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JFSE Journal for Future Society and Education

JFSE | eISSN: 3078-6010 | Vol. 1 No. 1 (2024) | OPEN ACCESS

https://doi.org/10.3991/jfse.v1i1.49323

SHORT PAPER

Linking Digital Technology, Omics and Education to Facilitate Global Equity

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ABSTRACT

There are many challenges, not least health inequities, global warming, and a rush for growth and economic development. Personalized, precision, and preventative medicine, bringing the latest omics techniques—genomics, transcriptomics, and metabolomics—for individuals allied to personalized prescription and care should help health equity. Digital technologies and artificial intelligence (AI) can help in an understanding of disease processes and in drug development. A holistic approach to the relationship between technology and the environment and clarity about both the positive benefits and negative harms resulting from using digital tools is necessary. We need to focus on the complete human-environmental interface and not just on climate change and carbon. It will be a measure of collaborative civilization if digital technology, omics techniques, and education can be used to promote global equity. Education linking diversities and performance throughout the world will be crucial.

KEYWORDS

equity, equality, health, deep sea mining, Sustainable Development Goals (SDGs), United Nations, cancer, artificial intelligence (AI), global governance

1 INTRODUCTION

In 2015, the United Nations member countries accepted the 17 Sustainable Development Goals (SDGs) (see Figure 1) for completion in 2030. The laudable aim is to use global partnerships to achieve global equity in 17 areas, from zero poverty and hunger to life under the ocean. The latter is particularly important, as we live on planet Ocean rather than planet Earth (see Figure 2). Ideally, one should aim to achieve equity rather than equality. Equality focuses on treating everyone the same, while equity goes beyond equality and emphasizes the importance of providing support and resources based on individual needs to achieve fairness and inclusivity. By adopting an equity-based approach, organizations can create a more inclusive and supportive environment for people with so-called disabilities. It is crucial that

Crabbe, M.J.C., Yue, G.X.-G. (2024). Linking Digital Technology, Omics and Education to Facilitate Global Equity. *Journal for Future Society and Education (JFSE),*1(1), pp. 56–63. https://doi.org/10.3991/jfse.v1i1.49323

Article submitted 2024-03-26. Revision uploaded 2024-05-28. Final acceptance 2024-06-03.

the 17 SDGs are linked together, for example, numbers three, four, six, 13, 14, and 15, so that the whole becomes more than the sum of the parts.

Fig. 1. The 17 United Nations' Sustainable Development Goals [1]

