Today's Common Sense in Science can be Changed Tomorrow

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Abstract: STEM-education also creates critical thinkers, increases science literacy, and enables the next generation of innovators. Although mathematics is robust, scientific laws are statements based on repeated experiments or observations that describe or predict a range of natural phenomena. Different observations may produce a new scientific law which may contradict with the conventional scientific laws. The teacher must tell all students that scientific laws are not always true, but only true under assumed observations. In other words, in the future, the current common sense of science can be changed tomorrow. Besides, we need to know that we are not always logical. This paper will present three examples to validate the proposed claims.

Résumé : L'éducation STEM crée des penseurs critiques, augmente la culture scientifique et permet de mettre en place une génération d'innovateurs. Bien que les mathématiques soient robustes, les lois scientifiques sont des énoncés basés sur des expériences ou des observations répétées qui décrivent ou prédisent une gamme de phénomènes naturels. Différentes observations peuvent produire une nouvelle loi scientifique qui peut contredire les lois scientifiques conventionnelles. L'enseignant doit donc dire à tous les élèves que les lois scientifiques ne sont pas toujours vraies, mais seulement vraies sous de constantes observations. En d'autres termes, à l'avenir, le sens commun actuel de la science peut être changé. En outre, nous devons savoir que nous ne sommes pas toujours logiques. Cet article présentera trois exemples afin de valider les allégations proposées.

1. RATIONALE

In science, we have taught students scientific methods on how to think, learn, solve problems, and make informed decisions. Dixon Terry stated in official document in 1977 on the objectives of science such that "many attempts have been made to define the objectives of science (Dixon, 1977). Now, in the latter part of

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this decade, many questions still remain unanswered". In other words, the objectives of science were not defined.

We have not been taught clearly what to consider when decision-making, and what is most important when decision-making. We have not taught that human life is of utmost importance. From the perspective of human life, the purpose of science is very clear.

STEM is an acronym for the fields of Science, Technology, Engineering and Mathematics. Mathematics is the foundation of science, technology, and engineering, a monotonically increasing knowledge base. Three examples illustrate how previous findings in the fields of science, technology, and engineering can be inconsistent with new findings.

The first example shows what is the best COVID-19 policy among individual health policies in the world from the viewpoint of human life. Many countries have their policy indicator to cope with the COVID-19 pandemic. The best policy means that what strategies can mitigate the COVID-19 pandemic in order to reduce the number of deaths due to the COVID-19. A single indicator, the number of deaths, can reveal the best policy numerically.

The second example shows that the famous Ohm's law is contradicted in the atomic world. Nature is an essential part of human life, but the plants and animals that live in nature also play an important role. We have always been pro-animal protection, but whether we appreciate it or not, we humans have taken the lives of animals and lived on their flesh as food. The last example will show the human contradiction, but we may solve the contradiction in the future with a new technology.

1.1 Scoring individual health policies against COVID-19

The first example is a scientific investigation into the policy of how to protect ourselves from COVID-19. There are many health policies in the world for mitigating and ending the COVID-19 pandemic. From a human life perspective, the success of an individual health policy can be scored simply by the number of COVID-19 deaths per population (in millions) (Takefuji, 2021a; Takefuji, 2021b; Takefuji, 2022).

This paper uses the latest scoring tool, scorecovid (Takefuji 2021a; Takefuji, 2022) with a single metric for comparing scores to reveal the best COVID-19 policy in the world. The single metric for scoring policies is based on dividing the number of deaths due to COVID-19 by the population in millions. The lower

the score, the better the policy. In other words, we know the fact that the more deaths, the worse health policy. The scorecovid is an open-source tool for policymakers to learn good strategies from countries with excellent scores.

The goal of scorecovid is for poorly scored countries to learn good strategies from countries with excellent scores for mitigating the COVID-19 pandemic.

From the Worldometers (Worldmeters, 2022), it is obvious that the health policy using robust digital fences (Gesley, 2020) implemented by several countries including Australia, China, Iceland, South Korea, and Taiwan is the best policy among many countries in the world. According to the Worldometers, Taiwan has the best score of 86.3 with 2056 COVID-19 deaths in a population of 23.82 million as of May 29, 2022.

However, not many developed countries do not implement the best health policy for mitigating the pandemic with illogical decision-making by policymakers. The US has the score of 3035.4 with more than million deaths due to COVID-19 as of May 29 2022. The UK has the score of 2631.3 with 178641 deaths.

