Journal of Multidisciplinary Engineering Science Studies (JMESS)
ISSN: 2458-925X
Vol. 10 Issue 11, November - 2024

Is Science Useful For Protecting The Natural Environment?

-A mechanism for controlling science-

Shuichi Kato
Director of SKLSC Institute of Natural Environment,
Professor Emeritus of TH. Unive.,
Ph.D. in Medical Science (Tokyo Univ.)
Chiba City, Chiba, 264-0015
Slimemold00@gmail.com

Abstract - Government agencies and the educational world around the world tend to underestimate the curiosity of young children that motivates them to science. It has been revealed that young children unconditionally assimilate with nature and have a genius ability to doodle, which is an instinctive act of young children. In addition, there is a tendency in society to confuse science with technology backed by science, and we would like to correct this. In other words, we need to clearly distinguish between science and technology and clarify the essence of science and the purpose of technology. Furthermore, the research system is insufficient due to the lack of a distinction between science and technology, and it should naturally be reviewed. Environmental damage caused by technology has become a problem, and there is an urgent need to introduce an international monitoring system for technology to address this issue.

Keywords–artificial intelligence; nuclear power generation; curiosity; military expenditure; science and technology; nuclear weapons; environmental destruction and environmental protection; environmental conservation costs; environmental pollution; environmental networks; environmental philosophy; research institutes; international surveillance system; symbiosis; war; natural science; early childhood education

I. INTRODUCTION

Let's look at various surveys to see how science is perceived. Is there a clear distinction between science and technology that uses science? When asking what science is, let's start by distinguishing between science and non-science. The definition of science is demonstrability, reproducibility, and objectivity. Demonstrability is when hypotheses are confirmed by experimental verification. Since G. Galilei [1], mathematical expressions have been widely used to unambiguously express predictions, hypotheses, and the results of experimental verification, but this is not necessarily limited to mathematics. This is simply because mathematics can take logical expressions. However, science has made great strides through the use of mathematics. Reproducibility refers to obtaining the same results through experimental verification under the same conditions. Objectivity refers to being recognized as a "fact" through demonstrativeness and reproducibility. Also, chance is not incorporated into science. However, by incorporating hypotheses such as the collective probability distribution of constituent factors and ideal gases [2], science has struggled to deal with chance. A non-scientific subject is called non-science, but even if it is not scientific, it is not something to belittle as unmodern, and many of them are the source of curiosity, which is the basis of science. Also, many people are confused about what they should do from birth to death. It is possible that consciousness of how to live is reflected in science. If the following items are not treated as non-science, it is simply because modern scientific methods are immature and they are not on the scientific table. Our greatest concerns are outside the scope of science. If our family members were to be infected with an incurable disease that cannot be cured by modern medicine, what would we, who believe in science, rely on? This is the significance of philosophy and religion. What philosophy [3] and religion[4] have presented are intuition, sensitivity, consciousness, morale, purpose in life, and in the religious realm, God, mystery, a sense of security, and the afterlife.To define science in other words, in philosophical terms, living science is an instinctive belief in the order of nature [5].

The curiosity that arises in infancy is an instinctive response. However, it is only when one becomes independent as a scientist that one can understand that “meaning-making” in natural cognition is experience.[6] In environmental philosophy, knowing the existence of an environmental network is what “meaning-making” is about through experience.

If the purpose of science is to understand nature, then curiosity is the basis of science. The seeds of science emerge where curiosity takes over. In this sense, science is personal, and therefore inherently socially purposeless. In other words, science begins with curiosity through natural observation, and the understanding of nature begins. The origin of natural science is the mysterious discovery of nature. This is based on personal sensibility and has no intention of contributing to society or practical meaning. Curiosity is a characteristic of early childhood in humans and animals. What is the educational system that fosters curiosity in early childhood? Cultivating curiosity is essential as the foundation of science, but the current

situation in fostering curiosity is not sufficient. The mission of education is to develop curiosity into science. To do this, it is essential to grasp not only curiosity but also the meaning of science. A characteristic of young children is that they refer to things in nature in the second person and treat them as familiar beings. This can also be seen as the beginning of a sense of symbiosis, such as showing respect for mountains, trees, and birds. As adults, they are interested in how familiar things can be useful and bring benefits. If children maintain a fresh feeling toward nature as children and have the ability to process it logically, they can expect to achieve scientific results. They are interested in natural phenomena like babies looking for their mother. Nature is the mother of all life. It is natural to be interested. Being interested in nature is one with nature because being natural is the standard of evaluation, and both animals and humans are interested in nature from infancy.

A survey on whether people are progressing as technology spreads can define the progress of technology. We have a sense of whether we have become rich, but we cannot judge whether we can entrust our foundations to technology. The content of research and education should be examined in detail at both university educational institutions, companies, and government agencies. Furthermore, can we distinguish between science and technology? Surveys and research funds that reflect science are necessary. It is necessary to investigate whether the concept of science has deviated from its original meaning and whether educational and research institutions are misusing technology as science. When science is combined with technology, the purpose of science becomes concrete. Technology are used for nuclear power generation and the development of nuclear weapons, and practicality is sought for national policy and profits. When science is applied as technology, as long as it is used to its full potential, it will lose the original curiosity that nature bestowed upon us. Science does not have a purpose, but when it is combined with technology and becomes technology, it does have a purpose. Technology brings convenience to our lives, produces profits, and brings victory in war. However, the uses of technology are selfish, so there is no choice but to strictly control how it is used. An institution is needed to control the characteristics of science that are easily combined with technology. The problem is that in order for this control institution to control things properly, it must be an institution that is not involved in profits and losses. To that end, we should aim to select people with a deep connection to the natural world, such as those involved in the environment, religion, and poets.

