbolic revelation of nature based on human language and thought
The value of pragmatism	Utilitarian; Benefit from practical use and material use of nature

Source Kellert 1996

environmental attitudes however, is the process where positive and negative aspects comprise our attitudes about the environment and associated concerns and problems. For example, environmental conservation implies a certain level of environmental protection and people possessing this attitude focus on protecting nature from abusive practices that contribute to environmental change. On the other hand, utilization or what has been called resource management is an attitude that reflects or justifies the use of our natural resources for our benefit and people and the belief that nature requires a level of management in order to be healthy. This attitude or belief justifies our use, transformation, and management of natural resources is an appropriate approach to protect, conserve, and sustainably use these resources. It's a version of Ramsar's wise use approach to wetlands, but the concept of "wise use" can be applied to management system so that we can justify how we use our natural resources without guilt. It's a delicate balancing act between the real need for these resources in order to survive and abuse of these resources for profit or personal gain.

Thomas Heberlein believed that values and attitudes are a yearning for certain things or an outcome regardless of whether it is right or wrong; individual, collective, or both. Therefore, solving environmental problems requires a good understanding of the attitudes of the general public on scientific issues and in particular where an individual lands on the scale compared to the community. Heberlein (2012) tried to explain human attitudes, how humans change attitudes, and influence behavior and said, "*Solving environmental problems requires a scientific understanding of public attitudes.*" He explained that the concept of attitude has neither is qualitative and difficult to measure. He believed promoting environmental protection is not an attempt to change society's attitudes on this matter, but rather, it's about designing solutions that strengthen environmental policies. As such, he said, "*Attitudes measured at very general levels should not be expected to be associated with a specific behavior.*"

He elaborated on these views on attitude by using Aldo Leopold, a well-known environmentalist, as an example. In his classic book *A Sand County Almanac*, Leopold (1949), went from using a shotgun to hunt wolves to protecting them. Although Leopold changed his view about wolves, he did not repeal the wolf hunting bill illustrating the point that human attitudes can, and often contrast with our behaviors. Observing the attitudes of a person or group of people is not difficult, but determining the impact of the social, economic, ecological factors that shape behavior is challenging, and changing individual and collective attitudes is even more challenging.

#### 4.4.2.2 Transformation of Environmental Attitude

Environmental attitude is the sensibility and the rationality of interactive thinking, perception, and dialectical perspective. Perception manifests emotional responses via sensory stimuli. If these experiences generate emotional responses through subjective cognition alone, then they are all perceptual experiences. Rationality is the ability of human beings to reason. From a rationalist point of view, environmental education should be rational education. We talked about the "existence of the environment" and "the nature of the environment" in Chap. 1, and in Chaps. 2–5, we used concept theory to talk about the "concept system" of environmental psychology. The concept system is abstract, which is not easy to understand, and is not of interest to environmental scientists. From the point of Immanuel Kant's (1724 ~ 1804) *Critique of Practical Reason*, they all want to derive knowledge through "independence from experience." Even in pure logic, one obtains a rational essence that is independent of time.

Of course, environmental education beyond the environment is a kind of rational thinking, and the effect achieved is a "quantitative, emotionless" education. However, education is not "teaching the truth"; true "environmental truth" or education that is transmitted only through one-

way transmission of teachers and students can achieve a real state of learning that fully understands the truth. From the empiricism of David Hume (1711 ~ 1776), environmental education is closely related to empirical theory. Empiricism hopes to establish theories from evidence through modern scientific methods, not to obtain answers through purely logical reasoning, nor to obtain answers from Kant's "independent of experience." We should explore what Hume's *An Enquiry Concerning Human Understanding* talks about, using rationality to pursue intellectual "relation of ideas." This kind of practice is deductive. In addition, the "matters of fact" depend on empirical evidence. This is achieved through observation, induction, and understanding of nature. We don't know if we will learn the uniformity of nature of the universe in our lifetime. This is of course the goal of scientists, but not the goal of educators. Because in addition to environmental education, we must learn the logical concepts and mathematics of abstract rationality, and need to understand the real world with a perceptual understanding as much as possible.

Therefore, the particularity of environmental education lies in the unity after contradiction. We understand that we have a continuous, rational, and chaotic personal attitude to the "environment, economy, and society." This self-struggling self-struggle is just the beginning of self-growth. When economic development and environmental protection are fighting, when human interests invade species, and when human left-brain rational thinking and right-brain emotional thinking are in conflict, we must fight against our own emotions, not against others. Fighting with yourself is seeking self-growth; fighting with others, social struggles, and national struggles will only produce chaos that can never be unified.

