



Design Research Based on Environmental Protection Concept and Children's Environmental Education in Interactive Installation Art

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Abstract. In recent years, global environmental problems have become increasingly serious, and the root causes of many environmental problems are closely related to the impact of human activities. From childhood, it is urgent to widely disseminate the concept of environmental protection and cultivate the awareness of environmental protection among the whole people. The integration of interdisciplinary knowledge and the development of science and technology make the application of interactive devices no longer limited to art, but gradually applied in various fields, and its advantages such as high interaction and strong immersion can just make up for the shortcomings of traditional education methods. This paper hopes to embody the concept of environmental protection, further combine interactive installation art with environmental education, so as to achieve the role of edutainment and publicity of the concept of protecting the earth.

Keywords: Environmental protection · children's environmental education · interactive installation art · global environmental issues

1 Global Environmental Issues and Children's Environmental Education Background

The development of mankind is extremely dependent on the earth, which is the seat of human survival and activities, providing human beings with various natural resources for production and consumption. In the course of the development of human civilization, people's various behaviors have inevitably had an impact on the global environment, and the seriousness of global environmental problems is deepening day by day, which cannot be underestimated. In 1977, in Tbilisi of the former Soviet Union, UNESCO and the United Nations Environment Programme convened an intergovernmental conference on environmental education, in which the objectives, contents and methods of environmental education were discussed, and environmental issues attracted the attention of the field of education. The goal of environmental education is clearly defined as the five aspects of awareness, knowledge, skills, attitude and participation, and the characteristics of the previous concept of environmental education focusing only on knowledge have been

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directly broken, and the content and methods of environmental education have been expanded. Environmental education has been elevated to a more comprehensive space, and the basic framework for the development of global environmental education has been established [1].

The implementation of environmental protection education is the cornerstone of enhancing the environmental awareness of the whole people, while the traditional written education form has problems such as rigid form and empty content, and children do not understand the basic environmental protection knowledge and the harm caused by behavior to the environment; Lack of awareness of environmental protection, insufficient awareness of the importance of environmental protection to human beings, knowledge and action cannot be integrated [2]. Therefore, it is urgent to carry out environmental education for children. The scientific and cultural qualities necessary for modern citizens have put forward the requirements for cultivating environmental protection awareness and mastering basic environmental knowledge and related skills. Comprehensively carrying out environmental protection education and allowing children to practice environmental protection in the future is very important in promoting the development of children's education, and how to better carry out environmental education and help children establish environmental protection concepts is a major focus [3].

2 Conveying the Concept of Environmental Protection in Interactive Installations

Interactive installations are a new product of the recent boom, and with the help of digital technology, they are highly interactive, immersive, and ornamental. It uses the computer as the medium of communication, provides a new way of information exchange, and achieves the role of two-way transmission of man and machine in practice. "Interaction" in interactive installation art refers to the establishment of a way of information exchange, transformation and transmission between objects and objects, people and things, and even between people, through the use of different information media, the participating audience is integrated into the work, and there is a deep interaction with it in behavior, senses and even ideas [4]. In expressing the concept of environmental protection, interactive installation art also has its application and development, and some cases are introduced and analyzed below:

Artist Helen's *Ozone Beijing* uses science and technology to reflect the air quality in the Beijing area through the transformation of analytical data. A computer-generated condensed cloud floats above the city picture, with vision and sound continuous time and space, and the color of the cloud constantly changes, reflecting the concentration of various substances in the air. By considering the relationship between environmental pollution and air quality information transmission, it shows the change of urban ecology. The interactive form of the work is mainly based on vision, and the person mainly feels and understands the ideas conveyed by the artist as a visitor.

Dutch multimedia artist Thijs Biersteker's *SHADED SEAS* aims to raise awareness of the problem of plastic in the ocean, using sensor motion capture and fast image tracking technology. The work implicitly conveys that every piece of plastic waste will follow us in the future and become a plastic shadow. The interactive experience of this

work is not only visual, but also further combines human movements. When people wave in front of the installation, the plastic sculpture will follow the movement of the human hand, deepening the understanding of the problem of ocean plastic through the combination of body movement and visual impact [5].