One of the advances in technology is the emergence of intelligent technology that mimics the mechanisms of natural organisms. It is considered to be a computer system that forcibly suppresses human behavior and thinking. Representative examples are genetic programming (GP) [7] and artificial intelligence (AI) [8]. GP utilizes the genetic properties of organisms, using a tree structure to represent genotypes, and its application areas include symbolic regression and the design of neural networks. AI is an artificial construction of brain neurons, a so-called neural network. By increasing the number of experiences, the weighting can be adjusted and optimal solutions can be obtained. It is an application of information processing systems that occur in nature.AI is not suitable for intuition. Shogi players who use their intuition choose the process that leads to a match, but AI chooses the experience or combination that will lead to victory, or the highest probability by adjusting the weighting of the network. Human players can follow the process and logically trace the outcome of the match. This is similar to a mountaineer aiming for a caldera-type mountain summit descending near the apparent summit and aiming for the true summit. When the game becomes difficult, it seems that the correct answer cannot be found by the gradient of AI probability alone. It is difficult to get inspiration from the natural world, as in poetry and science, which use emotions to communicate with nature and have a close relationship with it. In current science, the scientific unknowns include the origin of consciousness, the meaning of self-existence, the existence of individuals after death, what we should do in nature, what we should achieve to feel at ease, the reason for curiosity, and judgment by intuition. None of these seem possible for AI, but there is a possibility for intuition if we understand its origin. Intuition is heterogeneous data, so collecting a large amount of homogeneous data is useless. For AI to receive curiosity from nature and develop it into science, it must be able to make judgments after acquiring the ability to create new algorithms that utilize even small amounts of heterogeneous data through unsupervised deep learning. Intuition is a typical example of an AI's weakness. A shogi player who uses his intuition chooses the process that leads to a match, but an AI chooses the experience or combination that will lead to victory, with the greatest probability, by adjusting the weighting of the network. A human player can follow the process and logically trace the outcome of the game. If the game becomes difficult and a new algorithm is needed without relying on experience, it seems that the correct answer cannot be found by the gradient of the AI's probability alone. This is similar to mountaineering aiming for a caldera-style summit, because the climber descends from the apparent summit to reach the true summit. It is difficult to get inspiration from the natural world, as in the world of poetry and science, which use emotions that have a close relationship with nature as a form of communication with the natural world.

Various research projects are conducted around the world under the pretext of research funding, but research is not for the development of scientific technology, but for the prosperity of countries and companies. In university research, graduate schools are in charge, but dissertations are determined by the number of submissions to well-known academic

journals, and the dean in charge makes the decisions, but many of the deans themselves have no achievements. The reason for this is that the deans are people who have brought economic benefits to the university through drug discovery, etc. In Japan in particular, even if an excellent paper is published in an unfamous academic journal, it is not recognized as a dissertation. This not only shows that there is no ability to review within the university, but also shows that the national government's way of establishing doctoral programs is wrong. This is because doctoral programs are established at universities that do not have the ability.

Next, we need to clarify the actual state of environmental destruction brought about by technology. How is the actual state of global military expenditure related to science changing? The development of weapons is increasing every year, and it is a cause of environmental destruction. To curb this, there is an environmental budget, but the results of a survey on the actual state are awaited. If the environmental budget is higher than the military budget, we can see the future, but if it is lower, there is no future for humanity. As things stand, advances in technology are leading to environmental destruction, causing problems with wildlife diversity and coexistence. The extent of environmental destruction can be understood by conducting awareness surveys and clarifying the actual situation that the progress of technology as an extension of the current situation leads to environmental destruction. Nature is being destroyed by technology that utilizes science. Technology create practical value centered on humans, but the scale of environmental destruction is expanding, including the development of nuclear weapons, disasters at nuclear power plants, and global warming. Technology does not necessarily move toward environmental protection. The elucidation of the substances that science deals with is a part of nature, but nature constitutes an environmental network of the atmosphere, heat, microorganisms, etc., that is, a network that is related to nature. Science can develop general theories by limiting the environment when formulating hypotheses, such as assuming an ideal gas. However, in the field of medical technology, ignoring individual differences in pharmacological action and pharmacokinetics will increase the damage.

From the perspective of environmental protection, we cannot ignore diversity in favor of generality. It is necessary to strictly manage the scope of science's use. The purpose of environmental protection is symbiosis, but as for how to coexist, we need to reject or accept depending on the other party, and discard the egocentric thinking that is unique to humans, and consider acceptance from various perspectives. Natural science is about knowing the natural world well through reconstructible observations and experiments. Environmental protection means knowing the relationships that make up nature, that is, in nature, there is the construction of a magnificent environmental network, and through this we can know the reality of symbiosis in nature. In the natural world, adaptation and evolution continue ceaselessly, so even symbiosis is always changing. The natural world itself changes, and the dynamics of plants and animals change. Is humanity progressing? Science has deepened our understanding of nature, but in terms of symbiosis, animal and plant abuse is on a large scale. As environmental pollution and global warming become more severe, regulations continue to be put in place, but developing countries, whose national power is lower than that of developed countries, do not approve. Technical support and financial assistance from developed countries are necessary, but issues such as religious issues and autonomy are blocking our way. We are given life and consciousness by the natural world, but from the perspective of the natural world, it can be considered evolution to adapt. Genetic information and sharp fangs can be considered adaptations, but this is useful for preserving species. Nature is deepening our endless understanding. As long as this exists, the evolution of natural science will continue. The problem is that we still do not understand the natural mechanism of symbiosis. We do not know how each other's existence can cooperate with each other. It is too late once the disadvantages of technology are understood. This is because technological progress is rapid and the adverse effects are immeasurable. Current environmental protection measures are only taken after the adverse effects have become clear, so in short, they are behind the curve.

The author preached the need for environmental morality [3] and emphasized the importance of environmental awareness [9]. In order to avoid the extinction of humanity [10], we must cooperate with the religious community [4], science, and technology to achieve a society of symbiosis with nature. In this paper, we have examined how technology should be, not just science, to protect a society of symbiosis with nature. In addition, the confusion between science and technology is seen everywhere, which is causing problems. There is a confusion between science that has no purpose and technology that has a clear purpose, and a correction of science is required. It is necessary to clearly distinguish between science and technology and clarify the roles of science and technology. For this reason, the research system is also inadequate and should naturally be reviewed. The purpose of the use of science used in technology should be clarified, and an international monitoring system without conflicts of interest should be established in response to concerns about environmental pollution. War is a representative example of environmental destruction. If both the invading country and the invaded country go to war, the religious groups and citizens who support them will also become parties to environmental destruction. The United Nations can bring about a ceasefire, but if the invading country is a permanent member of the UN Security Council and has veto power, the UN's functions cannot stop the war. The very existence of the United Nations and its veto power is being called

into question. If measures are not taken to prevent environmental destruction, it will cause harm on a global scale.