As the saying goes, "There is nothing in the world, and mediocre people disturb themselves." This is the truth. The Hindu Vedanta philosopher Sankara (686 ~ 718) believes that his own subjective thinking, that is, imposing "I" on the truth, forms a hallucination of the human world, and at the same time produces pain.

Hume once said that human beings usually assume that the "I" is the same as the "I" five years ago. However, people's attitudes change. "I" has been circulating; "I" is not a fixed form. In the process of introspection, he suddenly realized that the Song Dynasty poet Xin Qiji (辛弃疾) (1140 ~ 1207) said in the *Sapphire Case*: "He looked back, but the man was in the dark." If you seek him out, then you are pursuing your life's self-worth. However, looking back suddenly, the ego was not asking him, but was near. Hume believes that human beings have always been in the flow and suddenly felt the ego, and that ego is a collection of many different feelings accumulated. "Looking back, I feel like I'm changing and extending at a fast flow speed." In other words, attitudes are always changing, and the process of changing long-term attitudes changes through thinking, and at the same time, feelings also change. With the habits that have been cultivated for a long time, the way of thinking has also changed, and new ideas have emerged. When we understand that everything is transmuted, everything is stretched. There is no need to adhere to rigid environmental attitudes, but to keep pace with the times, producing "spirit and flesh," "rational/perceptual," "deduction/induction," "ideal/reality," "logical/empirical," "peace/emotion"—adjustments and conversions. There is no absolute, no uniformity, only the colorful and brilliant, only the brilliant and splendid, and only the Russian literary critic theorist Mikhail Bakhtin (1895 ~ 1975) "heteroglossia," which can completely present the diversity of the environmental role dialogue (Bakhtin 1981, 1994; Guez 2010).

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#### 4.5 Cognitive, Affective, and Psychomotor Skills

In the first three sections, we talked about the motivation of environmental education, environmental awareness and sensitivity, and environmental values and attitudes. All the above are implicit environmental driving forces. Explicit learning has become the mainstream of environmental education. Environmental education consists of consciously solving problems and

actively working to learn skills and produce a clear learning process. In the implicit stage of education, Benjamin Bloom (1913 ~ 1999) described the education of the “Cognitive Domain” and “Affective Domain,” David R. Krathwohl (1921 ~ 2016) and Bloom’s description of the “sphere of affection” in 1964 was revised in 2001 by Krathwohl. From the three main areas of learning by Bloom and Krathwohl for curriculum construction, there are related classifications from cognitive thinking to emotional feelings to technical (physical/ kinesthetic) activities. According to Bloom et al. (1956) book *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain*, the cognitive domain is divided into six levels (Bloom et al. 1956). By 1964, the area of affection, *Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook II: Affective Domain*, began to be classified (Krathwohl et al. 1964). But the field of skills was not fully described until the 1970s. The following describes the content of cognition, affection, and skills.

## 4.5.1 Cognitive Domain

### 4.5.1.1 Knowledge

It includes memory and knowledge, and can recall important nouns, facts, methods, standards, principles, and principles.

### 4.5.1.2 Comprehension

The meaning of important concepts can be grasped and can be translated and explained.

### 4.5.1.3 Application

Can apply the learned abstract knowledge, including knowledge concepts, methods, steps, principles, and general principles to practical application in special or specific situations. For example, after learning about resource recovery, you can know how to classify resources.

### 4.5.1.4 Analysis

Information that can be used to communicate. It contains ingredients, elements, relationships, and

organizational principles, and is analyzed and explained so that others can better understand the meaning and can further explain the organizational principles of these messages and the effects of communication.

### 4.5.1.5 Synthesis

Refers to the ability to integrate the piecemeal knowledge learned to form a self-complete knowledge system, or to show the relationship among them.

### 4.5.1.6 Evaluation

After learning, you can give a value judgment on the knowledge or methods learned based on your personal point of view.

## 4.5.2 Affective Domain

### 4.5.2.1 Receiving

The attitude of voluntarily accepting and paying attention to the learning activities they engage in while studying or after studying. Acceptance includes the existence of a conscious situation, a willingness to accept it, and conscious attention.

### 4.5.2.2 Responding

Actively participate in learning activities and get satisfied from participating activities or work. For example, in resource recovery, you can work silently. These reactions include voluntary and contented responses.

### 4.5.2.3 Valuing

It expresses positive affirmation in attitudes and beliefs about the content learned in environmental education. These contents include value acceptance, value affirmation, and value practice.

### 4.5.2.4 Organizing

After conceptualizing the content of learning, it is incorporated into the personality traits of individuals and becomes individual values. Form value conceptualization and constitute personal value system.