The communication of the concept of environmental protection in interactive installation art is also combined with education, Yuepai Technology uses advanced computer vision technology and projection display technology interactive installation, projecting a large touch screen on the wall, people can click on the year displayed on the screen to watch the national policies and regulations of the year, the knowledge of garbage classification has been publicized and legal popularization. In the process of interaction, people can turn passive into active, actively participate in garbage classification, learn environmental protection knowledge, so as to deepen their understanding of garbage classification knowledge and promote the education of garbage classification knowledge more efficiently. The company has also developed a series of interactive environmental protection games relying on screen display and simple operation, such as Help Reduce Carbon, Garbage Sorting Breakthrough, How Long Can Garbage “Live”, etc., combining environmental issues with interactive installations and game modes to achieve the role of environmental education.

Compared with written education, the integration of interactive installation art can undoubtedly better convey the concept of environmental protection and meet the requirements of environmental education. However, most of the interactive installations that convey the concept of environmental protection weigh the artistry, are more abstract in education, and the educational content is more monotonous, which is not conducive to children’s understanding and learning. Interactive installations that are mainly educational are monolithic and uninteresting. Most of the existing cases have slightly rough images that make it difficult to attract children’s interest. Based on this, the author hopes to combine the advantages and characteristics of existing interactive installations in environmental protection education, improve the interaction methods, picture effects, and game content settings, and design an interactive device with environmental protection education as the core concept for children, so as to attract children to understand environmental issues and help children establish environmental awareness.

3 Healing the Wounds of the Earth Design Application Practice

3.1 Design Description

Healing the Wounds of the Earth is an interactive educational installation designed for school-age children aged 6–8 with the theme of “breathing together, sharing a common destiny, protecting human life and home, and healing the wounds of the earth together”. The work uses Arduino and Processing programming techniques to combine physical operations with animated interactions to create a scarred earth, vividly presenting the serious problems facing the earth today, and calling on people to protect the earth.

When designing the content, the author focused on three prominent global issues: climate and global warming, environment and air pollution, and waste of resources and resources. These three global environmental problems are modeled on the different symptoms of the earth’s illness: fever, cough, and weakness. In the animation part, the

game is mainly guided by hand-drawn animation. In the process of interacting with the installation, children play the role of little doctors, giving the right medicine to the earth and alleviating its suffering. Such an identity substitution can enhance children’s sense of responsibility, and they can be more focused and patiently engaged in the interactive process of “curing diseases”. The physical device part is set up with three trays corresponding to three diseases, the effective pills are planting trees and grass, green travel and resource conservation, and the ineffective pills are folding trees and pulling grass, driving private cars, and wasting at will, which is easy for children to understand. In the overall play process, children can fully understand the current problems facing the earth, and at the same time learn to distinguish between beneficial and harmful behaviors for the earth, planting a seed in their hearts to protect the earth and love the human home.

3.2 Preparation of Props

The physical part of the device uses the capsule shell, counterweight particles, and tray as props to present the scene of seeing a doctor to the earth, and the hardware part selects the HX711 pressure sensor module to realize the function, and judges whether the child is placed correctly by detecting the weight of the pill. The animated section uses a display split screen to present the three symptoms of the earth, adjusting and changing in real time after detecting the child’s behavior. The operation of physical hardware combined with programming software and animation is combined to achieve the promotion of the plot to achieve the effect of interaction between people, installations and animations.