Ⅱ. SURVEY ABOUT SCIENCE

1. Comparative analysis of awareness of science and technology (here, science and technology refers to technology backed by science) in Japan, the United States, and the United Kingdom International Comparison [11]

1) High interest in scientific discoveries

Based on an internet survey conducted in March 2009 by the Research and Development Group 2 of the National Institute of Science and Technology Policy, Ministry of Education, Culture, Sports, Science and Technology, there is a comparative analysis of awareness of technology in Japan, the United States, and the United Kingdom, targeting people in their 20s to 60s. Regarding "high interest in new scientific discoveries," 20.5% (n=2191) in Japan, 40.6% (n=1500) in the United States, and 35.7% (n=1500) in the United Kingdom were interested. Regarding "use of new technology and inventions," the figures were 23.7% (n=2191), 37.9% (n=1500), and 34.7% (n=1500), respectively. The problem is that there is no survey on awareness of what technology is. This is a survey on awareness of and technology among people over 20 years old, and there is no survey of children who are interested in natural phenomena. This survey also shows that interest in technology is low in Japan. In a 2005 public opinion survey, 25.2%, 80.1%, and 50.0% of respondents in Japan, the United States, and the United Kingdom answered "beneficial" to the question "Is scientific progress beneficial or harmful to humanity?" (World Values Survey 1995, 2005), with sample sizes of 1,096, 1,249, and 1,041, respectively. This shows that public awareness of science in Japan is significantly lower than in the United States and the United Kingdom. However, the survey respondents did not clearly distinguish between science without a purpose and technology with a utilitarian purpose. The survey respondents also seem to confuse science and technology. This is because the question "Is scientific progress beneficial or harmful to humanity?" does not make sense. If we consider the meaning of technology rather than science, the meaning becomes clear.

2) Age group and interest level as seen from science survey

(1) The need for early childhood education

Children have a curiosity that is the basis of science, and they are interested in morphogenesis and natural phenomena. 1. R. Kellog introduces R. Herbert in his book [12] [13]. According to Herbert, he advances the idea that drawings drawn from the scribbles of young children are quite natural and essential for all children, and recommends the integration of reading, writing, and arithmetic curricula to create a wide range of art-based programs in schools. In addition, a questionnaire was conducted on junior high school students (14-16 years old), university students (19-22 years old), and specialist teachers of science subjects (25 years old and over) to find out what they were interested in about slime molds, a representative of the natural world (multiple answers allowed) [14]. The questions were as follows: 1. Searching for slime molds and discovering new species, 2. Raising slime molds, 3. Observing the life cycle of slime molds, 4. Changes in the shape and movement of slime molds (morphogenesis), 5. The body and movement of slime molds (physiological research on proteins, ions, protoplasmic streaming, etc.), 6. The mysteries of slime molds (long life spans, fusion and separation, sclerotia (continues to live as an individual even when dried)), 7. The mechanism of life through slime molds (long life spans, reasons for having both plant and animal properties, etc.), 8. The intelligence of slime molds (memory and learning ability), 9. Applications to human life (longevity, therapeutic drugs, slime mold robots and slime mold computers), and 10. The relationship of slime molds to the surrounding organisms and environment (environmental adaptation). Junior high school students showed interest in the movements and shapes of Physarum plasmodium (of 79 multiple answers, 1st place: morphogenesis 43.9%, 2nd place: the mysteries of slime molds 36.2%, 3rd place: applications to life 13.1%, relationships with other organisms and the environment 6.5%). Among university students, teachers were interested in the practical uses of slime molds and their contribution to society. (Among university students, out of 51 responses, the top answer was applications to daily life (23.5%), followed by the discovery of new species (17.6%), the mystery of slime molds (13.7%), and connections to other organisms and the environment (5.8%). Among teachers, out of 91 responses, the top answer was applications to daily life (18.9%), followed by the mystery of slime molds (12.6%), the mystery of morphogenesis (10.1%), and connections to other organisms and the environment (8.8%). The survey was conducted on junior high school students, university students, and elementary school science teachers. The survey results showed that interest in the mystery of slime molds is high regardless of age. Also, there is no interest in environmental issues regardless of age, but this is probably because they do not view environmental issues as problems close to home. Junior high school students tend to be interested in the appearance of slime molds' shapes and colors, while university students and teachers tend to be interested in more practical matters. As part of a science support project[15] sponsored by the Ministry of Education, Culture, Sports, Science and Technology, 150 fifth and sixth graders at elementary school were asked to observe slime molds with the naked eye and under a microscope. The students showed an interest in morphogenesis, just like the junior high school students in this survey. Children are interested in the curiosity that underpins science,

while adults are interested in the practicality of combining science with technology. To foster curiosity as science, scientific conditions must be met. This is where education is needed. When people reach adulthood, they become more interested in combining science with technology, its usefulness to society, its practicality and application, in other words, how it can be useful to human life.

3) Evaluation of science

(1) Question: Has science (i.e., science-backed technology) made the world a “better”?

(2009 survey) 47.4% in Japan (n=2191), 78.5% in the US (n=1500), 78.5% in the UK (1500).

(2) Question: Is the progress of science beneficial or harmful to humanity?

In the 1995 survey, 23.7% in Japan (n=1054) and 58.6% in the US (n=1054) answered that it was beneficial, but in the 2005 survey, 25.2% in Japan (n=1096), 80.1% in the US (n=1249), and 50.0% in the UK (n=1041) answered that it was beneficial. This question confuses science and technology, and as a result, there is a difference between the answers of ① "better" and ② "benefiting," but the difference in the respondents' perceptions is not taken into account. In the United States and the United Kingdom, nearly 80% of respondents believe that science has made things better, but in Japan, that number is less than half. The number of respondents who believe that scientific progress benefits humanity is on the rise in both Japan and the United States, but in Japan, it remains at the 20% level. This may be unavoidable in a country with a history of atomic bombs and natural disasters. (3) Survey on Attitudes toward Environmental Destruction According to an Internet survey [11], the percentage of people who answered that they were "very interested" in environmental pollution issues was 28.3, 30.7, and 28.1% in Japan, the United States, and the United Kingdom, respectively, but the figures were 21.3% for men in their 20s and 30s, 23.7% for American men, 25.0% for British men, and 29.0, 40.5, and 33.9% for women in their 40s and 50s, respectively. As for the issue of global warming, the figures were 34.3, 29.0, and 28.1% overall, respectively. Furthermore, while the figures for men in their 20s and 30s in Japan, the United States, and the United Kingdom are 22.8, 24.6, and 25.6% respectively, the figures for women in their 40s and 50s are 37.1, 37.2, and 31.6%, respectively. Environmental issues[4] will have a devastating effect on the future, and it is cause for concern that young men in their 20s and 30s in all three countries have little interest in environmental pollution and global warming. There are no surveys targeting women of the same age. There are also no surveys on attitudes towards technology and environmental issues. In other words, there are no surveys on how technology and environmental issues are related. Since technology and environmental issues are inseparable, an attitude survey should be conducted. According to a Cabinet Office public opinion survey, in response to the question "Has science and technology improved the safety of society and life?", 16.0% answered "yes" in 2004 (n=2,084), 18.9% answered "yes" in 2007 (n=2,084), and 30.3% answered "yes" in 2010 (n=1,916), showing that trust in technology has increased, but it has not yet reached a level where people can be confident that safety has improved. Looking at the individual concerns in the Cabinet Office public opinion survey, 57.0% answered "yes" in 2007 for global environmental issues such as acid rain and global warming, and 50.7% answered "yes" in 2010 for genetically modified foods and nuclear power, while 59.7% answered "yes" in 2007 and 50.2% answered "yes" in 2010 for genetically modified foods and nuclear power. There is no doubt that the development of technology has led to interest in global environmental issues, genetically modified foods, and nuclear power. As for nuclear power generation, Japan is an island nation and prone to natural disasters such as earthquakes, tsunamis caused by volcanoes, and river flooding. Regarding genetically modified foods, there have been disasters caused by harmful foods and drugs in the past, and we are in an environment where technology cannot be trusted unless it is of high quality. However, awareness surveys are insufficient.