#### 4.5.2.5 Characterizing by value Set

Synthesizing the connotation of learning by individuals, after receiving, reacting, evaluating, organizing and other internalization processes, the knowledge or ideas obtained from a personal character. This is the environment. The ultimate practice of education character formation attitude.

#### 4.5.3 Psychomotor Domain

After the connotations of cognition and affection were discussed, discussions in the field of skills only began in the 1970s, including discussions on scoping (Dave 1970; Simpson 1972). Anita Harrow proposed the connotation of the Psychomotor Domain in 1972, as follows:

##### 4.5.3.1 Reflex Movements

Reflex motion involves spine motion and muscle contraction.

##### 4.5.3.2 Basic Fundamental Movement

Basic movements include walking, running, jumping, pushing, pulling, and manipulating related skills, actions, or behaviors. The simple basic actions of human beings are combined parts that form complex actions.

##### 4.5.3.3 Perceptual

Perceived ability involves the functions of the body, including related skills such as vision, hearing, touch, or muscle coordination. These skills draw information from the environment and react.

##### 4.5.3.4 Physical Activities

Physical action is related to endurance, flexibility, agility, strength, and reaction time.

##### 4.5.3.5 Skilled Movements

Skills and movements learned in games, sports, dance, performance, or art.

##### 4.5.3.6 Non Discursive Communication

Creative gesture expression through gestures, gestures, facial expressions. These actions are to

understand how the brain strengthens memory through learning, through physical movements, and helps to assist positive learning with embodied learning.

#### 4.5.4 Modify the Cognitive Domain

In 2001, Bloom's students, Lorin W. Anderson (1945~) and David R. Krathwohl (1921 ~ 2016), revised the Cognitive Domain. In the original version, the list of functions from simple to the most complex was ordered by knowledge, understanding, application, analysis, synthesis, and evaluation. In the 2001 version, steps were changed to verbs and ranked according to recall, understanding, application, analysis, evaluation, creation (Anderson et al. 2001). Knowledge is related to learning and retention, and the remaining five are related to learning transfer.

##### 4.5.4.1 Remember

Extract relevant knowledge from long-term memory.

##### 4.5.4.2 Understand

Create meaning from learning messages. Build new knowledge and connect with old experience.

##### 4.5.4.3 Apply

After using procedures and steps, perform tasks or solve problems, and closely integrate with program knowledge.

##### 4.5.4.4 Analysis (Analyze)

Involves the decomposition of materials into local materials, pointing out the correlation between local and overall structure.

##### 4.5.4.5 Evaluation

Evaluate according to criteria and standards.

##### 4.5.4.6 Create

Combines various elements to form a complete creative idea, cost, or plan.

From the modified Cognitive Domain of Anderson and Krathwohl, different learning

models in the learning pyramid were mapped (Lalley and Miller 2007). The learning pyramid emphasizes positive forms and is more effective for long-term learning. If we say that humans remember 10% of what they read, about 20% of what they watch and hear, up to 90% of human beings teach others to teach them to protect the environment in order to understand knowledge (Fig. 4.10). Of course, some people are better at learning than others. Although in most cases the construction of the learning pyramid makes sense, it still faces criticism.

### 4.5.5 Correction of Skill Areas

The behavioral goals in the field of corrective skills proposed by Elizabeth Simpson in 1972 (Simpson 1972), in addition to motor skills, also include procedures and advanced actions before actions are generated, which may be more Educational skills needed for education:

#### 4.5.5.1 Perception

The individual uses the senses to obtain clues for the required motor skills. Can be used to stimulate discrimination, make clue choices, and learn movement conversions.

#### 4.5.5.2 Set

Before the study of motor skills, psychological preparation has been completed. This stage is preparation for action that belongs to

psychological tendency, movement tendency, and emotional tendency.

#### 4.5.5.3 Guided Response

Acting under the guidance of the demonstrator to respond. This stage is followed by imitation and trial and error.

#### 4.5.5.4 Mechanics

This stage refers to the attainment of a considerable degree of skill learning and the coordination of hand and eye movements in order to achieve a habitual degree.

#### 4.5.5.5 Complex Overt Response

In complex reactions, learning a variety of motor skills can already reach the point of learning familiarity. At this stage, learn about motion positioning and automatic work.

#### 4.5.5.6 Adaptation

After learning skills have reached a level of proficiency, you can change the skills at any time to meet the needs of the situation to solve the problem.

#### 4.5.5.7 Origination

From the knowledge of innovation performance, further use of skills to surpass personal experience and achieve the effect of innovative design.