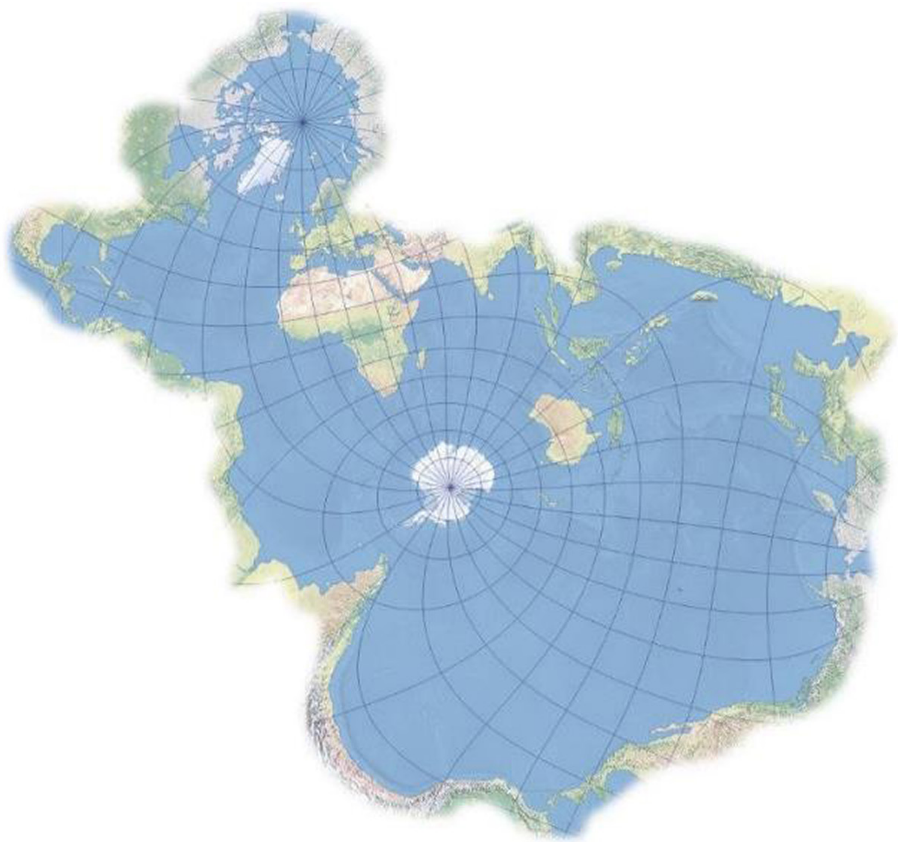

Fig. 2. There is just one ocean-we live on planet ocean [2]

2 IS PERSONALISED, PRECISION AND PREVENTATIVE MEDICINE A ROUTE TO GLOBAL HEALTH EQUITY?

Medical institutions throughout the world are working towards personalized, precision, and preventative medicine, bringing the latest omics techniques—genomics, transcriptomics, and metabolomics—for individuals allied to personalized prescription and care. Globally, around 20 million people suffer from cancer, and around 10 million will die this year. The projected increase can be attributed largely to just two factors: longevity and smoking, to which we must add the impact of deterioration in the health-related quality of lifestyles: unhealthy nutrition, sedentary lifestyle, suboptimal quality and quantity of exercise and sleep, multi-faceted stress, environmental pollution, and climate change. This means that a large minority of cancer cases are preventable. While cancer is often seen as a genetic disease, environmental factors—from air pollution to viral threats and beyond—play an equally critical role in cancer pathogenesis, too often affecting the most socio-economically vulnerable groups, thus leading to socio-economic and geographic inequity [3].

Improved public health is crucial, as many cancers can be caused by poor water quality and a lack of hygiene. In many parts of the world, to escape controls and benefit from lower costs, polluting industries have been transferred from developed regions to undeveloped regions and trigger the transportation of cancer risks to unprotected regions and people [4–6].

Analyses of inequalities and inequities related to personalized, precision, and preventative medicine, for example, in cancer, show disparities between countries with different economic levels and within countries with high gross domestic product (GDP), and the development of omics and clinical research provides opportunities that make their implementation into healthcare systems complex [3] [7–9].

Large initiatives, e.g., the USA-cancer moonshot and the EU-mission on cancer, have been implemented to boost cancer prevention and to mitigate present inequalities and inequities. Linking preclinical and clinical research, together with the latest omics techniques and the use of AI methods—for example, natural language processing—is of vital importance to ensure state-of-the-art patient care within any country's healthcare system. Comprehensive cancer centres (CCCs) are one way to try and achieve this. We also need research in health economics to correctly assess the cost-effectiveness of healthcare prevention, intervention, and mitigation. Data sharing between institutions and countries is also essential, and governments will need to incentivize work on research, prevention, and an increased focus on individual patients' needs [3].

3 DIGITAL TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE CAN HELP IN AN UNDERSTANDING OF DISEASE PROCESSES AND IN DRUG DEVELOPMENT

A warmer global climate can cause mutations to have more severe consequences for health. Virus mutations can be particularly affected. A virus mutation recognition tool has been developed for automated virus mutation recognition using natural language processing [10–11]. This is freely available and has been applied to a number of viruses, including influenza virus and severe acute respiratory syndrome coronavirus-2 [7]. Other AI techniques have been used for multiple biological tasks to assess reliability and feasibility in tumor sample classification integrated by gene expression data, similarity and specificity comparison based on gene-gene ontology pair enrichment in tumors, and novel gene panel identification and gene function prediction through gene-gene similarity score (GGSS) networks [12–14]. Similar techniques can also be used for drug development and drug repurposing, potentially avoiding expensive and time-consuming phase 3 clinical trials [15].