2. World military expenditure and environmental budget

In 2021, the United States will spend 800,672 (million US dollars), 3.48% of GDP, and 38.55% of the world share. China comes in second with 293,352, 1.74% of GDP, and 14.12% of the world share. India comes in third with 76,598, 2.66% of GDP, and 3.69% of the world share. The United Kingdom, Russia, France, Germany, Saudi Arabia, and Japan follow. World total is 2,077,095 in 2021, 2.22 times higher than 933,016 in 1990 [16]. It has been increasing every year since then. In response to this, the United Nations Environment Programme (UNEP) is working mainly on seven sub-programs, including climate change, disasters and conflicts, ecosystem management, environmental governance, chemicals and waste, resource efficiency, and environmental review, to promote international cooperation to protect and enhance the quality of the environment for human life and welfare from now until the future. The contents of the fund include international cooperation including policy, coordination of environmental policies within the UN system, environmental reviews, analysis and provision of information in cooperation with scientific and other expert organizations, and support for capacity building in developing countries to implement environmental policies. The total income of the Environment Fund in 2019 was just under 70 million US dollars [17]. In addition, the European Commission has budgeted 5.45 billion euros for environmental protection and climate change for 2021-2020 [18]. Meanwhile, the United States has budgeted 555 billion dollars for environmental production in 2021 [19]. The total environmental

expenditure of the United States, the EU, and the United Nations is far too small compared to the world's military expenditure.

III. CURRENT STATE OF SCINTIFIC RESE ARCH FUNDING

1. Research funding systems

We will explain the research funding systems in other countries in 2010 (USA, UK, France, Germany, EU) [20]. The research funding systems in other countries are not systems for scientific research itself, but systems for the application of scientific research to the development of technology.

1) United States

The US federal government does not have an administrative agency that oversees the university system or universities themselves, and there is a strict division of responsibilities among the federal government's administrative agencies, like in Japan, but in the US, many ministries and agencies also compete to provide funding for research conducted at universities. Of the US federal government's research and development expenditures of $147.7 billion, $81.7 billion (55.3%) is military-related, and $66 billion (44.7%) is non-military. Looking at the US research budget, most of it is war reserve funds, with the remainder shared among various fields, but while there are items for individual research that can be done at will, there is not much of a budget. There is no link with the education system, and no mechanism for cultivating curiosity. Other countries do not even have individual research allocations that can be used as freely as the US. The research grant system serves as a war reserve for the development of the next nuclear weapon, and as a world-leading country, it should be reviewed. It is also important to note that a significant portion of military-related research and development costs are connected to academic research activities, for example, about 30% of the funding provided by the Department of Defense to various institutions for basic and applied research is allocated to universities. Furthermore, the presence of private funding organizations (e.g., the Gates Foundation) is also important in the US, and they are actively working on global issues that tend to be overlooked in the federal funding system.

2) United Kingdom

In the UK, the UK government is responsible for science policy for the whole of the UK, while the governments of each region, England, Scotland, etc. are responsible for education policy. The Department for Business, Innovation and Skills (BIS) supplies research funds for the public research sector, allocating the budget for scientific research to the Research Councils, which are organized by purpose and field. The Research Councils provide funding to support research and development and research training at higher education institutions and research institutes.

In addition, some Research Councils have affiliated research institutes both domestically and overseas for university researchers, and RCUK (Research Councils UK), which was jointly established by these Research Councils, is not a public institution established based on laws and regulations, but an institution that functions as a council for the Research Councils as a whole. It was established with the aim of responding to existing research areas as well as research areas that may cross multiple fields, building a unified strategic framework for the Research Councils as a whole, and acting externally as a "single virtual council" so that it can work together with other institutions. Meanwhile, basic funding for university education, research and knowledge transfer is allocated to each country by the Higher Education Funding Councils in the form of block grants with no specific purpose. In addition to allocating education and research funds to universities, the Higher Education Funding Council also subsidizes programs that support the development of higher education and research, monitors the soundness of university funds and management, and checks the evaluation of the quality of education. Research funds are evaluated based on the number of researchers at each university and their track record in research and knowledge transfer, and the amount allocated is determined. In addition, although they are not government organizations, The Royal Society, The Royal Academy of Engineering, and The British Academy express and submit independent opinions on behalf of the academic community (scientific community) when forming policies, allocate funds to researchers based on government grants, and work to build an international network of outstanding researchers.

3)France

The government established ANR in February 2005 as a GIP (public interest organization) to provide funding for research projects in accordance with the priorities identified by the government, with the objectives of making focused investments in national priority areas, building a transparent evaluation system that meets international standards, establishing a flexible research implementation system, revitalizing research by fostering a competitive environment, promoting inter-institutional partnerships such as industry-academia collaboration, and maintaining an appropriate balance between basic and applied research. Furthermore, in the same year, OSEO was established through a merger between the Agency for the Promotion of Research and Development (ANVAR: which bears the financial risks of technological innovation by small and medium-sized enterprises through grants and loans) and the Bank for the Development of Small and Medium Enterprises (BDPME: a government-affiliated financial institution that provides loans and credit guarantees to SMEs) to provide comprehensive support to SMEs, including technological development.

4) Germany

The main government organizations involved in science and technology policy in Germany are the Federal Ministry of Education and Research (BMBF), the Federal Ministry of Economics and Technology (BMWi), and 16 state governments, with the Joint Science Council (GWK) (until 2007 it was the Federal-State Joint Committee for Educational Planning and Research Promotion (BLK)) coordinating these. In Germany, the Basic Law stipulates that the federal and state governments jointly support research. As research funding organizations, the German Research Foundation (DFG) mainly provides funding for basic research at universities, while the Association of German Industrial Research Associations (AiF) provides funding for research carried out by industry.

5) EU

As a research plan, the 7th Framework Project (FP7) was launched covering the period 2007-2013.