Whether it is the different skill areas proposed by Anita Harrow or Elizabeth Simpson in 1972, they want learners to reach the level of mastery learning. That is, through learning, to become proficient, and to enter the “creation” that Anderson and Simpson jointly praise. The learning context varies according to the learner's age, type of environmental education, learning method, and learning process. Although scholars have criticized the learning pyramid, the learning pyramid still exists in academia, and there is currently no more appropriate theory to replace it. Therefore, in the process of environmental literacy learning, we should recognize that environmental education and learning is a continuous process, and it does not exclude the use of more direct methods for further learning.

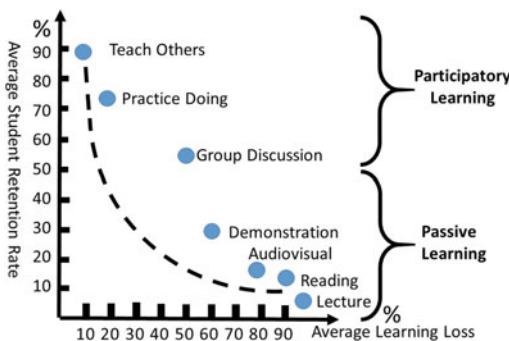


Fig. 4.10 Residual rates of environmental education methods (Illustrated by Wei-Ta Fang)

## 4.6 Environmental Action Experience and Pro-Environmental Behavior

In Sect. 4.5, we discussed about psychomotor skills. This section discusses environmental mobilization experience and pro-environmental behavior in environmental literacy. It explores the differences between action and behavior, and explains why humans take pro-environmental behavior.

### 4.6.1 Actions and Behaviors

Generally speaking, there is no obvious difference between behavior and action. In fact, the difference between behavior and action is an animal event that is distinguished by modern behavior. In the past, humans interpreted all behaviors, even physical objects, as intentional.

#### 4.6.1.1 Action

Social action is the process that considers individual actions and reactions. Tom Campbell (1981:178) explained that action is an intentional activity that requires awareness or consciousness of the actor. But Alfred Schütz explained that individual actions are different. Therefore, action is a flow of movements and a process.

The action described by Max Weber (1864–1920) is different from what Schutz said. He explained the difference between “action” and “social action.” He believes that when actors consider the actions of others and are therefore guided by their actions, this “action” is a “social” activity. Therefore, Weber found that action is an interesting and important concept in sociology. He explained “the meaning of the word action, which is a process of motives and feelings experienced by human beings. It is also an activity involving personal awareness. This activity has its purpose and is Activities that act in a certain way.

#### 4.6.1.2 Behavior

Weber believes that “behavior” is a purely mechanical body movement. The behavior has no intention and has no special meaning to the individual. This is a distinction between behavior and action that automatically responds to specific impulses. In the last century, “behavior” was considered not the exclusive name of human beings (Ingold 1990; Kelso et al. 2006; Taylor 2021). Behavior is the system or living organism's response to various environments. According to Tom Campbell, behavior is just a kind of “reflection” and a response to what happened, so Campbell believes that objects need behavior to produce behavior (Campbell 1981:173).

### 4.6.2 Research on Actions and Behaviors

We sort out the differences between Weber, Campbell, and Schutz on action and behavior:

“Action” is a conscious activity. Action has a subjective meaning or goal for the environment and human beings involved.

If we say that a boy recycles plastic bottles correctly before a recycling bin, this is then an action.

If we say, a boy is holding a can of a drink, it is then a behavior.

When behaviors are the result of an unconscious response, we believe that these behaviors are meaningless and uncountable. Here, we refer to “behavior” as an uninterpreted or minimally interpreted description of an event.

Review related research on environmental protection, and rarely discuss the difference between action and behavior. Behavior defines how individuals act; act is anything an individual does; and the psychological idea of how they do these things is related to motivation. In contrast to socially normative human behavior, “action” is an event that is completed in order to achieve a goal.



### 4.6.3 Pro-environmental Behavior

When sociologists make a semantic distinction between behavior and action, the word usage of behavior plus “environmental behavior” becomes an adverb and even forms “Pro-environmental behavior”. These are changes of unconscious behaviors in response to the needs of the times, and become conscious environmental behaviors.

After the 1970s, scholars analyzed the causes of environmental problems from different perspectives, and tried to verify human factors that may affect environmental problems. Although care may be an inducer of environmental behavior, this relationship is not linear. When its feasibility, importance, and necessity are fairly certain, humans will generate actions. Therefore, the development of a positive environmental attitude is a precursor to effective environmental action. From environmental attitudes to environmental actions, this is defined as a psychological disposition.