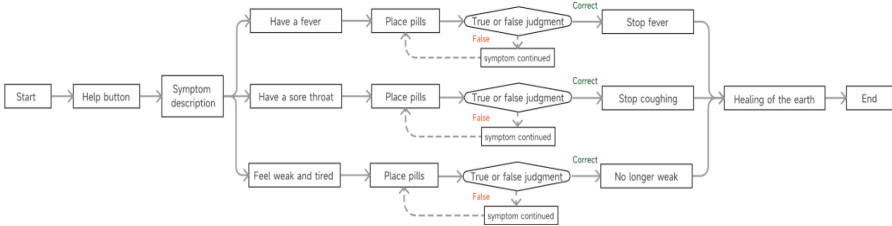


Fig. 1. Flow chart of Healing the Wounds of the Earth



Fig. 2. Device simulation display

3.3 Game Flow

The flow chart is shown in Fig. 1. The display shows a wounded earth, and at the same time calls out: “Little friend, I am so uncomfortable, can you help me?” Press the ‘Help’ button to help me with my physical examination!” After the child presses the “help” button, the earth begins to describe its symptoms: “I feel like my body is going to burn” (climate and global warming); “I have a sore throat and cough all the time” (ambient and air pollution); “And powerless” (waste of resources). Three symptoms are displayed in a split screen.

Then, the earth guided the children to operate: “Children, there are many pills here, can you help me choose one and put the correct 3 pills into their respective trays, let my body better?” Children analyze the problem and try to lay out the pills.

When the child’s pill is detected, judgment and feedback are made, and when the child places the effective pill on the corresponding symptom tray, the earth’s disease will be alleviated. If an invalid pill is placed or is in the wrong position, Earth will further direct the child to modify it. Until all three pills are placed correctly, the earth will become vibrant, and the text will show “The earth is our common home, it breathes and shares our fate, we must take good care of it, and no longer let it suffer and cry alone.” The overall test process is shown in Fig. 2.

3.4 Program Display

In the process of function realization, some codes need to be used repeatedly. Table 1 shows the main codes.

3.5 Program Display

After the design, the author conducted a project test in a primary school in Haidian District, Beijing, and invited 60 school-age children aged 6–8 years to participate in the game (20 participants of each age). After the game, the participants were invited to evaluate the game project in the form of questionnaires and interviews. This paper selected some key data for analysis:

As shown in Fig. 3, on the issue of personal gain, the vast majority of children have gained in the process of playing, more than half of them agree on the three evaluation dimensions, and only 5% of children feel that they have gained nothing. It shows that the interactive device has completed the project objectives and achieved the goal of environmental education for children. As shown in Fig. 4, on the issue of game experience, 76% of children rated it as “interesting” or above, indicating that the design of the project has grasped the characteristics of children and realized the combination of education and pleasure. During the interview, more children were curious to ask how the pill placement was related to the screen animation. The wonder of computer technology has taken root in his heart.

To sum up, through the project test, the feasibility of the project has been confirmed, meeting the design requirements and reaching the preliminary design objectives.

Table 1. Main codes of Arduino.

```

void setup()
{
  Serial.begin(9600);
  delay(3000);
  Weight_Maopi1 = HX711_Read1();
  Weight_Maopi2 = HX711_Read2();
  Weight_Maopi3 = HX711_Read3();
}
· Obtain the weight when empty weighing

void loop()
{
  Weight1 = Get_Weight1();
  Weight2 = Get_Weight2();
  Weight3 = Get_Weight3();
  delay(2000);
· Get the weight of the pill on the sensor

buttonState = digitalRead(pushButton);
  if(buttonState == HIGH)
  {
    Serial.println('A');
    delay(32000);
  }
· Read button status when button is pressed, triggering symptom introduction animations

  if(Weight1 >= 3 && Weight1 <= 7 && Weight2 <= 3 && Weight3 <= 3){
    Serial.println('B');
  }
  if(Weight2 >= 15 && Weight2 <= 19 && Weight1 <= 3 && Weight3 <= 3){
    Serial.println('C');
  }
  if(Weight3 >= 30 && Weight3 <= 36 && Weight1 <= 3 && Weight2 <= 3 ){
    Serial.println('D');
  }
  .....
  if(Weight1 <= 3 && Weight2 <= 3 && Weight3 <= 3 && buttonState == LOW){
    Serial.println('V');
  }
· Weighing function calculates the weight placed on the sensor, reads the button status, and triggers a
symptom introduction animation when it detects that the button is pressed.