（1）Overview of the 7th Framework Project (FP7) 4The basic structure has the following four items.

① Cooperation:

10 fields (health, bio, information and communications, nanotechnology, energy, etc.) will be set up to promote joint research between EU countries and other countries.

② Idea:

Establish ERC to support basic research led by researchers based on academic values in the fields of science and technology, including engineering, social science, and humanities.

③ People:

Support activities to strengthen R&D human resources.

④ Capacities:

In addition to developing research infrastructure, supporting research by small and medium-sized enterprises, and promoting regional research (building clusters), support research on "science in society" and international cooperation.

(2) ETP and JTI collaboration with EUREKA

In order to build a European-level R&D system centered on major companies for sectors and important technologies that have a large economic and social impact, ETP (European Technology Platform) will formulate a strategic agenda based on reports from experts and promote projects. In addition, for ETP projects that are highly strategic and have a large socio-economic impact, JTI (Joint Technology Initiative) will provide a system for implementing the innovation stage following R&D, and will support activities that reflect the intentions of private companies at a stage close to the market. Through these efforts, support for market-ready technologies will be strengthened, and collaboration with EUREKA (European Advanced Technology Community Initiative), an intergovernmental initiative in Europe, will be strengthened. The central organizations that formulate and implement science and technology-related policies, including innovation policies, are the European Commission's Directorate-General for Research and Directorate-General for Enterprise and Industry. Directorate-General for Research is responsible for promoting R&D programs and funding policies, and as the coordinating organization for the FP, it is working on financial support for technology development, including basic research. In order to support basic research in FP7, the European Research Council (ERC) was established in 2007 as an autonomous EU funding agency, and is promoting researcher-led basic research.

2. Research institutes

1) Companies

Many of these are called research and development. They are research departments for development to increase purchasing power.

2) University-affiliated research institutes or research institutes

(1) Evaluation

In recent years, while top-level research universities in other countries have been improving their research capabilities with abundant funds, Japanese universities are in a poor state in both the quality and quantity of research papers. One of the reasons for this is that universities in other countries have enriched their research environments and invited world-class research talent based on various financial sources such as public financial support, collaboration with private companies, donations, and asset management, and such environments have created a virtuous cycle of intellectual value creation, in which new research talent and investment and donations from private companies are attracted.

In Japan, as universities continue to expand their capabilities, they must also feel a sense of urgency about improving their research capabilities through international competition, and must not only attract world-class researchers, but also make bold resource allocations to foster independent young researchers who will lead the next generation and enable them to play an active role, reduce the burden on researchers to ensure sufficient research time, and value the intellectual resources of universities. For this reason, universities that are expected to develop internationally outstanding research and utilize research results that will bring about change in the economy and society will be recognized as international outstanding research universities, and university funds will be used to support the international outstanding research university research system strengthening plans that these universities create. Research results are requested to be submitted to international academic journals. The

evaluation is based on the number of citations of the paper by other submitters.

(2) National research institutes

Determined by budget allocation, following global research production that has a high economic impact even without a great vision. Since this does not make it an original research, there was an attempt to make it a theme of spontaneous ideas, but now it is settled as a small scientific research grant as an exploratory research, but the qualifications of the judges who can evaluate it are problematic.

3) Problems in science and technology

(1) Emphasis on individual behavior

Science and technology aim to replace individual behavior with the probability distribution of a group and to formulate it, but as the field of medicine shows, it is not possible to replace a group with individual behavior.

(2) We will carve out the future of science and technology with our own power

① If AI comes to have intelligence, sensitivity, and consciousness approaching that of the human brain, not only will human power be lost, but also the thinking, morals, and discipline that strive to achieve great things. If the social structure is developed with the aim of making AI more efficient, environmental destruction will be enormous. If we rely too much on AI programs, it will become difficult to make use of intuition from nature.

② Technical support for science toward symbiosis

Science that aims to understand natural phenomena and the technology that applies it are expected to lead to the development of nature conservation toward the coexistence of all things.

CONCLUSION

1. Early childhood education system

2. Correction of research education

Build an education system based on the definition of science and technology. Even if science and technology development are for the purpose of strengthening the nation, it is necessary to recognize that both are common property of humanity and the natural world.

3. Distinction between science and technology

4. Inadequacy of research system

Question the merits of the targeted research system before allocating a budget

5. Science and environmental pollution

6. Technology and environmental pollution

7. International monitoring system for science and technology

IV. DISCUSSION

The definition of what is meant by research in the research system is unclear, but if it refers to technological development, it is not scientific research. The world's research system refers to technological development, and those that seek national interests in the name of universities are prominent. If it is scientific research, it is done by individuals, not by groups. If it is scientific research, it is individual research, but no country is interested in research that does not lead to national interests. It is said that scientific research has moved from individuals to a period of group teamwork since the 20th century, but originally, scientific research is an individual who senses wonders from the natural world, and does not belong to a group. The reason for the insistence on teamwork is the efficiency of achieving scientific and technological results. Also, even if the number of papers is an absolute requirement for obtaining a degree, it cannot be said that the papers can be evaluated. It is particularly bad in Japan, but in the educational administration of the world, the authorities in charge of establishing graduate schools, and in Japan, the Ministry of Education, Culture, Sports, Science and Technology, allow the establishment of graduate schools, but the universities themselves cannot review the papers. Therefore, there is a tendency to evaluate them based on whether they are published in a proceedings hosted by a famous academic society or the number of citations of the paper. Not only is there a problem with the educational administration, but the university itself that runs the graduate school in question. There is a tendency for inexperienced people to become university presidents or research committee chairs and criticize papers written by faculty members and graduate students in specialized fields, but of course they are not qualified to criticize and this is an overstepping of authority. This is a case of negligence on the part of the educational administration authorities who manage this.