Although infection experts emphasize pharmacological approaches including vaccine, the state-of-the-art physical isolation information communication technology still shows the remarkable achievement against the COVID-19 pandemic (Worldometers, 2022). The non-pharmacological approach such as physical isolation technology is called a digital fence using smartphones providing locations of individuals and distances of individuals (Gesley, 2020).

There are three types of digital fences: a robust digital fence, a leaky digital fence, and no digital fence (Gesley, 2020). Many countries use the similar digital fence, but they failed to mitigate the pandemic. The significant difference lies in mandatory coronavirus Apps in New Zealand and Taiwan, and voluntary Apps in the failed countries. The digital fence implemented in New Zealand and Taiwan is robust while the other digital fences are leaky.

The real problem lies in data-sharing and the coverage where Taiwan's data-sharing is 100% with over 99% coverage while data-sharing of failed countries is not satisfactory, and the coverage is far from perfect. Although the best policy by Taiwan against the pandemic has been well known in the world, many countries do not use the robust digital fence at all.

Science, science policy, and health policy should be evidence-based, but inconsistent health policies in the real world have been implemented by many countries.

We may need the common sense of the lay public. We can conclude that health policies of many countries against the

pandemic are illogical while the rational health policy using robust digital fences produces the outstanding consequence on the death toll. Many policymakers have been ignoring the evidences and facts, and do not like their scores except Taiwan.

1.2 Ohm's law

The second example is Pouillet's law or Ohm's law. Based on Pouillet's law, the electrical resistance is proportional to electrical resistivity, the length of the specimen. According to the conductance quantum, the resistance of an atomic conductor does not scale proportional to length which contradicts with Pouillet's law (Chen, 1999).

Based on Pouillet's law, the electrical resistance of a uniform specimen of the material is proportional to electrical resistivity, the length of the specimen, and the inverse of the cross-sectional area of the specimen respectively (Chen, 1999). Au (gold) can be stretched into conducting chains of individual atoms. After a new discovery of the conductance quantum, we understand that the resistance of an atomic conductor does not scale proportional to length (Chen, 1999).

This means that Pouillet's law or Ohm's law is not correct under the conductance quantum. Science is always based on replacing expired facts and evidences with new ones. Teachers must follow the latest scientific facts.

Outdated teachers who do not have the latest scientific knowledge may hinder the development of their students. Without understanding the conductance quantum, students will assume that Ohm's law is always correct. In other words, a new scientific law such as the conductance quantum contradicts with the famous Ohm's law in the atomic world. STEM students need to understand the observed world and assumptions.

1.3 Animal welfare

The last example is about food. Humans have taken the lives of animals and lived off their meat as food with or without gratitude. With the latest science and technology (Takefuji, 2021c), if we provide bacteria with water and air, they can produce the protein that we need. Sustainable alternative protein can be produced by plant or microbe (Takefuji, 2021c). Animal-free dairy protein can be also produced by fermentation in microflora. To improve the real production, companies are focusing on fermentation for animal-free meat, eggs, and dairy respectively.

Without killing animals, we can produce protein products in competitive costs (Takefuji 2021c). Although Universal Declaration on Animal Welfare was adopted by the United

Nations to promote standards on the welfare of animals, we have taken the lives of animals and lived off their meat as food. We need to keep our students up to date on the new industries that will revolutionize our food culture and animal welfare. As far as we know, there is unfortunately not a single STEM textbook that mentions the food revolution of the new food industry.

We have always worked for animal protection, but whether we appreciate it or not, we humans have taken the lives of animals and lived on their flesh as food. Thanks to new sustainable alternative proteins, we will not have to kill animals for food in the future. In other words, STEM students must understand that new technologies have the potential to solve current problems in the future.

CONCLUSION

Teachers of STEM education must know two facts. One is that the current common sense in science can be changed tomorrow. Another is that the lay public including parents does not know that scientific laws may be incorrect under new observations. Scientific laws are not always true but true only under the confined observations. Once scientific laws (claims) were changed, the lay public may lose trust in science. Once the public trust is lost, rebuilding public trust in science is really hard.

Therefore, public science policy or pubic STEM policy should be addressed as follows: all scientific laws (claims) are temporal and they may be changed tomorrow. Today's common sense can be changed tomorrow. The pandemic significantly forces us to change our ways to study, to live and to work. We must understand that we are not always logical because of national leaders neglecting or being unaware of important scientific facts or evidences. We must understand that we are not always logical.

Declaration

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