Arbuthnot et al. proposed pro-environmental behavior (Arbuthnot et al. 1976, 1977). They tried to use the “foot-in-the-door” technique to induce the pro-environmental behavior of recycling. Stern later proposed pro-environmental behavior again (Stern 1978). He used psychological experiments to learn about increasing recycling centers and reducing the use of household heating fuels to promote environmentally friendly pro-environmental behavior. Later, Schoenfeld et al. proposed the concept of pro-environmental trends (Schoenfeld et al. 1979). However, pro-environmental behavior has only gradually gained importance since the 1980s (Dunlap et al. 1983). According to the definition of pro-environmental behavior, “People are intuitively looked for an action with minimal negative impact on the natural and man-made environment” (Kollmuss and Agyeman 2002). In the definition of pro-environmental behavior, it is found that the definitions of the two concepts of “behavior” and “action” are no longer distinct, but can be used interchangeably. But “behavior” is closely related to individual

actions in environmental improvement. In other words, “environmental behavior” is “direct environmental action” (Jensen 2002).

The Belgrade Charter states that the goal of environmental action is to improve all ecological relationships, including the relationship between human with nature, and the relationship between man and man. Therefore, in light of national culture and environmental differences, basic concepts such as quality of life and human happiness need to be defined. We need to identify actions that will improve human potential and develop social and individual well-being in harmony with the natural and human environment.

According to the research of scholars Hungerford and Peyton (1976, 1977), Hungerford et al. (1980, 1983, 1985, 1990); Hungerford and Volk (1990), it is believed that the modes of environmental actions can be roughly summarized into five categories. They are (1) eco-management, (2) consumer/economic action, (3) persuasion, (4) political action, (5) legal action, or/and any combinations of these five (Table 4.3) (Hungerford and Peyton 1977; Hungerford et al. 1999; Hassan 1992). Their summaries are as follow:

#### 4.6.3.1 Ecological Management (Eco-Management)

Ecological management (eco-management) are the actions taken by individuals or groups to maintain or promote existing ecosystems. Usually the work that the environment can do in person from garbage collection to forest conservation is all ecological management. The purpose is to maintain good quality

#### 4.6.3.2 Consumer or Economic Action

Consumer or economic action refers to the economic threats made by individuals or groups to changes in certain business or industrial behavior. This is the action taken by consumerism.

#### 4.6.3.3 Persuasion

Persuasion refers to interpersonal communication actions for environmental issues.

**Table 4.3** Mode of Environmental Actions

Action	Description
Ecological management (eco-management)	Any physical action taken with respect to the environment. It is the actual actions taken by individuals or groups to maintain or promote existing ecosystems. Usually, the work that the environment can do in person from garbage collection to forest conservation is all ecological management. The purpose is to maintain good quality of the environment or the disadvantages of improving the environment
Consumer or economic action	Consumer or economic action refers to economic threats made by individuals or groups to change in certain business or industrial behavior. This is the action taken by consumerism. Consumer action is effective when a group of people get together to take action
Persuasion	Persuasion refers to interpersonal communication actions for environmental issues. Persuasion is used when a person or a group of people try to convince others that a certain action is correct
Political action	This mode refers of any action that can bring pressure on political or governmental agencies and/or individuals to take positive environmental action. It should change the government's decision-making through the strategic actions of individuals or groups. For example, referendums, civic processions, lobbying governments and public opinion organizations, and writing to public opinion representatives in jurisdictions such as legislators and city councilor
Legal actions	Usually, this action is appropriate to adults. It includes complaints, cautions, court injunctions, complaints, cautions, court injunctions, and so on. This is done through the jurisdiction of court procedures and processes

Sources Hungerford and Peyton 1977; Hassan 1992; Hungerford et al. 1999; Hungerford and Volk 2003

#### 4.6.3.4 Political Action

Political action should change the government's decision-making through the strategic actions of individuals or groups. For example, referendums, civic processions, lobbying governments and public opinion organizations, and writing to public opinion representatives in jurisdictions such as legislators and city councilors.

#### 4.6.3.5 Legal Actions

Legal actions include complaints, cautions, court injunctions, and so on. This is done through the jurisdiction of court procedures and processes.

Pan et al. (2018) believed that the environmental actions of college students in Taiwan are not active; they often implement ecological management and consumerist actions, and rarely do persuasion and citizen actions. In addition, the level of environmental literacy is moderate, and in terms of affection, knowledge, and skills, the affective change group scores higher. This college student study shows that environmental

hopes, action intentions, and civic engagement skills are important predictors of environmental action.