```

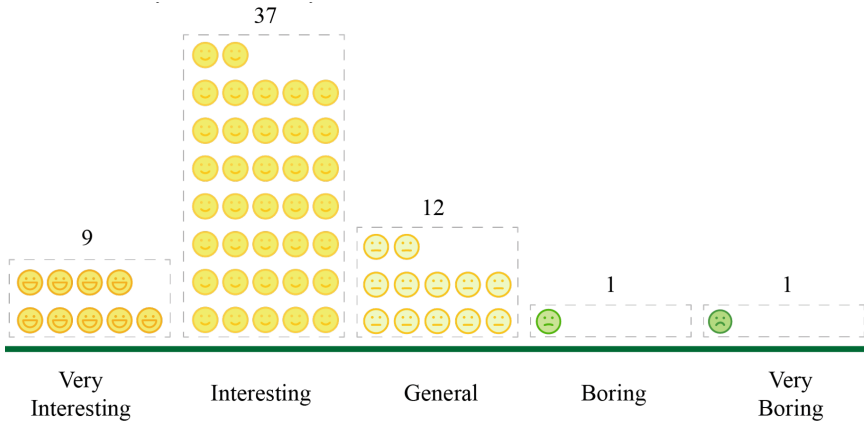


Fig. 3. The data of Game Experience

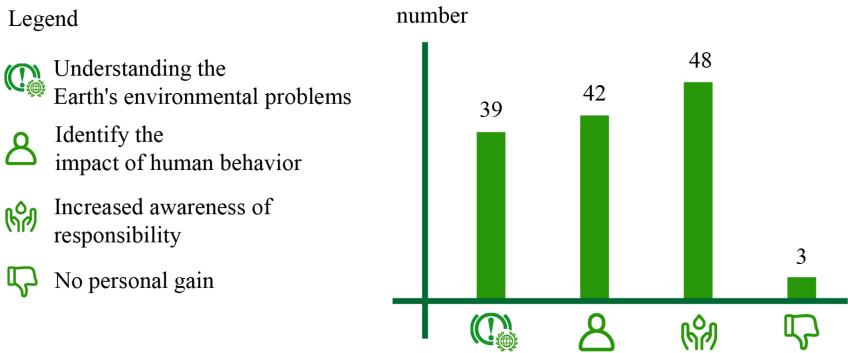


Fig. 4. The data of Personal Gain

4 Summary

By studying the combination of interactive installation art and environmental education, this paper makes Healing the Wounds of the Earth as a design practice and uses Arduino and Processing programming technology to complete the effective presentation, expressing the author’s concern about current environmental issues, and children’s environmental education. With far-reaching influence and important significance, effective environmental education in the best learning period for children can help stimulate children’s feelings of caring for the environment, forming good qualities and behavioral habits of caring for the earth and protecting the environment. Through this research and design practice, the author fully combines interactive installation art with environmental education, overcomes the shortcomings of traditional written education, provides children with opportunities to understand global environmental issues, and achieves the goal of better environmental education, edutainment, and environmental protection concepts.

The vigorous development of interactive installation art has been helped by the new era of science and technology, technology is a necessary condition for installation art

to fully “interact”, with the technical support provided by high technology, interaction is no longer a simple user response, but can have a richer form, more diverse methods, more interesting content, so that the installation and users to achieve a deep level of interactive communication, and interactive installation is more and more widely used as a carrier in various fields.

References

1. Yu Cao. Analysis on the Cultivation of Environmental Awareness by Education for Sustainable Development. *J. Chinese Character Culture*, 177–178 (2020).
2. Xinfu Xie . The practical exploration of infiltrating environmental protection education in primary school science teaching [J]. *Environmental Engineering*, 346 (2022).
3. Ping Mu. How to educate primary school students on environmental protection. C. Yunnan Association for Science and Technology, Chuxiong Prefecture Committee of the Communist Party of China, Chuxiong Prefecture People’s Government. *Proceedings of the Eighth Yunnan Association for Science and Technology Annual Conference* (2018).
4. Zhilu Li. Behavioral and sensory research on interactive installation art. *J. Western Radio and Television*, 70–72 (2021).
5. *Extending Life: International Triennial of New Media Art*. N. China Reading News, (2011).

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