When it comes to science and scientific technology, the world is confusing science and technology. It is necessary to clearly distinguish between science and technology and clarify the roles of science and technology. Surveys and research funding are conducted without clearly distinguishing between what science is and what scientific technology is. The confusion between science and technology is seen everywhere, which is causing problems. There is a demand for a correction of science, as there is a confusion between science that has no purpose and technology that has a clear purpose. In addition, both university educational institutions, companies and administrations tend to mix up science and technology, wasting the age in life when one can demonstrate scientific ability, regardless of cost-effectiveness. This is because technology with a purpose have the advantage of being efficient and easy to budget. In an international questionnaire survey, the organizers and respondents also confuse science with the applied technology in many places [15]. To answer a survey

about science, it is necessary to distinguish between science and technology. There is no point in answering unless we understand science and technology. Curiosity is the motivation for science, but curiosity is the understanding of nature, which is why science is called natural science. In terms of practical benefits, natural science is inherently purposeless. Science is combined with technology to realize its purpose. Technology are used for nuclear power generation and nuclear weapons development. When we pursue science for national policy or to increase profits, we lose the innate curiosity that nature bestowed upon us. This is because when science and technology are combined, the technology is always practical. Technology brings convenience to life, generates profits, and leads to victory in war. Science has no purpose, but when it is combined with technology to become science and technology, a purpose is born. However, because the uses of technology are selfish, there is no choice but to strictly control how it is used. Both educational institutions and research institutions are confusing science and technology. Many people think of themselves as scientists when they only use technology to apply science. A true scientist is one who is struck and humbled by the mysteries of the natural world. Regarding early childhood education, a policy to promote early science education should be promoted by the global education administration. The origin of natural science is the mysterious discovery in nature. The basis of science is curiosity. Children's unconditional assimilation and curiosity towards the natural environment are innate, as seen in animals. This goes back to the origin of symbiosis in environmental philosophy. There is a tendency to ignore young ages too much. R. Kellog [12] and R. Harvard [13] have called for a review of the curriculum for early childhood education, valuing the aesthetic ability of early childhood education. As adults, they tend to be more interested in technology than science. Natural science requires a science education system that allows people to become familiar with nature and generate curiosity. No country has a system that provides science education with a mechanism for becoming familiar with nature. Education systems are ignored in the budget allocation of each country. There is a lack of basic concepts of what science is to begin with. In order to cultivate curiosity as science, scientific conditions must be met. This is where the need for education lies. It is too late to take measures after becoming a graduate student or working in society. Natural science is about learning about the depths of nature through curiosity. Understanding nature is not limited to science. There are other fields such as religion, art, ethnic culture, and philosophy. Children sometimes understand nature and see it as play. We should understand nature comprehensively, taking advantage of the strengths of each field. Understanding means knowing the diverse characteristics of all things in the natural world and realizing a symbiotic society. Our goal should be to build personal and international symbiotic networks. An individual's purpose in life is to make use of the characteristics of diversity against the backdrop of a symbiotic network, that is, to pursue their own ideals.

Technology continue to advance in order to increase convenience and efficiency, but the advancement of computers has a remarkably wide range of applications, to the point of threatening social life. The first characteristic is that they have intelligence. It is an application of information processing systems that occur in nature. Organisms widely process information, and the genetics and neuronal functions of the brain that are applied to computers were inspired by observations of the natural world, but in nature, organisms are observed to have various abilities. The taxis of slime mold plasmodium show the ability to avoid harmful substances [21], and in nature there are various processing functions such as the adjustment of order, consideration for the weak, and leadership, which contribute to the prosperity of species. The abilities given to computers are unrelated to the existence of themselves or others. So-called AI is good at voice recognition and image processing, and can analyze past data and patterns to make predictions, but it cannot respond to unknown factors or sudden events. Furthermore, the second characteristic is that it brings about unexpected effects. It exerts its power beyond the expectations of the designer. For example, if a weapon is given intelligence, it can spread damage without the enemy noticing. Even the user cannot know which route the missile will take and which will cause the greatest damage to the enemy country. AI is highly practical for image diagnosis and voice recognition, which process a huge number of data, but it has also caused antisocial behavior such as fake news and fraud. Human common sense is required. If we aim to develop autonomous machines, we need comprehensive ability development, not just intelligence. If we aim to turn science and science into technology, it is essential to establish an international institution that can make judgments from a comprehensive perspective This is because those who aim for science are interested in personal things, while technology aims to put the results of science into practical use. The benefits of technology are immeasurable, but even though social convenience has improved, environmental destruction, including global warming, is progressing. To list the limitations of science, as long as we deal with nature in the pursuit of causes, which is the purpose of science, the depth of nature seems limitless. The law of causality is cause 1, cause 2, ., cause n, ., and n seems to continue infinitely. One of the problems that remains to be solved is how to balance the existence of self and others, that is, symbiosis, which is a network of nature, and curiosity aimed at clarifying things. When we understand the meaning of symbiosis, we will know the limits of science and the importance of nature conservation.

The last thing to mention is environmental destruction. The more technology evolve, the more environmental destruction there is in national policies,

and if technology are pursued for profit, the curiosity that nature provides will be used in a human-centered way, and the benefits of nature will be lost. A survey of whether the quality of people is improving as technology spreads can determine the progress of technology. It comes down to whether we feel that we have become richer, but we cannot judge whether we can entrust our foundations to technology. Current technology is a threat to all living things. One of these is the use and safety of nuclear power. There is a lack of safety management that does not take into account unexpected worst-case scenarios such as the Fukushima power loss accident. The perception of nature is the relationship between things [1]. In environmental philosophy, it becomes an environmental network. When we make meaning and associations that should be made, it becomes symbiosis. The things in nature form a network and each continues to exist as a meaningful self-existence. As long as there are those who start wars, those who support them, and those who pursue their own interests while ignoring others, environmental protection activities will stagnate and it will be difficult to coexist with nature. Must human beings be wiped out in order to leave the natural environment intact? For what reason did nature create human beings? Nature will begin to strike back, not only against those who promote or support the pollution of the natural environment, but against everything else. Those who pursue wars and self-centered interests will either wait until nature strikes back, in other words, until something unjust happens to nature, or they will die out by self-determination, that is, environmental destruction. Environmental destruction is especially spurred by the misuse of technology.

Humanity has chosen to destroy the environment through war and the development of nuclear weapons, and as a result, resistance from the natural world, such as global warming, is inevitable. This is because it creates an environment in which humans cannot survive. If defense spending exceeds environmental conservation spending, humanity has no future. It would be choosing extinction. Not only defense, but current technology are against environmental conservation, so measures to compensate for this are necessary. If things continue as they are, the reality of the environment can be seen by examining the penetration rates of cars, which are convenient around the world, and efficient nuclear power, which are representative of environmental destruction. This is because cars and nuclear power become environmental destruction when war or disaster strikes. If things continue as they are, the reality of the environment can be seen by examining the penetration rates of cars, which are convenient around the world, and efficient nuclear power, which are representative of environmental destruction. This is because cars and nuclear power become environmental destruction when war or disaster strikes. In the eternal flow of the natural world, there is only so much humans can do. The only way to understand nature is to assimilate with nature. The human species also believes that it can dominate the natural world, but if it becomes unnecessary for the natural world, it will be wiped out. Even if that is not the case, it will destroy itself due to its overconfidence. If we hope to live a comfortable life, the only thing we can do is remove the unpleasant things that exist now, such as not waging war and preventing environmental pollution. There will inevitably be an internal collapse that leads to self-destruction, but this is a tug-of-war until then. The less the budget for environmental measures relative to military spending, the more environmental pollution there will be. Human actions are destructive to the natural order, so the human species will eventually become extinct, but it may be possible to delay extinction by taking measures against pollution. Extinction will be hastened if destruction from war and the scope of deforestation expand. The extinction of the human race is certain. This is because the environmental budget is too small compared to military budgets.