#### 4.6.4 Responsible Environmental Behavior

Responsible environmental behavior has always been an important goal of environmental education. When citizens have the knowledge, attitudes, and skills on environmental issues, they will actively participate in approaches to solve current and future environmental problems (Hungerford and Peyton 1977).

At the broader social level, environmental sociologists have studied the relationship between environmental action and political action (Dunlap 1975), norms and values (Heberlein 1972; Heberlein and Shelby 1977), and other demographic factors. Examples include age, race, and socioeconomic status (Van Liere and

Dunlap 1980). Hudspeth (1983) analyzes environmental planning and decision-making participation, and argues that citizen participation addresses environmental issues. Early research has shown that among young, well-educated people, environmental issues are more important. But the dynamic process of attitude development at the individual level cannot be presented.

The reason is that in environmental education, it is necessary to cultivate citizens who are responsible for the environment. When citizens have the knowledge, attitude, and skills, they can participate in the solution of various problems, and then develop the premise of protecting the environment and developing Sense of responsibility to perform responsible environmental behavior.

Lipsey (1977) summarized ecologically responsible behavior and became the outpost of responsible behavior research. Borden and Schettino (1979) summarize the factors of responsible environmental behavior based on the basis of social psychology. They construct according to affective, cognitive, and behavioral attitudes to solve environmental problems.

Promoting responsible environmental behavior is a form of civic participation (Hines et al. 1986/1987). Civic awareness means that it is necessary to cultivate citizens with environmental behaviors, that is, to educate citizens with environmental literacy through environmental education. In order to achieve this goal, a curriculum structure needs to be established to plan and cultivate students with responsible environmental behavior. Hungerford and others first proposed an environmental literacy model (Hungerford and Tomera 1985).

Therefore, how to convert environmental literacy into human's daily environmental behavior is based on the environmental behavior model suggested by Jody M. Hines (Hines et al. 1986/1987), as shown in Fig. 4.11. Hines made use of the meta-analysis method. The Model of Responsible Environmental Behavior proposed in 1986/1987 has been widely used in environmental education.

Hines et al. (1986/1987) analyzed 128 articles published in journals and books on

environmental behavior related research or unpublished dissertations since 1971, and proposed a responsible environmental behavior model. The main factor that produces environmental behavior is that the individual has an intention to take action, and this intention is affected by the individual's personality, skills, knowledge of action strategies, and knowledge of problems. This means that before people have the intention to act, they must first recognize the problem and strengthen their attitude, control, and sense of responsibility.

#### 4.6.4.1 Attitude

Attitude is often defined as the persistent positive or negative feelings that humans have about other objects or problems, and thus, attitudes affect responsible environmental behavior (Hines et al. 1986/1987). Attitude has a positive impact on environmental intentions.

#### 4.6.4.2 The Concept of Control

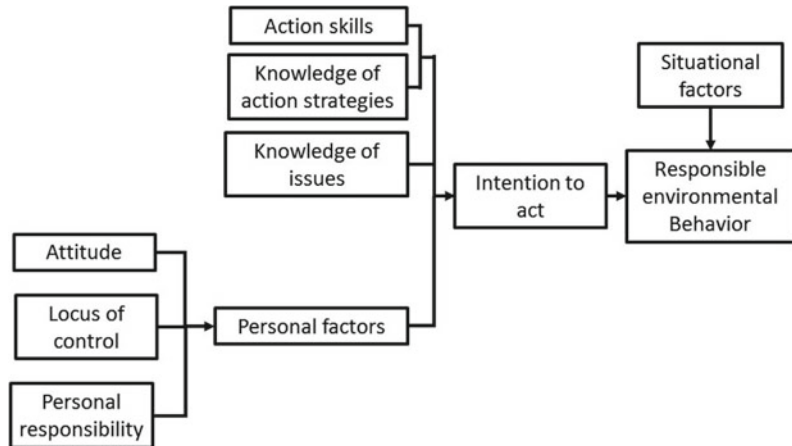
The concept of control is to the mode of operation of one's beliefs. When a person's personality traits "internal control tendency" tells the self to strengthen a certain behavior, it is more likely to produce that behavior; and this behavior will continue to strengthen the internal locus of control. On the other hand, if a person has an "outside control tendency" and does not believe that his actions can affect it, then the person may not do it. Many studies in the past have shown a link between control concepts and environmental behaviors (Hines et al. 1986/1987); control concepts are also factors that influence environmental behaviors; that is, control concepts have a positive effect on environmental action intentions to influence.

#### 4.6.4.3 Personal Responsibility

Personal responsibility is also a factor that drives environmental action. Personal responsibility can have a positive effect on action intentions.