4 GLOBAL WARMING–DEEP SEA MINING: THE NEED FOR A HOLISTIC APPROACH

Our ocean planet is undergoing severe stress. Sea surface temperatures (SST) across much of the tropics have increased by 0.4–1°C since the mid-1970s, with a parallel increase in the frequency and extent of coral bleaching [16–18]. Atmospheric carbon dioxide concentration is expected to exceed 500 parts per million and global temperatures to rise by at least 2°C by 2050–2100, values that significantly exceed those of at least the past 420,000 years during which most extant marine organisms evolved [19].

We have seen above some examples of where digital technologies can be helpful, but we need to ensure that we maintain a holistic approach to the relationship between the technology and the environment and be clear about both the positive benefits and negative harms resulting from using digital tools. We need to focus on the complete human-environmental interface and not just on climate change and carbon.

One important example of this is in deep-sea mining (DSM). DSM is the process of retrieving mineral deposits from the ocean bed at depths of below 200 meters [20]. There has been interest in this since the 1970s, but this has increased significantly recently owing to the depletion of deposits from terrestrial sources of metals such as manganese [21]. There is demand for many seabed minerals in the manufacturing of digital equipment, including mobile phones, tablets, laptops, and batteries, as well as green technologies to mitigate climate change, including wind turbines.

The international seabed authority (ISA), an organization affiliated with the United Nations, is tasked with managing DSM activities. Created in 1994, it regulates activities in international waters, guided by its member nations plus the European Union (EU). The ISA is headquartered in Kingston, Jamaica, and has more than 150 state members. The supreme authority of the ISA is the assembly, in which all ISA members are represented. The assembly sets general policies, establishes budgets, and elects a 36-member council, which serves as the ISA's executive authority [22].

To ensure that DSM in international waters is carried out for the benefit of humankind as a whole over time, the ISA needs to identify the net benefit to humankind as a whole over time from DSM. This can be achieved only through a full cost-benefit analysis of both regulatory and contractual arrangements governing DSM applications [23–24].

5 MITIGATION OF GLOBAL WARMING–GEOENGINEERING

Given that the goals of climate warming in the COP Paris accord of 2015 will not be achieved, much research is being undertaken on climate modelling and geoengineering. Geoengineering is the deliberate large-scale intervention in the Earth's natural systems to counteract climate change and involves either or both carbon dioxide removal (CDR) and solar radiation management (SRM) [25–26].

For example, in a study on using SRM over the whole of South Asia, although simulations showed that implementation of climate engineering would decrease the mean temperature, there were significant differences in extreme climate responses to three future scenarios. Some areas were mitigated considerably, while others reflected a worse set of circumstances than would be the case without climate engineering. Interestingly, the Kashmir and Himalaya mountain ranges were predicted to have more extreme warm events after climate engineering than before. As these regions are the source of major rivers in South Asia, such warming would cause more mountain glacier retraction and result in the frequent occurrence of flood events. This showed that SRM climate engineering was not an effective tool to mitigate future climate extremes in South Asia during global warming [27–28].

6 EDUCATION HELPS TO BRING TOGETHER THE SUSTAINABLE DEVELOPMENT GOALS

The bringing together of key SDGs—for example, quality education, affordable clean energy, climate action, and life on land—will be a mark of global collaborative civilization. Education from the earliest age will be an important element in making this happen. Recognition of diversity, culture, and performance—an equilibrium in education—will help (see Figure 3). Currently we lack the type of global governance to make this happen, not least because of the geopolitical differences between East and West, North and South [29–30].

We need to ensure the importance of indigenous communities and youth in decision-making. But how to get them to the table? Non-governmental organizations (NGOs) and education at all levels will be critical. We must avoid the mantra of 'Decisions about us, without us'. Above all, youth must have a place at the table; it is their world, and all the rest of us can do is pledge our support. It is only through collaboration and cooperation between people and organizations that we will achieve our SDGs to maintain our oceans and our land by 2030.

Fig. 3. Development of evidence-based trust to link cultures and performance [31]

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