Environmental destruction is accelerated by war. If both the invading country and the invaded country fight back, they become parties to environmental destruction. When a permanent member of the United Nations Security Council exercises its veto, if the country is a party to the war, the UN's role as a mediator is rendered meaningless. Humanity has the wisdom to avoid environmental destruction, but it has no choice but to destroy itself by prioritizing its own convenience. What kind of relationship is there between the natural world and individuals in the first place? Religion says that behind nature there is God, a great power, a power full of compassion. In religion, there are people who have intuition and people who do not. Also, there is no way to correct whether intuition is correct or not. It may be fine as long as the results are good. For example, when a monk builds a bridge, a school, or a hospital, he or she is following God's will. The result is symbiosis. Living together is an important point in environmental philosophy. In environmental philosophy, God's will is a way of living in symbiosis. It is not clear whether this is wrong or not. However, the attitude of cherishing nature, which is essentially the meaning of coexistence with nature, will be a great legacy for future generations. Nature is irreplaceable, no matter what it is, as the mother of birth. Irreplaceable is nothing other than the wisdom of nature that gives birth to life. One day, humanity will find a mechanism for giving birth to life, but it will also discover a mechanism for harmony and symbiosis with other beings, but this is also a long way off. Before that happens, there is a high possibility that we will go down the path of self-destruction by misusing science. If we destroy nature, we will be denying our own existence. Science has advanced our understanding of nature, and people have benefited from it, but environmental destruction continues. This is because there are things that are misused. Both science and environmental philosophy give us clues to cherish nature. What we can do in this world is to cherish nature, but the first priority will be to aim for symbiosis. Of course there is no God, and let's say that the

wisdom of nature is nonsense. It may be meaningless to rely on such things to get through this world. However, natural science is progressing. Progress is understanding nature. Understanding is limited to matter, but we understand the components of matter, such as what it is made of, what conditions it is in, and how much energy it contains, and our ability to apply it has expanded. However, we still have no idea what our fate is, or the relationship between our existence and nature, or what we should and shouldn't do. The true nature of matter, which is deeply related to the birth of life, is still unknown.

During the impressionable period, worries deepen, but eventually interest shifts to practical matters, and one begins to think only of one's own happiness and that of those around one. Natural science will continue to progress endlessly. This is because the bosom of nature that it proposes gives infinite depth. If there is nothing to learn from the natural world, one will rely on one's own science, but this will lead to self-praise, and since there is nothing to restrain oneself, one will rush down the path to self-destruction. How can one understand nature and progress apart from the mother nature that gave birth to oneself? What is the meaning of life? What should one do in this world? This meaning has meaning during life and after death. Otherwise, one will not know what to do in this world. For example, in order for an athlete to be a runner who breaks records, he or she needs to be creative with the invisible daily life and the way of training. At the very least, efforts in the sun alone are incomplete, and efforts in the shadows are necessary. Our consciousness does not only seek happiness in this world. We search for the basis from which the consciousness of nature was born, whether it exists or not. Because we are lost. Current technology cannot cope with this. Because it only provides a way to conduct oneself in this world. When we look at the vastness of the universe, we think that human actions are not that important, but the progress we have made in traversing the universe and understanding matter has been remarkable. At the same time, humanity, which is making nuclear weapons and devoting itself to rearmament, seems to be heading down the path of self-destruction. Some people are trying to organize their consciousness and explore the meaning of the environment. We do not know whether the existence of humankind is or should be meaningful to nature, but judging from “the free will “given to humans, it must be "meaningful" or it will lose its value. This is not a matter of science, but a matter of philosophy and belief. Understanding nature leads to understanding nature, and although it is biased, it is the heritage of humanity and a place to interact with nature. We should strive to move people towards a path of symbiosis. Science has progressed in terms of understanding matter, and technology has progressed in terms of convenience and efficiency. It is arbitrary and selfish. Although we may understand nature, we cause natural disasters, and spread pollutants in nature through war, crime, or selfishness. People ask how we can understand nature if we are polluting. To understand means to understand the feelings of Mother Nature. If we were Mother Nature, how would we feel about the selfishness of humankind? We don't know if nature has a will. However, we can instinctively agree that it does. We were born from the mother of nature, and we use our will to reaffirm the order of nature. We are searching for our homeland, so to speak. When we think of cars or artificial intelligence that behave in a certain way, we can understand the designer's intentions. If a product is wrong, it is punishable by law. It is unthinkable that all things are created without purpose. We would like to reconsider this from the perspective of the created. The question of whether God exists has been considered a religious or faith issue. There is order in living things, in matter, and in the universe. Humans have creativity and consciousness. These are left to the individual as free will. If we call this order and function the wisdom of nature, or God, there is no need to prove the existence of God. This is because it is self-evident. If we want to strictly prove the order and function of nature, we need a proof function that goes beyond current scientific thinking. Material things can be proven by science today, but when it comes to the endowment of free will, such as creativity and consciousness, a different proof is needed, and science today has not progressed that far. It is a mistake to say that something does not exist because it cannot be proven by science today. Nature provides everything we need. The canvas, paints, and even models to paint. What to paint and how to paint are the artist's own problem. If they want to, they can even paint the universe. It is unreasonable to complain about the materials or the model just because we cannot draw as we want. If we are dissatisfied, we can just try harder. It is an individual problem. The above example is exactly the problem of how we live. We should ask ourselves how we live and what we rely on to live, but nature has already given us hints that are suitable for each individual. Even as an ideal way of life, there are storms in life. The wisdom of nature is not just static. It has turbulent dynamics.