Since the 1980s, many paths and frameworks for environmental behavior have been proposed, involving responsible environmental behavior. In addition, there are included theories of planned behavior (Ajzen 1985, 1991), the "value-belief-

**Fig. 4.11** Responsible environmental behavior patterns (modified after Hines et al. 1986/1987; Illustrated by Wei-Ta Fang)



normative” theoretical model (Stern et al. 1999; Stern 2000), and the entry-level variables (entry-level variables), ownership variables, and models of empowerment variables (Hungerford and Volk 1990).

Among them, Chao (2012) analyzed structural models of Responsible Environmental Behavior and the Theory of Planned Behavior (Hines et al. 1986/1987; Ajzen 1985, 1991). Finally, it was found that the predictiveness of the Responsible Environmental Behavior model in the field of environmental education is more significant than the planned behavior theory model; and Chao's research also pointed out that the personality factor has the highest deduction and happens to represent a person's personality traits can have a significant impact on their responsible environmental behavior. We discuss personality traits in Chap. 5.

## 4.7 Environmental Aesthetics

In Sects. 4.3 through 4.6, we discussed many abstract concepts of environmental literacy, such as environmental awareness and sensitivity, environmental values and attitudes, environmental mobilization experience, pro-environmental behavior, and responsible environmental behavior. At the end of this chapter, we discuss environmental aesthetics.

Environmental aesthetics is an emerging discipline. From the perspective of artistic philosophy of classical aesthetics, environmental aesthetics originates from a reflection that places too much emphasis on artistic media and expression. Environmental aesthetics is the pursuit of appreciation of the value of the natural environment. However, this subjective aesthetic experience includes both the natural environment and the social environment affected by humans (see Fig. 4.12). At the same time, environmental aesthetics began to consider examining the environment, emphasizing the aesthetics of daily life. These aesthetic connotations involve not only objects, but also daily activities. Therefore, in the early twenty-first century, environmental aesthetics accepted the study of almost all environmental protection matters except art, which included aesthetic significance. Therefore, the category of environmental aesthetics, from natural environment to man-made environment, is an aesthetic connotation that can be explored.

Environmental aesthetics is related to the coordination of nature, whether it is hue, color system, balance, and comfortable wind, water, light, and rhyme. If we say that environmental aesthetics is pursuing the harmonious characteristics of human heart, then this is another reflection on modern art. Because of the art of “modernism” or “modernism,” since the twentieth century, from the avant-garde and avant-

**Fig. 4.12** This subjective aesthetic experience includes both the natural environment and the social environment affected by humans (Heping Island, the doorway to Keelung Harbor, Keelung, Taiwan. It was one of the settlement of Ketagalan Tribe at an early time)(*Island of Love*, Watercolor on Arches, 1986, 42 cm × 58 cm) (Illustrated and painted by Wei-Ta Fang)



garde colors, there have been many violent artistic thoughts and schools that break the tradition and resist nature. The above-mentioned modern art is formed by the combination of various types of visual styles, based on scientific and rational foundations. The main schools include Fauvism, Prophet, Cubism, Surrealism, and Expressionism, Abstract Expressionism, Constructivism, Futurism, Dadaism, Style, Bauhaus, Surrealism, Abstractism, Popular Art (Pop Art), Optical Art (Op Art), Conceptual Art, etc. After the 1960s, landscape art reexamined the relationship between human life and artistic landscape, and restored the art of man and nature.

However, modern art is stimulated by media that are represented by multimedia combinations such as sound, light, and video. Various artists are established through mutual subjective relationships with the audience. From the appreciation of environmental art, to return to the embrace of nature, this is a reflection on the intervention of human life through natural art, and also a response to the control of human society by modern artificial intelligence and criticism of the reality of science and technology on the depression of human nature. The following is a brief introduction to the artistic genre that

provides reflection on the real environment under the turbulent environment of the twentieth century.

#### 4.7.1 Dadaism

Dadaism was influenced by anarchism in 1916, and through anti-war leaders, it protested capitalist values with an anti-aesthetic work. The characteristics of Dadaism include the pursuit of sober irrationality, while refusing to agree on artistic standards. Therefore, this is an opposition to *fait accompli*, but also an opposing force to war. The Dada movement later influenced Pop Art in 1955. But the irony is that Pop Art is pursuing fashion and accepting the facts of convention.