What we should do in the natural world is to realize symbiosis. What is the relationship between this act and ikigai? Although there are harmful beings in symbiosis, we have no choice but to respond consciously and intelligently to how we can contribute to each other. As for the relationship with ikigai, we have no choice but to realize that nature is necessary for ikigai. There are ways to protect forest life like Thoreau [22], to live with animals and plants, to satisfy curiosity like science, or to experience a state of security by becoming one with nature through meditation. In any case, it is about becoming familiar with nature and its mechanisms. Because it is the birthplace of our birth. There are concerns that AI technology will become widespread and become a threat to humanity. On the other hand, it has a great role to play in freeing us from routine work. Future science will have a huge impact on society, but even if we satisfy our curiosity through natural exploration, we need to be prepared to take on the responsibility of

realizing a symbiotic society. Computers with minds [23] are being considered, but as long as humanity does not understand what nature is, it is impossible for AI to play the role of a true scientist who tries to learn from nature. AI, nuclear power, and automobiles provide convenience, but on the other hand, they also cause problems such as crime and unexpected accidents. This proves that technology have reached a stage where they can no longer be controlled by humans. Nuclear weapons are said to be for war defense, but they are a powerful weapon for an invading country. The reason for invading can be anything as long as it has the support of the people. If it is a state of war, it will go beyond the stage of exclusively defensive defense and become a world of win and lose. How far will science evolve? It will seek something that will replace humanity and exceed the decision-making ability of humanity. It will also develop systems and weapons with powerful energy. This is because convenience and powerful power are always objects of admiration. When a person with decision-making ability has great power, a person with decision-making ability with even greater power is needed to control it, but if it goes out of control, no one can stop it. The development of AI and nuclear weapons is just the beginning. Creations that exceed the will of humans will spread around us, and we will be unable to live our daily lives without them. A more thorough computer society will arrive than the arrival of the car society and the computer office society. The only way to accept this and maintain human dignity is to observe nature and meditate. By experiencing a connection with nature, we can be aware of the power behind nature and utilize it in our daily lives. What attitude should we take toward science? Should we accept it as it is, or should we judge it on a case-by-case basis and hope for it? Should we accept the existence of animals and plants in nature and "get along" with each other as our basis? If there is a God, there are ethics and faith, but if there is no God, are there no ethics or faith? People's fear of AI depends on its high cognitive ability. Deep learning, which can process a lot of data, can be done instantly, and new algorithms can be formed by itself without a teacher. Unmanned cars are being put into practical use, and they are used in a wide range of applications such as medical care, welfare equipment, infrastructure maintenance, and engineering. Conventional AI requires learning from huge amounts of data, but recently, efforts have been made to reduce the number of parameters that need to be optimized during learning. However, as a negative social impact, it is being used as a weapon for fraud crimes and armed invasion. Technology increasingly does not require people, or has power beyond the ability of humans to control it. As applications to crime and weapons progress, capabilities beyond the enemy's defensive measures are required. Crime and weapons development are becoming more intelligent, and as the technology becomes unmanned, the damage will only increase. Even as technology becomes more powerful, the attitude we should take is one of calling for observation of nature. In order to avoid extinction, we need to further advance observation of nature, find ways to build an environmental network that bridges diversity and coexistence, and change the direction of technology to promote further construction.

REFERENCES

[1] Galilei, G. (1968) Lettera a Madama Cristina di Lorena, in Ristampa, Firenze, G. Le Opere di Galileo Galilei, Edizione Nazionale, Nuova Barbera, Editore, 1968, vol. 5

[2] Born, M. (1949) Natural Philosophy, Oxford at the Clarendon Press, London

[3] Kato, S (2021) The Moral Law for Natural Environment -Morals to protect natural heritage, material and life heritage- JMEST, Vol.8. Issue 8, Aug.

[4] Kato, S (2023) Can Religion Contribute to Environmental Conservation? JMESS, Vol.9. Issue 12, Dec.

[5] Whitehead, E. A（1952） in The Impact of Science on Society by Russell, B, George Allen and Unwin Ltd., London

[6] Whitehead, E. A （ 1955 ） An Enquiry Concerning the Principles of Natural Knowledge, Cambridge University Press

[7] Koza, J. R (1993) Genetic Programming, The MIT Press. London

[8] Kuniyoshi, Y. (2018) On the future of AI and human/ society. J. Science and Technology Studies, No. 16.

[9] Kato, S (2022) Consciousness in Environmental Philosophy. JMESS, Vol.8. Issue 10, Oct.

[10] Kato, S (2021) Human Extinction Crisis - Environmental Philosophy. JMESS, Vol. Issue 12, Oct.

[11] Kuriyama, T. Sekiguchi, H. Otake, Y, and Chayama, H. (2011) International Comparison of the Public Attitudes towards and Understanding of Science and Technology

-Comparative Study of Internet Survey in Japan, the United States of America, and the United Kingdom-2ne Policy-Oriented Research Group, National Institute of Science and Technology Policy, Ministry of Education, Culture, Spouts, Science and Technology, JAPAN

栗山, T. 関口、H. 大竹、Y. 茶山、H.（2011）日・米・英における国民の科学技術に関する意識の比較分析-インターネットを利用した比較調査-文部科学省 科学技術政策研究所第 2 調査研究グループ 東京

[12] Kellogg, R.（1969） Analizing Children's Art. E. Tuttle Co., Inc. Tokyo

[13] Herbert, R. (1945) Education Through Art. Pantheon Books. New York

[14] Kato, S. (Ed.) (2019) Welcome to Mistellious World of Slime mold (JPN), Marusinshobo, Chiba,Japan

加藤修一監修（2019）*粘菌の不思議な世界にようこそ*丸進書房　千葉

[15] Kato, S (2008, 2010) Observation of Slime Mold. Science Education Support Staff Member, Chiba Prefectural Board of Education.

加藤,S. (2008, 2010) 度理科支援員等配置授業千葉県教育委員会、*粘菌の観察*　千葉

[16] Stockholm International Peace Research Institute (SIPRI) (2022)

[17] Ministry of Foreign Affairs of Japan, (2019), English Version, United Nations Environment Program (UNEP), Tokyo

[18] Yougova, D. (2021) LIFE programme for 2021-2027. European Parliamentary Research Service

[19] The White House（2021） President Biden Announces the Build Back Better Framework 、Oct.28,2021

[20] Promotion Planning Division (2010). Research funding systems in foreign countries (JPN). Research Promotion Bureau, Ministry of Education, Culture, Sports, Science and Technology, (2010)

文部科学省研究振興局振興企画課（2010）諸外国における研究助成体制について　東京

[21] Kato, S. (2019) Learning of Physarum plycephalum for detecting a toxics substance, Proceedings of the 12th Symposium of the 21st Century Science and Human

加藤, S. (2019) Physarum plycephalum *の学習効果による有害物質検出能力*

第 12 回２１世紀科学と人間シンポジウム

[22] Thoreau, H.D. (1854) Walden; or, Life in the Woods, Ticknor and Fields: Boston

[23] Kato, S. and Takeda, S. (1999）Introduction to Multimedia Studies-Computer with a heart -, Kyouritsu-Shuppan, Tokyo

加藤, S .武田, S.（1999）：マルチメディア概論-心を持ったコンピュータ-　協立出版　東京