#### 4.7.2 New Expressionism

Neo-Expressionism was a genre that emerged in Germany in the late 1970s. Neo-Expressionism reflects on Expressionism of 1911 and does not emphasize simple “repetition of nature,” nor is it mechanical imitation “unnatural.” Neo-

**Fig. 4.13** Action Act:  
*Exploring Womb* (Acrylic on  
card, 1987, 104 cm  
× 76 cm)(Illustrated and  
painted by Wei-Ta Fang)



Expressionism is a reaction to Pop Art, emphasizing self-expression, showing the returning tendency to Expressionism in terms of pictures, brushwork, and mood. Neo-Expressionism accepts the philosophy of existentialism, learns the artistic tradition of abstract expressionism in practice, pays attention to the emotional bursts and improvisations of the painting process, pursues primitivism, and strives for the true colors. Therefore, they are in the works, the ugly phenomenon of society, or self-mockery.

### 4.7.3 Action Art

Action art refers to modern art that originated in Europe in the 1950s. It refers to an art composed of individual or group behavior at a specific time and place. Performance art is different from action art. It is an artistic process in which the artists personally plan and promote and form a group participation. Performance art must include the shaping of the space between the performance artist's body and the communication with the audience at a specific time and place. This art form is different from the art forms composed of specific things, such as painting and

sculpture, but a unified expression of environment, body and space, see Fig. 4.13.

### 4.7.4 Landscape Art

Landscape art, also known as earth art, is an evolution from environmental art, which is a kind of environmental art. Landscape art originated in the United States in 1960. After 1970, many painters and sculptors showed landscape works outdoors. Although the art of landscape is a kind of display that combines with nature, it will retouch nature and rethink the relationship between human and nature. The audience visits the landscape art in nature, and gets an artistic perception of being integrated with nature.

### 4.7.5 Installation Art

Installation art used to be called “environmental art,” which means that the artist displays the consumed objects in human daily life in a specific space-time environment. The earliest environmental art was exhibited in France by Marcel Duchamp (1887 ~ 1968). He showed

the work of Fontaine in the shape of a urinal. In 1917, Duchamp purchased a ceramic urinal at a chain store on Fifth Avenue in New York, turned it 90 degrees, and left the signature “R. Mutt 1917.” The first environmental artwork was born. Environmental art involves artists choosing, using, transforming, and combining materials, and then re-selecting spaces, using media’s visual and auditory sensory experiences to produce artistic effects. Installation art welcomes the audience to get involved, so as to gain a new experience for the audience.

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#### 4.8 Summary

Although the process of globalization, pollution and environmental problems have become increasingly more pervasive, and environmental issues are getting more attention because they are now substantially impacting our way of life and the cost of doing business. Hungerford (1975:21) recognized that environmental education should not be based on “overgeneralizations, questionable logic, myths, pedagogical excesses, simple untruths, and at least a modicum of hypocrisy” and defined environmental education as the process of educating citizens about ecologically-related issues and the impact of these issues on our social fabric. This behavior focuses on the development of responsible /acceptable responses of the public regarding such issues. This definition is based on the environmental and social issues that have been created by humans and predicated on the notion that society itself determines the people’s behavior or attitudes that are related to existing and emerging environmental issues and that there is an inherent expectation that the people who created the problems have the potential or should be held responsible to resolve the issues. We, therefore, all know that the basic spirit of environmental education lies in the “education process,” “societal values,” and our collective “knowledge, attitude, and skills,” and ability to solve “problems.” In short, the desired effect of environmental education is whether we can improve the environmental literacy of the people and

formulate and implement corrective actions to resolve environmental problems without creating additional problems. For example, phytoremediation technologies that are based on plants and microbes can be used to remediate (clean) a wide variety of soil and water contaminants with H<sub>2</sub>O and CO<sub>2</sub> typically being the end products of these novel technologies (Paz-Ferreiro et al. 2014). Despite the simplicity of such technologies, educating the public on the complex biological, chemical, and physical processes that occur and the risk of creating compounds that are more harmful to the environment and human health compared to the original pollutants is a challenge. In this Chapter we explore the processes of environmental education, including learning motivation, environmental awareness and sensitivity, environmental values, attitudes, experience, and pro-environmental behaviors, with the goal of providing our readers with an appreciation for nature, the role nature plays in our way of life, and the knowledge and skills that citizens need to start taking action to correct some of the environmental issues that we are facing through environmental aesthetics (Saito 2010) and sound science. However, the development of environmental literacy for an entire population cannot be achieved overnight. Such a process requires time and a group of individuals that consciously care for the environment and work individually and collaboratively, typically for generations. Through educational channels, environmentally consciousness people, accumulate knowledge that develops community and cultural pro-environmental behaviors, that ultimately form a collective social force that is powerful and advocates for environmental rights.

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